

This is a post-print version of the following published paper:

PACTE Group. Amparo Hurtado Albir (principal investigator), Anabel Galán-Mañas, Anna Kuznik, Christian Olalla-Soler, Patricia Rodríguez-Inés & Lupe Romero (research team, in alphabetical order) (2020) *Translation competence acquisition. Design and results of the PACTE group's experimental research*, *The Interpreter and Translator Trainer*, 14:2, 95-233, DOI: <https://doi.org/10.1080/1750399X.2020.1732601>

Link to this article: <https://doi.org/10.1080/1750399X.2020.1732601>

Translation competence acquisition. Design and results of the PACTE group's experimental research

In honour of Willy Neunzig

Introduction

The PACTE group was established in 1997 to carry out research on the process of translation competence acquisition (TCA) in written translation. As no validated models of translation competence (TC) existed at that time, we had to undertake initial research on how TC works. To that end, we conducted two series of exploratory studies in 2000-2001 (PACTE 2002a, 2002b, 2003) and a pilot study in 2004 (PACTE 2005a, 2005b), before finally carrying out an experiment, in 2005-2006, in which we compared the performance of 35 professional translators and that of 24 foreign-language teachers with no prior translation experience (PACTE 2008, 2009, 2011a, 2011b, Hurtado 2017a). Upon completing our research into TC, we began to study TCA in January 2010. After a pilot test in June 2011, we carried out a TCA experiment in November of the same year, with the participation of 129 first to fourth-year trainee translators and recent graduates.¹

¹. See PACTE 2014, 2015, in press a for our first results on TCA.

In this publication we present our research on TCA. Although we collected data on both direct and inverse translation in the research in question, for reasons of space we focus exclusively on the former here. We firstly describe the conceptual and methodological framework of our research (article 1). We then present our study's measurements and results (articles 2-7), beginning with translation acceptability (article 2), a cross-cutting indicator whose results are brought together with those of most of the other indicators, and followed by the different study variables (articles 3-7), namely knowledge of translation; translation project; identification and solution of translation problems; decision-making; efficacy of the translation process; and use of instrumental resources. The study's conclusions are set out in article 8. The publication also includes a bibliography in which all the works cited in the various articles are listed, and appendices containing our hypotheses (appendix 1), the main instruments we used (appendices 2-4), our statistical test results (appendix 5) and a glossary of key terms from our research (appendix 6).

Funding from Spain's Ministry of Science and Innovation² made our research on TCA possible. We also received funding from the Government of Catalonia's Agency for University and Research Grant Management.³

We would like to thank all the students from the Universitat Autònoma de Barcelona's Faculty of Translation and Interpreting who took part in the study, as well as Luis Castillo, Mònica Fernández, Gabriele Grauwinkel, Gisela Massana, Margherita

². 'Estudio empírico de la adquisición de la competencia traductora en traducción escrita', Spanish Ministry of Science and Innovation. Fundamental research projects (FFI2009-07960), 01/01/2010 - 31/07/2013.

³. 'Grup de recerca consolidat (PACTE)', Government of Catalonia, Agency for University and Research Grant Management (AGAUR): 2009 SGR 64, 01/01/2009 - 31/12/2013; 2014 SGR 275, 01/01/2014 - 31/12/2016.

Taffarel and Stefanie Wimmer, who participated in preparatory activities and data collection.

We would also like to thank Paul Taylor for translating all the articles in this special issue from Spanish and/or revising them in English.

Lastly, we want to say a very special thank you to Allison Beeby and Olivia Fox (both retired), who participated in preparatory activities, data collection and the study's first analyses. Our research would have been impossible without them. Special thanks are also due to Willy Neunzig (deceased before the publication of this volume), who came up with the design for our research and to whom we dedicate this publication.

1. Translation competence acquisition. Conceptual and methodological framework

In this article we present the conceptual and methodological framework of PACTE's research on translation competence acquisition (TCA). Firstly, we provide an overview of research on TCA, covering the models that have been proposed and the empirical studies undertaken. Secondly, we present PACTE's models of translation competence and TCA. Lastly, we describe the design of PACTE's experimental research on TCA, including our hypotheses and study variables, the type of study we performed, the characteristics of its sample, the tasks involved and the instruments used, and our test and data analysis procedures. We also point out the study's limitations.

Keywords: translation competence acquisition; conceptual framework; methodological framework; experimental research

1.1. Research on translation competence acquisition

Many models of translation competence (TC) have been proposed, from different perspectives, since the mid-1980s. Examples include Nord 1988/1991, 1992; Bell 1991; Neubert 1994, 2000; Kiraly 1995; Hurtado 1996a, 1996b; Cao 1996; Hatim and Mason 1997; Risku 1998; Kelly 2002, 2005, 2007; González-Davies 2004; Shreve 2006; Alves

and Gonçalves 2007; Katan 2008; and Göpferich 2008, 2009. Also of note is Wilss's (1976: 120) pioneering proposal from 1976. The majority of the models in question focus on suggesting components of TC, such as linguistic and extralinguistic knowledge, documentation skills, etc. They differ in their terminology, their component distribution and the importance they attribute to each component.⁴

Most of the models proposed, however, have not been empirically validated. There is thus a lack of empirical research to draw on, and this may be a consequence of: (1) the complex nature of TC, owing to the wide variety of areas of cognition and activities involved; (2) the complexity of the relationships of those areas and activities; (3) TC's heterogeneity, due to it involving very different skills (which, furthermore, can vary from subject to subject); and (4) TC's diversity, in that it varies according to professional profile and directionality (translation into L1 or L2). A further factor is the proceduralisation and automatisisation of the way TC works (see Hurtado 2017b).

As certain authors (Campbell 1998, 18; Waddington 2000, 135) state, no model of TC can be complete without encompassing the translation competence acquisition (TCA) process.

1.1.1. Models of translation competence acquisition

Unlike in the case of TC, very few models of TCA have been proposed. Most of the TCA models that do exist are based on observation and experience and on studies carried out in other disciplines. Only Harris (1973, 1977, 1980) and Alves and Gonçalves (2007) have sought to empirically validate their proposals.

4. See Hurtado 2017b for a review of proposed models and their evolution.

Harris's natural translation

Harris (1973, 1977, 1980) and Harris and Sherwood (1978) refer to the existence of a *natural translation* ability, a universal innate capability of all bilingual speakers. Harris (1977) defines natural translation as the translation that bilinguals who have not received special training to translate perform in everyday circumstances. Based on results from empirical studies (some of them longitudinal) conducted in the USA on bilinguals over the first 18 years of their life, Harris and Sherwood (1978) show natural translation to be an innate ability that appears at a very early age and develops from what they term a *pretranslation* stage to a *semi-professional* stage.

Nonetheless, as Toury (1986, 1995) and Presas (2000) point out, a natural translation ability does not necessarily generate TC. Toury (1986) explains that TC does not develop automatically and in parallel to natural bilingualism, and that translators must build up not only language competence but also transfer competence, which requires the transfer of texts and thus involves knowledge structures that are not part of bilingualism. Presas (2000) contrasts the notions of *natural translator* and *trained translator*, stressing that it takes more than a natural translation ability to be a translator.

Toury's socialisation as concerns translating

Toury (1980, 1995) puts forward the concept of *native translator*, complementing the notion of *native speaker* from linguistics, in reference to individuals who develop translation skills progressively, without formal training.

Toury (1995, 241-258) proffers a model of the process whereby a bilingual becomes a translator, which he calls *socialisation as concerns translating*. He says that translating always consists of communicative production and, therefore, is always an interactive act, in which feedback from the social environment plays a key role. Such

feedback is essentially normative and a translator may receive it in the form of *sanctions* (if their translation is poor) or rewards (if their translation satisfies the sender or receiver). This mainly happens in the initial stages of a translator's development, when, as a novice, they are discovering how the social environment works and do not know what is expected of them or how to judge the appropriateness of different solutions or alternative strategies. They later develop an internal monitoring mechanism that operates while they translate. As their TC matures, they may begin to resist normative pressure without the risk of sanctions. From then onwards, they might not only act contrary to but even bring about changes in prevailing norms.

During the socialisation process, according to Toury, translators gradually assimilate the feedback they receive and modify their basic TC in consequence. TC is thus a blend of innate, assimilated and socially determined mechanisms at every stage of its development.

Toury also hypothesises that the more varied the translation situations an individual encounters are, the greater the range and flexibility of their personal ability to act appropriately will be. It is thus *adaptability* that they acquire. He suggests that when *specialisation* occurs it may counteract an individual's adaptability, reducing their overall TC.

Shreve: from natural to constructed translation. Expertise trajectory

Shreve (1997) regards TC as a specialised form of communicative competence, one that, unlike the latter, not everyone possesses.

According to Shreve, the development of TC is a continuum spanning *natural translation* and *constructed translation* (professional translation). Within the continuum, however, movement is not automatic or linear and there is no established path. Shreve refers to a *three-dimensional polygon* encompassing different translation

forms and functions, translation experience and translation situations. Variation in translation performance, he says, can be attributed to variation in: (1) individual cognitive styles; and (2) translation acquisition history (through training, mentoring from another translator, or independent acquisition).

Shreve states that the development of TC entails changes in the nature of the translation process and translation norms. There are thus differences between *natural translators* and *professional translators*. For example, natural translators produce culturally and/or stylistically inappropriate translations; translate on the basis of small units without considering aspects of coherence and cohesion; focus on lexis, to the detriment of other elements; and do not take a translation's purpose into account. Shreve emphasises the key role of the nature, level and frequency of translation tasks over the course of TCA, going as far as to say that TC cannot be restructured without changes in such tasks.

In a later work, Shreve (2006) links TCA with the notion of *expertise trajectory* (Lajoie 2003). He suggests that, with practice, declarative knowledge (i.e. what is known about a task) is converted into production rules that lead to proceduralisation and, therefore, to less effortful processing and greater automaticity. He argues that TCA can take place differentially, depending on variations in how further practical experience is acquired.

Chesterman's five stages of translation expertise

Drawing on the five steps Dreyfus and Dreyfus (1986) identify as being involved in acquiring any skill, Chesterman (1997) proposes the following stages of TCA:⁵

5. Dreyfus and Dreyfus do not give the five stages they identify specific names. The names of the stages included here are as proposed by Chesterman.

- Stage one: *novice stage*. Individuals learn to recognise objective facts and predefined relevant features. They also learn rules for determining actions based on such facts and features.
- Stage two: *advanced beginner stage*. Individuals begin to recognise features that, while relevant, are difficult to define (or are undefined). Their experience and level of recognition increase.
- Stage three: *competence stage*. As their experience and level of recognition increase, individuals have to develop a sense of priorities, i.e. hierarchical decision-making procedures. Competent individuals follow conscious rules, process information and make choices.
- Stage four: *proficiency stage*. Individuals make decisions based on personal experience more than on conscious rules. They operate according to intuitive comprehension.
- Stage five: *expertise stage*. Individuals' actions are deliberate and flow smoothly. Intuition is prioritised and consciousness takes the form of critical reflection on intuition itself.

Chesterman defines this as a gradual process of automatisisation which develops ‘from atomistic to holistic recognition, from conscious to unconscious responses, from analytical to intuitive decision-making, from calculative to deliberative rationality, from detached to involved commitment’ (1997, 150). As an individual's expertise grows, so too does their ability to recognise features of situations and use appropriate and increasingly automatic and intuitive strategies (1997, 151).

Alves and Gonçalves's relevance theory model

On the basis of connectionist approaches, Alves and Gonçalves (2007) regard TCA as a

gradual, systematic, recurrent process involving neural networks expanding between different units of an individual's cognitive environment. Drawing on four empirical studies with translation students and professional translators (see Alves and Gonçalves 2003; Alves and Magalhães 2004; Alves 2005a, 2005b), they distinguish between two cognitive profiles:

- *Narrow-band translators*, who work mostly on the basis of insufficiently contextualised cues (i.e. dictionary-based instead of contextualised meaning) and fail to bridge the gap between procedurally, conceptually and contextually encoded information.
- *Broadband translators*, who tend to work mostly on the basis of communicative cues provided by the ST and reinforced by contextual assumptions derived from their cognitive environments. In this way, expert translators are able to integrate procedurally, conceptually and contextually encoded information into a coherent whole to encompass higher levels of meta-cognition.

Kiraly's four-dimensional model of the emergence of translator competence

Having previously criticised two-dimensional TC models for being unable to capture the complexity involved, Kiraly (2013, 2015) proposes a three-dimensional TC model to which he adds the time factor to produce a four-dimensional model of the emergence (rather than acquisition) of translator competence.

Kiraly's model reflects the complex interplay of competences and their non-parallel emergence over time, and that each individual's competence development is different. Although the model depicts TC as a complex network, and sub-competences as sub-networks, Kiraly opts against identifying specific sub-competences (whose labelling he sees as reductionist) on the grounds that there is no consensus on which

ones actually exist. He highlights, nonetheless, that a myriad of aspects influence a translator's competence acquisition process, which undergoes constant evolution. Those aspects include 'the translation tasks and projects they engage in and learn from, their personal and interpersonal disposition for translating, their disposition for learning, the human and material resources available and drawn upon and also the affordances of the learning environment' (2013, 212). The translator's dispositions for learning, abstracting from experience, using language creatively and adapting to norms are among the other factors that can influence TCA and make every process unique.

In Kiraly's emergent competence system, each sub-competence appears near the lower (novice) level as a separate dynamic vortex. There are complex links throughout the system towards the upper (expert) end of the model due to experience and learning, including learning from interpersonal interaction. At the end of the process, 'the separate sub-competences will have merged into a highly integrated and largely intuitive super-competence' (2015, 29).

As can be seen, all the aforementioned authors agree that TC is an acquired rather than innate ability, and that its acquisition is a cyclical process that goes from an initial stage to a stage of competence consolidation. Some authors (Chesterman, Shreve, Alves and Gonçalves) liken TCA to the process involved in acquiring any knowledge and stress the gradual process of proceduralisation and automatisisation that takes place. As a cyclical process, TCA can be assumed to comprise various stages. Empirical knowledge of what they are and how they work is lacking, however.

1.1.2. Empirical studies on translation competence acquisition

A wide range of empirical studies on matters related to TCA have been carried out since

the 1980s.⁶ They focus on the performance of translation students of a given level or of different levels, or compare translation students' performance with that of bilinguals or, more frequently, professional translators. Most such studies involve small samples.

Until the mid-1990s, data were chiefly compiled by means of think-aloud protocols (TAPs). The late 1990s saw the emergence of a more multi-method approach geared to data triangulation and involving a greater variety of data compilation techniques and instruments, such as direct observation, questionnaires and interviews, and the use of key-logging and screen-recording software. This approach was consolidated in the second half of the 2000s, with sounder research designs, the use of statistical analysis and the incorporation of new technological tools, such as eye-tracking, for collecting data.

The TCA-related matters that empirical studies have encompassed include:

- The characteristics of a successful translation process (e.g. Jääskeläinen 1990).
- Creativity (e.g. Kussmaul 1991; Bayer-Hohenwarter 2011).
- Automatisation processes (e.g. Jääskeläinen and Tirkkonen-Condit 1991; Kiraly 1995).
- The comprehension process (e.g. Tirkkonen-Condit 1988; Dancette 1994, 1995, 1997).
- Decision-making processes (e.g. Prassl 2010a; Presas and Martín de León 2014).
- Analyses of metacognitive processes (e.g. Alves 1995, 1996, 1997).
- Translation strategy use (e.g. Seguinot 1991; Kunzli 2004; Göpferich 2012; Lachat 2013; Gregorio 2014).
- Cultural competence (e.g. Yarosh 2012; Olalla-Soler 2017).

6. See Massana (2016, 39-67) for a review of such studies up to 2015.

- The use of sources of documentation (e.g. Kunzli 2001; Dimitrova and Jonasson 2002; Prassl 2010b).
- Translation correction and revision (e.g. Muñoz Martín and Conde Ruano 2007).
- Pauses in the translation process (e.g. Janisch 2009).
- The influence of bilingualism (e.g. Gómez Hurtado 2006).
- The influence of working memory (e.g. Rothe-Neves 2003).
- The influence of task type in the reading process (e.g. Jakobsen and Jensen 2008).
- The effects of time-related pressure (e.g. De Rooze 2003).
- Instruments used for measuring TCA (e.g. Orozco 2000; Orozco and Hurtado 2002)
- The effects of using TAPs (e.g. Matrat 1992; Jakobsen 2003).
- The effects of using screen recordings (e.g. Angelone 2014; Shreve, Angelone and Lacruz 2014).
- The effects of using automatic speech recognition (e.g. Mees, Dragsted, Hansen and Jakobsen 2013).

The studies in question only deal with particular aspects of the TCA process, however.

There is little in the way of research that looks at TCA in its entirety and on the basis of large, representative samples.

There are certain studies that notably do involve large samples. Seguinot (1991) conducted a study, aimed at comparing native and second language translation strategies, in which 195 specialised translation students performed a translation test at the beginning and the end of each academic year. Orozco (2000) and Orozco and Hurtado (2002) studied the production of instruments for measuring TCA in written translation, with the participation of 235 first-year students from three Spanish

universities. Also of note are certain doctoral theses that deal with aspects related to TCA:

- Lachat (2003) studied how experience and learning affect the problem-solving process and strategy use, working with 111 novice second-year and 98 advanced fourth-year degree students and 12 professional translators.
- Gregorio (2014) studied the development of strategic competence in relation to cultural translation problems with 1,046 (655 first-year and 391 fourth-year) degree students from five Spanish faculties of translation and interpreting. She included a longitudinal study in which 37 students performed the same tests in their first and fourth years.
- Quinci (2014) undertook a longitudinal study over three years with 53 students from translation undergraduate and master's degree courses (one group of undergraduate and two groups of master's degree students). The aim of the study, which also looked at the performance of 10 professional translators, was to observe whether linguistic patterns vary according to competence level.
- Massana (2016) conducted an experimental study on TCA in relation to the translation (Portuguese-Spanish) of false friends with 10 professional translators and 30 second, third and fourth-year translation students (10 from each year) from two Spanish universities.
- Olalla-Soler (2017) carried out an experimental study on the acquisition of translator's cultural competence with a sample comprising 10 professional translators and 38 first, second, third and fourth-year Translation and Interpreting degree students (approximately 10 from each year) taking German as a second foreign language.

Two research projects involving longitudinal studies on TCA should also be mentioned:

- The TransComp project (2008-2011, University of Graz) tracked the performance of 12 translation students over a period of three years and compared it to that of 10 professional translators (see Göpferich 2009).
- The Capturing Translation Processes (CTP) project (2009-2011, ZHAW Institute of Translation and Interpreting) made comparisons between translation students at different stages in their training (194 beginners and 112 advanced students) and 39 professional translators (see Massey and Ehrensberger-Dow 2011; Ehrensberger-Dow and Massey 2013; Ehrensberger-Dow 2013).

1.2. PACTE's translation competence acquisition model

1.2.1. PACTE's translation competence model

According to PACTE, TC is the underlying system of knowledge, skills and attitudes required to translate. We consider that TC (Figure 1.1): (1) is predominantly procedural knowledge; (2) comprises different interrelated sub-competences; and (3) includes a particularly important strategic component. In our model, TC comprises five sub-competences (bilingual, extralinguistic, knowledge of translation, instrumental and strategic), as well as psycho-physiological components (PACTE 2003, 2017a, 39-40):

- *Bilingual sub-competence.* Predominantly procedural knowledge required to communicate in two languages. It comprises pragmatic, sociolinguistic, textual, grammatical and lexical knowledge in the two languages. It includes the specific ability to control interference when switching between two languages.
- *Extralinguistic sub-competence.* Predominantly declarative knowledge, both implicit and explicit, about the world in general and specific areas. It comprises:

(1) bicultural knowledge (about the source and target cultures); (2) general world knowledge; and (3) subject knowledge (field-specific).

- *Knowledge of translation sub-competence.* Predominantly declarative knowledge, both implicit and explicit, about what translation is and aspects of the profession. It comprises: (1) knowledge about how translation functions, encompassing translation units, processes required, methods and procedures used (strategies and techniques), and types of problems; and (2) knowledge related to professional translation practice, encompassing the labour market, types of translation briefs, target audiences, etc.⁷
- *Instrumental sub-competence.* Predominantly procedural knowledge related to the use of documentation resources and information and communication technologies applied to translation and translation technologies: dictionaries of all kinds, encyclopaedias, grammars, style books, parallel texts, electronic corpora, search engines, assisted translation software, machine translation software, terminology database management software, post-editing software, etc.⁸
- *Strategic sub-competence.* Procedural knowledge for guaranteeing the efficiency of the translation process and solving problems encountered. This is an essential sub-competence that affects all the others in that it creates links between the different sub-competences as it controls the translation process. The functions for which it is used are to: (1) plan the process and carry out the translation project (selecting the most appropriate method); (2) evaluate the process and the

7. Other aspects are also involved, such as knowledge of translation associations, rates and taxes.

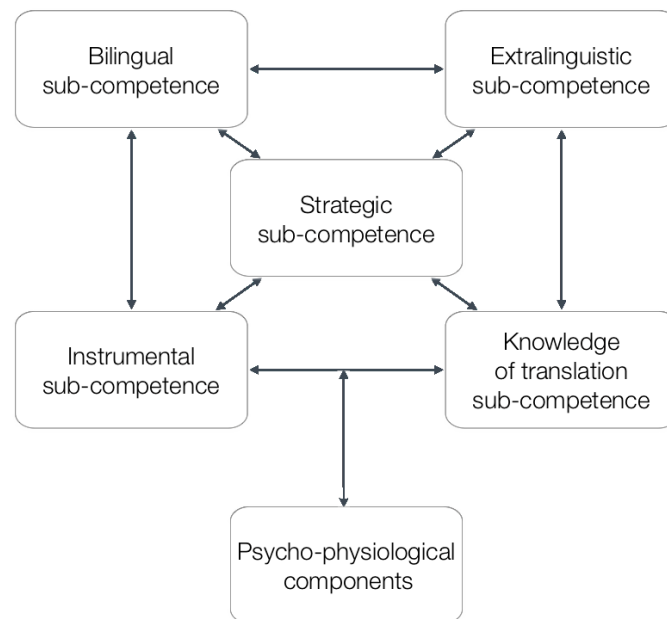
8. We have updated our definition of this sub-competence since PACTE 2003 was published.

partial results obtained in relation to the final purpose; (3) activate the different sub-competences and compensate for any shortcomings in them; and (4) identify translation problems and apply procedures to solve them.

- *Psycho-physiological components.* Different types of cognitive and attitudinal components and psycho-motor mechanisms. They include: (1) cognitive components such as memory, perception, attention and emotion; (2) attitudinal aspects such as intellectual curiosity, perseverance, rigour, critical spirit, motivation, knowledge about, confidence in and the capability to measure one's own abilities; and (3) abilities such as creativity, logical reasoning, analysis and synthesis.

In PACTE's model, the knowledge of translation, instrumental and strategic sub-competences are specific to TC, and we therefore made them the focus of our experimental research on TC. It should be noted that there is a close relationship between the strategic sub-competence, which is cognitive in nature and includes the ability to use internal support strategies, and the instrumental sub-competence, which includes the use of external support strategies.

Figure 1.1. PACTE's translation competence model (PACTE 2003, 60, 2017a, 41)



PACTE's empirical and experimental research on TC has validated this model (see Hurtado 2017a).

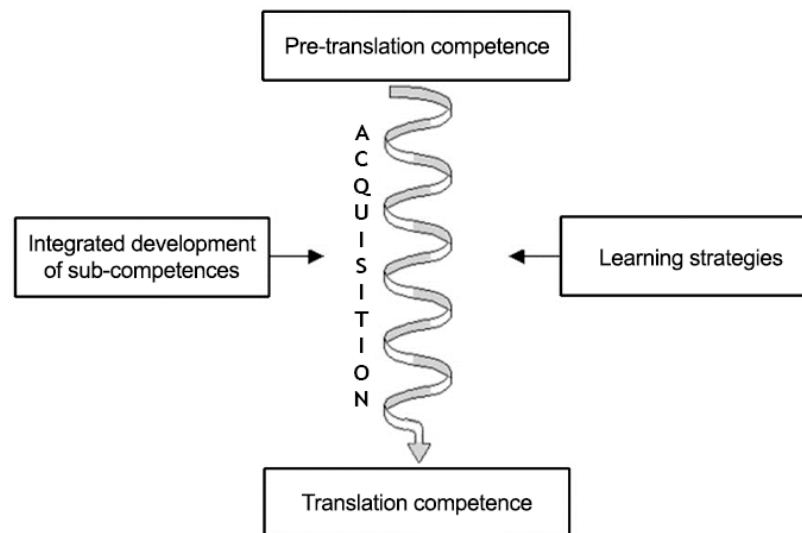
1.2.2. PACTE's translation competence acquisition model

PACTE conceives TCA as a spiral, a non-linear process in which novice knowledge (pre-TC) evolves into TC, involving the development of sub-competences and learning strategies (see Figure 1.2). Our model, developed in 1998, includes insights from research into learning processes, and postulates that TCA is:

- (1) A dynamic, spiral process, that, like all learning processes, evolves from novice knowledge (pre-TC) to TC. It requires learning competence (learning strategies).
- (2) A process of restructuring and developing the sub-competences and psycho-physiological components of TC.
- (3) A process in which both declarative and procedural types of knowledge are integrated, developed and restructured.
- (4) A process in which the development of procedural knowledge – and, consequently, of the strategic sub-competence – is essential.

The process thus consists of an evolution that begins at a stage where an individual has only bilingual and extralinguistic competence and a rudimentary natural translation ability (Shreve 1997), and ends with the acquisition of TC. Empirical research on TCA will also provide data on the initial pre-TC stage.

Figure 1.2. PACTE's translation competence acquisition model (PACTE 2000)



TCA involves relationships, hierarchies and variations where sub-competences are concerned. The sub-competences that play a part in the process: (1) are interrelated and compensate for each other; (2) do not always develop in parallel (i.e. at the same time and rate); (3) are organised hierarchically; and (4) may vary depending on the translation direction, language pairs, specialisation and learning environment involved. On that basis, the TCA process might not be parallel for direct and inverse translation. Furthermore, the process may evolve at different speeds depending on the language pair, and one sub-competence may be more important than another depending on the translation speciality (legal, literary, etc.). The learning context (formal training, self-learning, etc.) has an influence on the acquisition process, as does the methodology used by teachers. Obviously, there may also be personal differences between subjects (knowledge, abilities, cognitive styles, etc.), which are difficult to measure in studies

such as PACTE's, which do not set out to gauge such differences but rather to identify patterns of behaviour in large groups.

1.3. Research design

Before carrying out our experiment on TCA, in June 2011 we performed a pilot test with 15 fourth-year Translation and Interpreting degree students at the Universitat Autònoma de Barcelona (UAB). Our aim in doing so was to refine our hypotheses and check the suitability of the instruments adapted from our TC experiment (especially our translation problems questionnaire).

As was the case in our TC experiment, in our TCA experiment we focused on the three sub-competences specific to TC (the knowledge of translation, instrumental and strategic sub-competences) and did not study its psycho-physiological components. We also chose not to study the acquisition of learning strategies or the influence of pedagogical input, which ought to be investigated in other research. Like our work on TC, our research on TCA focused on non-specialised translation.

1.3.1. Hypotheses

We drew on our TCA model to formulate our research's theoretical hypotheses. Our general hypothesis was that TC is acquired as a result of a process of development and restructuring of different sub-competences. On that basis, we established the following theoretical hypotheses:

- (1) TCA is, like all learning processes, a dynamic, non-linear, spiral process.
- (2) TCA involves an evolution from novice knowledge (pre-TC) to TC.
- (3) TCA is a process in which the sub-competences of TC are developed and restructured.

- (4) In TCA, not all sub-competences develop in parallel, i.e. at the same time and at the same rate.
- (5) In TCA, the development of the strategic, instrumental, and knowledge of translation sub-competences is particularly important.
- (6) TCA is a process in which the development of procedural knowledge – and, consequently, of the strategic sub-competence – is essential.
- (7) TCA is dependent upon directionality (direct/inverse translation).
- (8) TCA is dependent upon the learning environment.

Given that this publication only includes our results on direct translation, as explained in the introduction, and that we did not study the influence of pedagogical input, the last two of our theoretical hypotheses are unverified here.

Our empirical and operational hypotheses are included in each variable's description (see articles 2-7 and appendix 1).

1.3.2. Study variables

The study's independent variable was subjects' number of years of experience of translating, in which regard we distinguished between first-year students, second-year students, third-year students, fourth-year students and recent graduates.

As in our TC experiment, the study's dependent variables were knowledge of translation, translation project, identification and solution of translation problems, decision-making, efficacy of the translation process, and use of instrumental resources. We analysed a total of 22 indicators, comprising: 20 indicators distributed between the six study variables (Table 1.1); the dynamic translation index, an indicator related to the knowledge of translation and translation project variables (representing the mean of indicators 1, 3 and 4, as listed in Table 1.1); and translation acceptability, a cross-

cutting indicator whose results we brought together with those of the variables' indicators.

Table 1.1 shows our study variables and their indicators, and identifies the article in which they are discussed.

Table 1.1. Study variables and indicators

Dependent variables	Indicators
KNOWLEDGE OF TRANSLATION (see article 3)	1. Dynamic index of knowledge of translation 2. Coherence coefficient of knowledge of translation
TRANSLATION PROJECT (see article 3)	3. Dynamic index of the overall translation project 4. Dynamic index of the translation project for translation problems 5. Coherence coefficient of the translation project
KNOWLEDGE OF TRANSLATION + TRANSLATION PROJECT (see article 3)	6. Dynamic translation index
IDENTIFICATION AND SOLUTION OF TRANSLATION PROBLEMS (see article 4)	7. Perception of difficulty coefficient 8. Identification of prototypical translation problems 9. Problem-solving procedures 10. Satisfaction coefficient 11. Characterisation of the text's main types of difficulties 12. Characterisation of prototypical translation problems
DECISION-MAKING (see article 5)	13. Sequences of actions 14. Type of internal support
EFFICACY OF THE TRANSLATION PROCESS (see article 6)	15. Total time taken 16. Time taken at each stage
USE OF INSTRUMENTAL RESOURCES (see article 7)	17. Total time spent on searches 18. Time spent on searches at each stage 19. Variety of resources 20. Number of searches 21. Variety of searches

1.3.3. Study type

A longitudinal study, involving a series of measurements made at regular intervals over an extended period of time and with the same group of subjects, is the ideal method for researching a competence's acquisition. In our case, however, such an approach would

have entailed various practical and technical problems:

- The difficulty of retaining the same group of subjects for five years.
- The need to develop and test comparable instruments for each measurement.
- Complications in terms of controlling extraneous variables, such as external factors liable to affect subjects' language and translation skills.
- Technological changes in hardware and software.

We consequently opted to simulate a longitudinal study, to which end we took measurements from groups of first, second, third and fourth-year students and a group of recent graduates simultaneously. We used a screening questionnaire to ensure that the subjects in each group were homogeneous and representative of the corresponding level. Our approach enabled us to collect all our data in a single month, using the tasks and instruments validated in our TC experiment, thus guaranteeing that the data for every indicator were collected in the same conditions. The experiment was conducted in November 2011, when our first-year subjects had just begun their degree course and had yet to take any translation subjects. The recent graduates had completed their studies in June 2011 (four months before the experiment).

1.3.4. Sample

Working with a universe comprising trainee translators, we drew our sample from first to fourth-year undergraduate students and recent graduates from the UAB's Faculty of Translation and Interpreting. We regarded the graduates as students representing the end of the training process. To ensure that the subjects were homogeneous and representative of the relevant stage of training, and to control extraneous variables (e.g. the possibility of some subjects acquiring greater linguistic or extralinguistic knowledge or experience of translating than the others outside their university training), we

screened the experimental sample using a questionnaire. We selected approximately 30 students for each year from all those who met our requirements.

The subjects we selected met the following requirements: their first language (L1) was Spanish or Catalan; their age was within a pre-established range representative of each year; and they had not transferred from another degree course and had passed a minimum of 80% of their subjects in the previous year (including translation, L1 and L2 subjects), thus guaranteeing similar language skills and experience of translating.

The first-year students had just begun their studies and had not yet taken any translation subjects, which are taught as of the second semester. The second-year students had taken single-semester introductory subjects on translation and translation technologies, in addition to which the third-year students had completed a single-semester subject about documentation applied to translation and a year-long direct translation subject. The fourth-year students and graduates had also studied single-semester subjects on translation theory, specialised direct translation, terminology and inverse translation, along with another translation technologies subject. They had all taken subjects intended to enhance their L1 and L2 skills.

As our objective was to analyse the TCA process rather than the influence of pedagogical input, we did not establish a control group with different training for comparison purposes.

We used the 35 professional translators who had taken part in our TC experiment as a 'control group'. We considered this group to be a benchmark for the acquisition process as it comprised subjects who already had TC (validated in our TC experiment) and had acquired it before we collected our data on TCA. It can be deemed a benchmark group for TCA as it was directly related to the study's independent

variable, in that its members were the subjects with the most years of experience of translating and were no longer in the process of acquiring TC.

In total, our TCA experiment involved 129 subjects, comprising 24 first-year students, 25 second-year students, 28 third-year students, 30 fourth-year students and 22 recent graduates. We worked with six language pairs, as we had in our TC experiment, with English, French and German as L2s, and Spanish and Catalan as L1s.

1.3.5. Tasks and instruments

As in our TC experiment, our subjects:

- (1) Translated a text into their L1 (direct translation), then answered a questionnaire on the translation problems involved.
- (2) Translated a text into their L2 (inverse translation), then answered a questionnaire on the translation problems involved.
- (3) 3. Answered a questionnaire on knowledge of translation.

As stated in the introduction, in this publication we focus exclusively on our direct translation data. The results we obtained from inverse translation are described in PACTE 2014, 2015, in press a.

We used the data collection instruments we had validated in our TC experiment, i.e. our knowledge of translation questionnaire; texts for direct and inverse translation; an adapted version of our personal data questionnaire for obtaining personal information on the subjects (languages in which they were proficient and how they had learned them, translation experience outside university, computer programs they used, etc.); and a revised version of our translation problems questionnaire (see appendices 2-4). The subjects answered all questionnaires online. We recorded their on-screen activity using the *Camtasia* software.

The subjects were provided with a form for recording details related to any consultations they made using printed resources, specifically the item or expression looked up, the resource used and the time at which they began their consultation.

1.3.6. Test procedure

The tests were held in classrooms with computers in the UAB's Faculty of Translation and Interpreting and spread over three sessions. All the subjects representing a particular year took the tests together in the same classroom. Each subject used a computer on which we had previously created a work folder (with a code) containing files for saving their direct and inverse translations. The subjects had access to a virtual space we had prepared containing electronic documentation resources and there was no limit on the number of consultations they were allowed to perform. They were paid to participate in the experiment and assigned codes to ensure their anonymity.

Before the tests began, we gave an oral presentation about their content and issued the subjects with a dossier containing instructions for performing them (steps to follow, accessing files and questionnaires, saving files, etc.), forms for recording details of consultations made using printed resources, and a list of the printed and electronic resources available.

The experiment was divided into three parts, with a break between each to avoid the subjects getting tired. In the first part they performed the direct translation task and answered the translation problems questionnaire. They were then given a 15-minute break. In the second part they performed the inverse translation task and answered the translation problems questionnaire, and then took another break. We told them they had approximately an hour to translate each text, although we did not stop any of them working on the grounds of time. While they were translating we used *Camtasia* to record their on-screen activity. If they looked anything up in printed resources, they

recorded the details of their consultation on the corresponding (direct or inverse translation) form.

In the third part they answered the knowledge of translation and personal data questionnaires.

To ensure the ecological validity of the experiment, the subjects were told that they were participating in a study on establishing competence levels in the EHEA. The subjects and PACTE signed an agreement whereby the subjects allowed PACTE to use the data collected from the experiment and PACTE guaranteed anonymity and that the data would remain confidential and only be used for research purposes.

Each of the experiment's three sessions took approximately four hours in total.

1.4. Data analysis

1.4.1. Texts and rich points

We used the same texts and rich points (RPs) as in our TC experiment, having tested them beforehand in a pilot study (see appendix 2).

When selecting the texts to use in our TC experiment, we endeavoured to find texts that posed the types of translation problems most frequently encountered by professional translators. Based on our exploratory and pilot tests on TC, with a view to facilitating data collection and analysis we decided to focus on RPs, i.e. specific source-text segments containing prototypical translation problems (PACTE 2005, 2009, 2017b, 109). The TC experiment's results showed our use and choice of RPs to be appropriate for data collection and analysis (PACTE 2017c, 297-300).

When identifying RPs in the texts selected for direct and inverse translation, we considered five categories of translation problems (Table 1.2).

Table 1.2. Categories of translation problems (PACTE 2011b, 327, 2017b, 110)

Translation problems	Description
Linguistic problems	Lexis (non-specialised) and morphosyntax. Problems of both comprehension and reformulation may be involved.
Textual problems	Coherence, cohesion, text genre and style. Problems of comprehension or reformulation may be involved, and are associated with differences in the way texts function in each language.
Extralinguistic problems	Cultural, world and subject-domain knowledge. Problems that also derive from cultural differences.
Intentionality problems	Difficulty in understanding information in the source text (intertextuality, speech acts, presuppositions, implicatures). Problems of comprehension.
Problems relating to the translation brief and/or the target-text reader	Difficulties (affecting reformulation) which, from a functionalist point of view, would affect all rich points.

Our research on TC has shown that translation problems are not unidimensional and may combine features of several different categories (see PACTE 2017d, 175-176).

For the direct translation task, we used parallel English, French and German texts from the same text genre and on the same subject (news items on computer viruses). To ensure the different texts' RPs would be comparable, we selected the same types of translation problems in the three texts (see appendix 2). The results of our TC experiment showed the three texts to be of a similar level of difficulty (PACTE 2017d, 176-178, 188-189).

We selected the following RPs for direct translation:

- RP1. Title: intentionality and textual problem. RPs: *Email virus strikes in new form* (EN); *Wurm in der Leitung* (DE); *Bugbear.b, le virus informatique qui lit par-dessus l'épaule de ses victimes* (FR).
- RP2. Technical term: linguistic reformulation and extralinguistic problem. RPs: *keylogger* (EN); *Download-Verzeichnis* (DE); *édition de logiciels antivirus* (FR).

- RP3. Reference: textual problem. RPs: *propagation rate...doubled...surge* (EN); *Schädling ... E-Mail Würmer...Vorgängervariante* (DE); *le ver...résurgence...ses congénères* (FR).
- RP4. Element in apposition: textual and intentionality problem. RPs: *"Trojan horse" program which could allow a hacker to take remote control of infected machines* (EN); *Dateien-Tauschbörse Kazaa* (DE); *soumissions, des communications du virus* (FR).
- RP5. Element involving difficulties in terms of comprehension and reformulation: intentionality and linguistic reformulation problem. RPs: *Cheltenham-based virus filtering firm* (EN); *Tastatureingaben von PC-Nutzern nach Kreditkartennummern und Ähnlichem überwacht* (DE); *enregistrer les caractères tapés sur le clavier* (FR).

On the basis of a functional concept of translation, we assumed target reader expectations and the purpose of the text to affect all the RPs.

1.4.2. Use of different sources of data. Data triangulation

As in our research on TC, we collected a number of indicators' data from the translations the subjects performed during the experiment. In some cases, this information was only related to RPs; in others, it was related to the whole translation.

We used *Camtasia* recordings when studying the variables decision-making, efficacy of the translation process and use of instrumental resources.

In the case of the indicators related to the subjects' general concept of translation (dynamic index of knowledge of translation; and coherence coefficient of knowledge of translation), meanwhile, we obtained information from our knowledge of translation questionnaire.

We took a multi-methodological approach with a view to triangulating different types of data, combining quantitative and qualitative methods and a variety of instruments and tools to collect data. In analysing the data we obtained for each study variable, we established relationships between data and results related to the process and the product; among some of the study variables' indicators; and between acceptability and most of the variables' indicators. We compared acceptability and the other indicators from a descriptive perspective and, using correlations (or, in one case, regressions), a statistical perspective. The correlations provided us with information on the nature of the relevant indicator's relationship with acceptability within each group, and our descriptive analysis gave us a general insight into their relationship among the groups.

In our analysis, we also compared the values of pairs of groups; of the first-year students and the graduates; and of the graduates and the professional translators.

1.4.3. Statistical analysis

Before performing our statistical analysis, we prepared all the data from the different sources for analysis in a validated database (all data verified and anomalies solved, e.g. missing data accounted for) built using *SPSS*. We firstly analysed the data using descriptive statistics, and then by means of inferential statistical techniques appropriate to the objectives of each part of the study.

The main objectives of our statistical analysis were: (1) to compare between consecutive pairs of groups (first and second-year students, second and third-year students, etc.) and between the graduates and the professional translators to identify any statistically significant differences; and (2) to analyse the relationship between translation acceptability and the other indicators within each group. For each objective, we selected the most appropriate test according to the data type (categorical, continuous

or count data) and distribution (parametric or non-parametric statistics) involved. When possible, we also calculated the effect size of each statistical result.

In articles 2-7, we present only the cases in which we detected statistically significant differences (alpha level = 0.05) and effect sizes of over 0.30⁹ (except in the case of Kruskal-Wallis H tests, where we took all statistically significant results into consideration).

To decide whether to use parametric or non-parametric tests for each quantitative indicator, we performed a three-step check to determine whether data was normally distributed, involving: (1) creating histograms to examine the distribution curve; (2) creating Q - Q plots; and (3) running Shapiro-Wilk tests. Given that none of our quantitative indicators was normally distributed and all our samples were smaller than 40 (Mellinger and Hanson, 2017: 78), we considered it more appropriate to use non-parametric tests.

We used the following tests to compare groups:

- The Kruskal-Wallis H test as an omnibus test (reported effect size: η^2) and the Mann-Whitney U test with Bonferroni correction for multiple comparisons as a post-hoc test (reported effect size: r) for continuous and count data. We firstly ran the omnibus test to determine whether there were any differences between the groups of students. If the result of the omnibus test was statistically significant, we ran the Mann-Whitney U test with Bonferroni correction to compare consecutive pairs of groups.

9. Since there is no general agreement regarding what constitutes a reasonable effect size (Cohen, 1988; Ferguson, 2009), and effect size magnitude interpretation is context specific (Mellinger and Hanson, 2017: 97), we decided to establish 0.30 as the minimum effect size for a difference or relationship to be considered strong and impactful.

- The Mann-Whitney U test (one-tailed; reported effect size: r) for continuous and count data. We used this test to determine whether the graduates' value was greater than the translators' value.
- The chi-squared test for categorical data with more than two categories (reported effect size: Cramér's V).
- The chi-squared test of independence for proportions (effect size not reported since it cannot be computed). We ran this test to compare the proportion of use of a specific sequence of actions in two consecutive groups.
- Fisher's exact test for dichotomous data (reported effect size: Cramér's V).

We used the following tests to measure each indicator's relationship with acceptability in each group:

- Spearman's rank correlation coefficient (r_s) for continuous and count data. We considered correlation coefficients under 0.3/-0.3 to indicate no association, between 0.30/-0.30 and 0.69/-0.69 a moderate association, and above 0.69/-0.69 a strong association.
- The chi-squared test for categorical data with more than two categories (reported effect size: Cramér's V).
- Multiple linear regression. We used this procedure for the identification and solution of translation problems variable, given the complexity of its indicators (see article 4).

In each article, we provide the total number of valid cases for each group. For maximum transparency, appendix 5 includes all our statistical test results.

1.4.4. Analysis of differences between groups and progression. Scales and typology

We subsequently analysed each indicator, based on the groups' respective mean values.

For description purposes (and bearing in mind that a difference can be a rise or a fall), when comparing between groups we considered that, on a scale of 0 to 100, a difference of:

- Under 5 points = no difference.
- 5 to 9 points = slight difference.
- 10 to 19 points = substantial difference.
- 20 to 29 points = very substantial difference.
- 30 points or over = extremely substantial difference.

Certain indicators have a scale with a range of 0-1 rather than 0-100, and in such cases the corresponding values are 0.05, 0.10, 0.20, 0.30, etc.

On the basis of these descriptions, once we had analysed the results obtained for all the experiment's indicators, we identified four recurrent types of *evolution* between the start and completion of training:

- Non-evolution: no difference in the values between consecutive groups between the start and completion of training.
- Rising evolution: values rise between the start and completion of training, with each value between consecutive groups being higher than or equal to the previous one.

- Falling evolution: values fall between the start and completion of training, with each value between consecutive groups being lower than or equal to the previous one.
- Mixed evolution: a combination of rising and falling evolution between the start and completion of training.

As explained previously, in our research we simulated a longitudinal study, controlling a range of factors to ensure that our subjects were representative of their respective levels, rather than carrying out a genuine longitudinal study (see 1.3.3 and 1.3.4). We therefore use the term ‘evolution’ in reference to differences in values between students at consecutive levels, not to evolution within a particular group of students.

For the purpose of describing the progression that occurs between the start and completion of training, we considered a difference between the first-year and graduate groups of between 20 and 29 points to represent progression, under 10 points no progression, between 10 and 19 points little progression, and 30 points or over major progression.

The cut-offs we established for each type of difference are not applicable to indicators measured using a range other than one of the two we regard as standardised (0-1 and 0-100). We thus had to perform conversions to be able to apply our criteria to indicators with values distributed among various categories. It was not possible to perform conversions for some indicators, due to their characteristics, and we were therefore unable to calculate the differences involved in such cases.

1.4.5. Presentation of results

For each variable we state the total number of valid subjects; the figure corresponding to the professional translators comes from our TC experiment. In our tables of results

standard deviation is shown in brackets.

We describe our results as follows:

- Type of evolution observed (rising, falling, mixed, non-evolution) and differences between groups. We omit the cases in which there are no differences, and generally only specify whether a difference is a rise or a fall if evolution is mixed.
- Values at the start and upon completion of training, comparing the first-year students and the graduates (whether or not progression has taken place).
- Comparison of the values of the graduates and the professional translators.

For most indicators, we also present the observations we made by analysing their results in conjunction with those we obtained for translation acceptability.

In addition, we evaluate the influence of the training received by the subjects. This should be understood as a general relationship between the independent variable (first year, second year, etc.) and the relevant dependent variable, as we did not establish parallel control groups to determine the influence of pedagogical input at each level.

1.5. Limitations of the study

Owing to the complexity of studying TCA and the shortage of previous empirical research to draw on, our study has a number of limitations that ought to be taken into account in future research:

- Limitations related to the sample. All our sample's subjects came from a single translator training centre. The study should therefore be replicated in a different educational context.

- Limitations related to the type of study. We went to great lengths to ensure that each year's sample was representative of the corresponding level. Nonetheless, we did not conduct a longitudinal study (as explained in 1.3.3). A genuine longitudinal study in which all the relevant extraneous variables can be controlled should thus be undertaken.
- Limitations related to the control group. We used the group of professional translators from our TC experiment as our benchmark group. We conducted our TC experiment between October 2005 and March 2006, and several years went by before we collected data from our TCA study sample. The time difference involved could have distorted some results (e.g. use of technological tools).

2. Translation competence acquisition. Translation acceptability

In this article we present the evolution of translation acceptability in the translation competence acquisition process in direct translation. Acceptability establishes translation quality, in PACTE's view, and we define it in terms of meaning, function and language use. Our analysis of acceptability is based on 'rich points', i.e. source text segments containing prototypical translation problems. Firstly, we define acceptability. We then explain our evaluation procedures and criteria, and describe how we conducted our data analysis. Lastly, we set out and discuss the results we obtained for each experimental group, each type of translation problem and each factor analysed (meaning, function and language). Our results show that translation acceptability increases as translation competence is acquired.

The experiment was conducted in November 2011, when our first-year subjects had just begun their degree course; the graduates had completed their studies in June 2011.

Keywords: translation competence acquisition; translation acceptability; rich points; experimental research

2.1. Introduction

Acceptability is linked to translation product quality. In PACTE's research it is a cross-cutting indicator, one used in conjunction with the specific indicators of dependent variables to determine the relationship between the results obtained for those indicators and the quality of subjects' translations. In our previous research on translation competence (TC) we validated our hypotheses that *the degree of TC influences the translation process and product* and *the degree of TC can be defined by the acceptability of the results* (PACTE 2017e). In our research on translation competence acquisition (TCA) we added the operational hypothesis that *translation acceptability increases as TC is acquired* (see Table 2.1).

Table 2.1. The cross-cutting indicator acceptability

ACCEPTABILITY Cross-cutting indicator	
Objective	To determine the relationship between the results obtained for the specific indicators of dependent variables and the quality of the translation product.
Definition	Acceptability is the degree to which a translation effectively communicates the meaning of the source text; fulfils its function (within the context of the translation brief, readers' expectations, and genre conventions in the target culture); and makes appropriate use of language.
Hypotheses	Empirical hypotheses: - The degree of TC influences the translation process and product. - The degree of TC can be defined by the acceptability of the results. Operational hypothesis: - Translation acceptability increases as TC is acquired.
Measurement	Categorical and numerical indicator. Categorical indicator (decision-making variable), three categories: acceptable solution, semi-acceptable solution, non-acceptable solution. Numerical indicator (remaining variables), values: 0 to 1.
Instruments	Translations (rich points).
Source of data	Solutions obtained for rich points: acceptable, semi-acceptable or non-acceptable.

2.2. Measurement of acceptability

We used the same texts, criteria and evaluation procedures as in our TC experiment (see PACTE 2009, 2017e) so we could compare the two experiments' data. Likewise, our analysis also focused on rich points (RPs), i.e. source text segments containing

prototypical translation problems.

The texts we used can be found in appendix 2. See section 1.4.1 for details of our text and RP selection criteria.

2.2.1. Acceptability criteria and evaluation procedure

PACTE defines acceptability in terms of meaning, function and language use; in other words, of whether or not a proposed solution to a translation problem effectively: communicates the meaning of the source text; fulfils the function of the translation (within the context of the translation brief, target readers' expectations and genre conventions in the target culture); and makes appropriate use of language.

With the above in mind, we established and defined three categories of acceptability (PACTE 2005a, 2005b, 2008, 2009, 2017e, etc.), namely acceptable solution (A), semi-acceptable solution (SA) and non-acceptable solution (NA).

The criteria according to which we evaluated the acceptability of subjects' solutions to the RPs were based on each RP's description, the type of translation problem represented, and possible acceptable, semi-acceptable and non-acceptable solutions we had identified beforehand. To ensure the evaluation criteria were duly applied in all language combinations and to all year groups (between which we made no distinction), we established a peer review process for each RP in each combination. Any doubts that arose during evaluation were put to PACTE as a whole.

Triangulating our results for each factor of acceptability (meaning, function and language) enabled us to identify 27 different permutations and assign them to a category of acceptability (A, SA or NA) (see Table 2.2). The factor to which we attributed the greatest importance was meaning.

We established the following criteria to determine overall acceptability:

- (1) Any solution that did not communicate the source text's meaning effectively was classed as non-acceptable, even if it was acceptable or semi-acceptable in terms of function and language.
- (2) Any solution deemed non-acceptable in terms of function or language dropped to a lower category of acceptability, even if it was acceptable or semi-acceptable in relation to meaning.

We assigned each permutation to one of the three categories of overall acceptability (A, SA or NA).

Table 2.2. Acceptability: permutations, categories and numeric values (PACTE 2009, 2017e, 123)

Evaluation by factor			Final evaluation	Numeric value
Meaning	Function	Language	Category	
A	A	A	A	1
A	A	SA	SA	0.5
A	SA	A		
SA	A	A		
A	SA	SA		
A	A	NA		
A	SA	NA		
A	NA	A		
A	NA	SA		
SA	SA	A		
SA	SA	SA	NA	0
SA	A	SA		
A	NA	NA		
SA	SA	NA		
SA	A	NA		
SA	NA	A		
SA	NA	SA		
SA	NA	NA		
NA	A	A		
NA	SA	A		

NA	SA	SA
NA	SA	NA
NA	A	SA
NA	A	NA
NA	NA	A
NA	NA	SA
NA	NA	NA

To minimise subjectivity in the evaluation process, we produced a detailed description of each RP, encompassing the type of problem it involved, in terms of comprehension and reformulation, and its characteristic traits. We also established criteria for identifying acceptable, semi-acceptable and non-acceptable solutions, and provided examples in each case (Hurtado 2017a, appendix IV.1).

2.2.2. Data analysis

Firstly, we assigned each category a numerical value: A = 1; SA = 0.5; NA = 0 (see Table 2.2). Secondly, we worked out each group's mean value and calculated descriptive statistics. Thirdly, we analysed differences in acceptability between groups, based on their respective mean values, and established an evolution typology (non-evolution, rising evolution, falling evolution and mixed evolution). Lastly, we described the progression that occurs between the first year and the graduates. See section 1.4.4 for definitions of the various types of evolution.

For description purposes, when comparing between groups we considered a difference of under 0.05 points to represent no difference; of 0.05 to 0.09 points a slight difference; of 0.10 to 0.19 points a substantial difference; of 0.20 to 0.29 points a very substantial difference; and of 0.30 points or over an extremely substantial difference. To describe progression between the first year and the graduates, we considered a difference of 0.20 to 0.29 points to represent progression; of under 0.10 points no

progression; of 0.10 to 0.19 points little progression; and of 0.30 points or over major progression.

2.3. Results

In this section we present our results for each group and each RP in our TCA experiment, and compare them with the results of our TC experiment's group of translators. We include a more detailed analysis of the three factors of acceptability (for our TCA experiment groups only) at the end of the section.

Our analysis is based on 128 students as one had to be excluded due to technical problems. The number of valid subjects by year group was 23 for the first year, 25 for the second, 28 for the third, 30 for the fourth, and 22 for the graduates.

Standard deviation is shown in brackets in our tables of results and omit non-significant results of statistical tests. The significance level we established was 0.05. See appendix 5 for the results of all our statistical tests.

2.3.1. *Acceptability by group*

Table 2.4 shows our acceptability results for each group.

Table 2.4. Acceptability by group in direct translation

	Mean
1 st year	0.45 (0.19)
2 nd year	0.59 (0.24)
3 rd year	0.63 (0.18)
4 th year	0.65 (0.17)
Graduates	0.70 (0.18)
Translators	0.73 (0.20)

According to our results:

- Acceptability undergoes rising evolution as training advances. It begins to increase in the second year and continues to do so, little by little, until training ends. There is a substantial difference between the first and second years; a statistical comparison based on a Mann-Whitney U test revealed a statistically significant difference ($U = 185.0$; $p < 0.05$, Bonferroni corrected, $r = 0.36$). There is a slight difference between the fourth year and the graduates.
- Progression occurs between the first year and the graduates (0.25).
- The graduates' value is similar to that of the translators.

2.3.2. Acceptability by rich point

Table 2.5 shows our results for each RP.

Table 2.5. Acceptability by rich point

	RP 1	RP 2	RP 3	RP 4	RP 5
1 st year	0.43 (0.38)	0.48 (0.41)	0.59 (0.39)	0.43 (0.43)	0.30 (0.29)
2 nd year	0.76 (0.39)	0.58 (0.45)	0.68 (0.38)	0.60 (0.46)	0.34 (0.31)
3 rd year	0.73 (0.42)	0.68 (0.41)	0.68 (0.41)	0.71 (0.37)	0.36 (0.36)
4 th year	0.48 (0.50)	0.67 (0.42)	0.73 (0.34)	0.70 (0.43)	0.68 (0.31)
Graduates	0.59 (0.48)	0.66 (0.42)	0.84 (0.32)	0.73 (0.40)	0.70 (0.37)
Translators	0.71 (0.39)	0.63 (0.41)	0.80 (0.35)	0.80 (0.37)	0.73 (0.37)

RP 1. Intentionality and textual problem

RP 2. Linguistic reformulation and extralinguistic problem

RP 3. Textual problem

RP 4. Textual and intentionality problem

RP 5. Intentionality and linguistic reformulation problem

According to our results:

- In the case of RP1, mixed evolution takes place. There is an extremely substantial rise between the first and second years ($\chi^2[2] = 10.39$, $p < 0.01$, $V =$

0.46); a very substantial fall between the third and fourth years; and a substantial rise between the fourth year and the graduates. Little progression occurs between the first year and the graduates (0.16). There is a substantial rise from the graduates' value to that of the translators (0.12).

- In the case of RP2, rising evolution takes place. There are substantial differences between the first and second and between the second and third years, with no evolution thereafter. Little progression occurs between the first year and the graduates (0.18). The graduates' value is similar to that of the translators.
- In the case of RP3, rising evolution takes place. There is a slight difference between the first and second years and a substantial difference between the fourth year and the graduates. Progression occurs between the first year and the graduates (0.25). The graduates' value is similar to that of the translators.
- In the case of RP4, rising evolution takes place. There are substantial differences between the first and second and between the second and third years, with no evolution thereafter. Major progression occurs between the first year and the graduates (0.30). There is a slight rise from the graduates' value to that of the translators (0.07).
- In the case of RP5, rising evolution takes place. There is no evolution until the third year, then an extremely substantial difference between the third and fourth years ($\chi^2[2] = 12.19, p < 0.01, V = 0.46$). Major progression occurs between the first year and the graduates (0.40). The graduates' value is similar to that of the translators.

The following conclusions can be drawn from our analysis of acceptability by RP:

1. Type of evolution. Rising evolution takes place in all cases except that of RP1 (intentionality, textual), where mixed evolution occurs. In general, acceptability

increases as training advances. When mixed evolution occurs, it does so with a RP that includes aspects of intentionality. There are three RPs that involve intentionality (RP1, RP4, RP5) and mixed evolution only takes place in the case of one of them (RP1).

Nonetheless, it does not occur with any other type of problem.

2. Level of acceptability between consecutive groups. There is a substantial difference between the first and second years in the case of every RP except RP5 (intentionality, linguistic reformulation), where there is no difference, and RP3 (textual), where there is a slight difference. The most substantial differences correspond to RP1 (intentionality, textual) and RP4 (textual, intentionality), both of which include the same types of problems (textual and intentionality). There is also an extremely substantial difference between the third and fourth years where RP5 (intentionality, linguistic reformulation) is concerned.

3. Acceptability level at the start of training. At this stage, the lowest acceptability level corresponds to intentionality problems. The RP that causes the greatest difficulty (resulting in the least acceptable solutions) at the beginning of the TCA process is RP5 (intentionality, linguistic reformulation), whose acceptability only rises as of the fourth year. RP1 and RP4 (both intentionality and textual problems) also have low acceptability at the start of training. The RP with the highest level of acceptability is RP3 (textual).

4. The graduates' acceptability level. At this stage, the lowest acceptability level also corresponds to an intentionality problem, RP1 (intentionality, textual). The RPs with the highest level of acceptability are RP3 (textual), RP4 (textual, intentionality) and RP5 (intentionality, linguistic reformulation), as was the case among the professional translators.

5. Progression between the first year and the graduates. Progression occurs for every RP and is at its greatest with problems related to intentionality. The lowest degree of progression corresponds to RP1 (intentionality, textual) and RP2 (linguistic reformulation, extralinguistic). The greatest degree of progression corresponds to RP4 (textual, intentionality) and RP5 (intentionality, linguistic reformulation). It is not possible to generalise in terms of a pattern of progression according to problem type, however.

6. Comparison between the graduates and the translators. The graduates' acceptability values for most of the RPs are similar to those of the professional translators. The exceptions are two RPs that include aspects of intentionality and textuality for which the graduates' values are lower, specifically RP1 (intentionality, textual), where there is a substantial difference, and RP4 (textual, intentionality), where there is a slight difference. The graduates' value is also lower in the case of RP5 (intentionality, linguistic reformulation), although the difference here is negligible.

2.3.3. Acceptability by factor: meaning, function and language

In this section we present the results of our analysis of acceptability in terms of meaning, function and language, the three factors we considered when evaluating translation quality (Table 2.6).

Table 2.6. Acceptability in terms of meaning, function and language

	Meaning	Function	Language
1 st year	0.65 (0.22)	0.62 (0.17)	0.50 (0.24)
2 nd year	0.70 (0.25)	0.70 (0.17)	0.65 (0.18)
3 rd year	0.75 (0.19)	0.74 (0.12)	0.67 (0.20)
4 th year	0.74 (0.15)	0.81 (0.14)	0.75 (0.23)

Graduates	0.78 (0.13)	0.85 (0.14)	0.74 (0.18)
-----------	----------------	----------------	----------------

According to our results:

- In the case of meaning, rising evolution takes place. There are slight differences between the first and second and between the second and third years, with no evolution thereafter. Little progression occurs between the first year and the graduates (0.13).
- In the case of function, rising evolution takes place. There are slight differences between the first and second and between the third and fourth years ($U = 285.5$, $p < 0.05$, Bonferroni corrected, $r = 0.33$). Progression occurs between the first year and the graduates (0.23).
- In the case of language, rising evolution takes place. There is a substantial difference between the first and second years ($U = 182.5$, $p < 0.05$, Bonferroni corrected, $r = 0.37$), and a slight difference between the third and fourth years ($U = 286.0$, $p < 0.05$, Bonferroni corrected, $r = 0.32$). Progression occurs between the first year and the graduates (0.24).

On the basis of the data obtained:

1. Type of evolution. In every case, rising evolution takes place and acceptability increases as training advances.
2. Level of acceptability between consecutive groups. There are differences between the first and second years for each factor, being slight in the cases of meaning and function and substantial in that of language. There are also significant differences between the third and fourth years where function and language are concerned.

3. Acceptability level at the start of training. The factor with the lowest level of acceptability at this stage is language. The values corresponding to meaning and function are practically the same.

4. The graduates' acceptability level. The factor with the lowest level of acceptability at this stage is language. The highest level is that of function.

5. Progression between the first year and the graduates. There is progression between the stages in question in the cases of language and function, and little progression in that of meaning, which is linked to intentionality problems.

2.4. Conclusions

The data obtained confirm our operational hypothesis that *translation acceptability increases as TC is acquired*. Additionally, the following conclusions can be drawn:

1. In overall terms, acceptability undergoes rising evolution. It undergoes rising evolution when analysed by problem type too, except in the case of an intentionality and textual problem (the text's title), where mixed evolution occurs. Rising evolution also takes place when acceptability is analysed by factor (meaning, function and language).

2. Greater complexity in the evolution of acceptability in the case of intentionality-related problems, as a number of findings demonstrate:

- When mixed evolution occurs, it is with a problem that includes aspects of intentionality.
- The lowest levels of acceptability at the beginning and upon completion of training correspond to intentionality problems.
- Little progression occurs between the first year and the graduates in the case of the factor of meaning (which is related to understanding intentionality).

- It is with such problems that the difference between the graduates' values and those of the professional translators is at its greatest.

These findings underline the highly complicated nature of such problems and the need to use various types of knowledge and skills to resolve them.

3. Between the first year and the graduates there is progression in overall acceptability, as well as in acceptability for every RP and for every factor (meaning, function and language), albeit on a low scale in the case of meaning.

4. Similarity between the acceptability values of the graduates and the professional translators. In overall terms and in our analysis by problem type, the graduates' values are similar to those of the professional translators, except where problems including aspects of intentionality are concerned. It thus seems that in a four-year training period students can be prepared for professional practice and acquire sufficient TC to be able to solve translation problems satisfactorily, apart from intentionality problems, for which greater experience of translating appears to be required in order to attain a level close to that of professionals.

5. Training influences acceptability. Acceptability increases as training advances, and progression occurs for all problem types and factors. Furthermore, the fact that differences mainly arise between the first and second years is attributable to training in translation, with students having performed direct translation for a semester by the end of their first year.

3. Translation competence acquisition. Knowledge of translation and translation project. The dynamic translation index¹⁰

10. Initial results for the knowledge of translation and translation project variables were published in PACTE (2015).

This article focuses on two of the variables in PACTE's study of translation competence acquisition, namely knowledge of translation (declarative knowledge) and translation project (procedural knowledge). The indicators of the variables in question are the dynamic index and the coherence coefficient. The dynamic index indicates how dynamic subjects' (declarative and procedural) knowledge about translation is, in which regard we consider a dynamic concept of and approach to translation to be textual, interpretative, communicative and functionalist. The coherence coefficient indicates how coherent subjects' concept of different aspects of translation is (in the case of knowledge of translation), and whether their approach to translating a text is consistent with their approach to translating its translation units (in the case of translation project). We firstly present the knowledge of translation variable, and then the translation project variable. We subsequently bring their dynamic index data together to calculate the dynamic translation index, which reflects the degree of consistency between subjects' concept of translation and their approach to specific translation problems.

The experiment was conducted in November 2011, when our first-year subjects had just begun their degree course; the graduates had completed their studies in June 2011.

Keywords: translation competence acquisition; translation project; dynamic translation index; knowledge of translation sub-competence; strategic sub-competence

3.1. Introduction

This article presents our results for the knowledge of translation variable (predominantly declarative knowledge, i.e. *know what*) and the translation project variable (predominantly procedural knowledge, i.e. *know how*) from our experiment on translation competence acquisition (TCA). We define declarative knowledge as a subject's implicit (i.e. acquired, internalised, intuitive) knowledge about the principles of translation, and procedural knowledge as their approach to the translation of a specific text and the units it comprises, within a specific context. The two variables' indicators are the dynamic index and the coherence coefficient. We consider a dynamic

concept of and approach to translation to be textual, interpretative, communicative and functionalist; and a static concept of and approach to translation to be linguistic and literal. The dynamic index indicates how dynamic subjects' (declarative and procedural) knowledge about translation is. Where the knowledge of translation variable is concerned, the coherence coefficient indicates how coherent subjects' concept of different aspects of translation is. In the case of the translation project variable, it indicates whether subjects' approach to translating a text is consistent with their approach to translating its translation units.

We calculated the mean of the two variables' dynamic index results to obtain the dynamic translation index, with a view to determining how subjects' dynamism evolves in the TCA process. We correlated our dynamic translation index results with those we obtained for the translation acceptability indicator to analyse the relationship between dynamism and translation quality.

When presenting our results, we show standard deviation in brackets and omit non-significant results of statistical tests. The significance level we established was 0.05. See appendix 5 for the results of all our statistical tests.

For each indicator, we analysed the differences between groups on the basis of their respective mean values, according to a typology we established (non-evolution, rising evolution, falling evolution, mixed evolution), and described the progression that occurs between the first year and the graduates. See section 1.4.4 for definitions of the types of evolution. To describe evolution, when comparing between groups we considered a difference of below 0.05 points to constitute no difference; of 0.05 to 0.09 points a slight difference; of 0.10 to 0.19 points a substantial difference; of 0.20 to 0.29 points a very substantial difference; and of 0.30 points or above an extremely substantial difference. To describe the progression that occurs between the first year and

the graduates, we considered a difference of 0.20 to 0.29 points to constitute progression; of below 0.10 points no progression; of 0.10 to 0.19 points little progression; and of 0.30 points or above major progression. We also compared the graduates' results with those of the professional translators from our TC experiment.

3.2. Knowledge of translation

This variable provides data on the acquisition of the knowledge of translation sub-competence.¹¹

3.2.1. Definitions and indicators

We define this variable as a subject's implicit knowledge about the principles of translation (see Table 3.1).

In our previous research on translation competence (TC) we validated our empirical hypothesis that there is a relationship between the degree of TC and knowledge of translation (PACTE 2017f). In our research on TCA we added operational hypotheses according to which differences in subjects' concept of translation and its coherence can be observed between levels of TCA.

The variable's indicators are:

- The dynamic index of knowledge of translation, which shows whether a subject's implicit knowledge about translation is predominantly dynamic (corresponding to a textual, interpretative, communicative, functionalist concept of translation) or static (corresponding to a linguistic, literal concept of translation).

11. An initial version of this variable's results was published in PACTE (2014).

- The coherence coefficient of knowledge of translation, which shows whether a subject's notion of different aspects of translation is consistently dynamic or static, and, thus, whether their concept of translation is coherent.

The instrument we used to collect data was our *knowledge of translation questionnaire*.

Table 3.1. Knowledge of translation variable

KNOWLEDGE OF TRANSLATION	
Related to the knowledge of translation sub-competence	
Objective	To collect data concerning declarative knowledge of translation
Definition	The subject's implicit knowledge about the principles of translation
Hypotheses	Empirical hypothesis: There is a relationship between the degree of TC and knowledge of translation. Operational hypotheses: 1. Differences can be observed between levels of TCA in relation to the concept of translation. 2. Differences can be observed between levels of TCA in relation to the coherence of the concept of translation.
Indicators	- Dynamic index of knowledge of translation. Numerical indicator; values: -1 to 1 - Coherence coefficient of knowledge of translation. Numerical indicator; values: 0 to 1
Instruments	Knowledge of translation questionnaire
Source of data	Subjects' answers to the knowledge of translation questionnaire

3.2.2. Instrument: knowledge of translation questionnaire

The questionnaire we used to collect data was the one we had previously validated in our TC experiment (see appendix 3). It is based on seven factors related to knowledge about translation, specifically concept of translation and TC; translation units; translation problems; translation process stages; methods required; procedures used (strategies and techniques, etc.); and the function of the translation brief and the target reader. For each factor we formulated statements corresponding to two paradigms or ways of thinking about translation, one of which we designated *dynamic* and the other *static*.

On the basis of test-theory and item-theory criteria, we initially produced a 36-item questionnaire. We used a forced-choice Likert scale featuring the options *I strongly disagree*, *I disagree*, *I agree* and *I strongly agree* to gauge subjects' opinions.

We validated the questionnaire in four main stages. After trialling it with lecturers and 35 second-year degree students (stage 1, exploratory test) at the Faculty of Translation and Interpreting of the Universitat Autònoma de Barcelona (UAB), we conducted a pilot study involving three foreign-language teachers and three professional translators (stage 2; see PACTE 2005a, 2005b), and then a validation test with 10 university science lecturers, as translation end users (stage 3).

The overall results of the pilot study and the validation test did not clearly distinguish between the opinions the groups of subjects expressed. Consequently, in stage 4 we opted to select five pairs of items (see Table 3.2) that were plainly conceptually opposed and had enabled us to differentiate between the groups of subjects in earlier tests. Because of the conceptually opposed nature of the items in each pair, we were able to assume that a subject who responded affirmatively to the dynamic item would respond negatively to the static item, so the selected pairs ought to give a clearer insight into subjects' opinions. Following scale-construction theory, we removed items that had failed to provide relevant information in the pilot study. The final version of the questionnaire comprised 27 items, 12 of them indicative of a dynamic concept of translation and 15 of a static concept.¹²

Table 3.2. Five pairs of selected opposed items (PACTE 2017f, 140)

Dynamic items	Static items

12. The results we obtained for this variable in our TC experiment and information on how we developed the questionnaire are available in Neunzig and Kuznik (2007) and PACTE (2008, 2011a, 2014, 2017f). The original questionnaire is in Spanish. A version in French can be found in PACTE (2007).

<i>Pair I</i> FUNCTION OF THE TRANSLATION BRIEF AND THE TARGET READER	<i>Item 3</i> ‘The client conditions how the translator translates a text.’	<i>Item 24</i> ‘When you translate a text, you should not be influenced by the target reader.’
<i>Pair II</i> TRANSLATION METHODS	<i>Item 10</i> ‘A text should be translated in different ways depending on who the target reader is.’	<i>Item 4</i> ‘The aim of every translation is to produce a text as close in form to the original as possible.’
<i>Pair III</i> TRANSLATION METHODS	<i>Item 23</i> ‘If you begin translating a text with certain criteria (e.g. respecting the format of the original text, adapting the text to the target reader, etc.), these should be kept to throughout the translation.’	<i>Item 11</i> ‘All translated texts should keep the same paragraphs and order of sentences in the target text as in the original text.’
<i>Pair IV</i> PROCEDURES USED (STRATEGIES, TECHNIQUES)	<i>Item 14</i> ‘When translating a technical text, terminology is not the biggest problem.’	<i>Item 5</i> ‘Most translation problems can be solved with the help of a good dictionary.’
<i>Pair V</i> PROCEDURES USED (STRATEGIES, TECHNIQUES)	<i>Item 27</i> ‘If you find a word in a text you do not understand, you should try to work out its meaning from the context.’	<i>Item 16</i> ‘As soon as you find a word or expression you do not know the meaning of, you should look it up in a bilingual dictionary.’

3.2.3. Measurement of the indicators

We measured this variable's indicators in the same way we did in our TC experiment (PACTE 2008, 2017f).

Dynamic index of knowledge of translation

To calculate the dynamic index for each subject and group, we began by assigning points to the Likert-scale answers available for each pair of items (*I strongly disagree* = 1, *I disagree* = 2, *I agree* = 3, *I strongly agree* = 4). We then attributed a ‘dynamic value’ to those points and classified them (Table 3.3).

Table 3.3. Classification prior to measuring the dynamic index of knowledge of translation (PACTE 2017f, 141)

Possible cases	Points for dynamic items; points for static items	Classification and dynamic value
1	4; 4	0
2	4; 3	
3	3; 4	
4	3; 3	
5	2; 2	
6	2; 1	
7	1; 2	
8	1; 1	
9	4; 2	0.5
10	3; 2	
11	4; 1	1
12	3; 1	
13	2; 4	- 0.5
14	2; 3	
15	1; 4	- 1
16	1; 3	

This method of classification underlined the need for a marked contrast between mutually exclusive items. If, for instance, a subject answered ‘I strongly agree’ (4 points) to both the dynamic and the static item in a pair (case 1 in Table 3.3), the dynamic value we gave their answers was 0, due to the absence of a clear tendency towards either a dynamic or a static concept of translation. If they unequivocally chose either option in a pair of items, we gave the dynamic option a dynamic value of 1 and the static option a dynamic value of -1 (cases 11-12 and 15-16 respectively in Table 3.3).

We used the same classification method to calculate the dynamic value of each pair of opposed items. We then calculated the mean dynamic value of the subjects' answers to each pair of items and, finally, determined the dynamic index.

Coherence coefficient of knowledge of translation.

On the basis of the classification of points described above, we established three categories for subjects' concept of translation, specifically dynamic (D); static (S); and ambivalent, dynamic/static (D/S) (Table 3.4).

Table 3.4. Step 1. Classification prior to determining the coherence coefficient of knowledge of translation

Dynamic value	Classification
0	Dynamic/static (ambivalent concept: D/S)
0.5; 1	Dynamic (D)
-0.5; -1	Static (S)

Next, we calculated the sum total of each subject's points in each of the three categories (D, S and D/S) based on their answers to each pair of opposed items. We then subtracted each subject's lowest score from their highest to obtain a single score (0-5) reflecting their answers to the five pairs of items (Table 3.5). We omitted the D/S category when calculating this score.

Table 3.5. Step 2. Classification prior to determining the coherence coefficient of knowledge of translation (PACTE 2017f, 142)

Possible cases	Pairs of items					Total score/subject
	Pair I	Pair II	Pair III	Pair IV	Pair V	
1	D	D	D	D	D	5
2	D	D	D/S	D	D	4
3	D	D/S	S	D	D	2
4	D	S	S	D	D/S	0
5	D/S	D/S	D/S	D	D	2
6	D	S	S	D/S	D/S	1
Etc.	D	S	D/S	D/S	D	1

Finally, we attributed a coherence coefficient of 1, 0.5 or 0 to each subject's total score, as follows:

- Total score of 4 or 5 = coherence coefficient of 1 (entirely consistent).
- Total score of 2 or 3 = coherence coefficient of 0.5 (intermediate consistency).
- Total score of 0 or 1 = coherence coefficient of 0 (entirely inconsistent).

We used the three categories in question to calculate each subject's coherence coefficient regardless of whether their concept of translation was dynamic or static.

3.2.4. Results

Our analysis is based on 129 students. The number of valid subjects by group was 24 for the first year, 25 for the second, 28 for the third, 30 for the fourth, 22 for the graduates, and 35 for the translators.

Dynamic index of knowledge of translation¹³

Table 3.6. Dynamic index of knowledge of translation

	Mean
1 st year	0.10 (0.24)
2 nd year	0.33 (0.23)
3 rd year	0.37 (0.17)
4 th year	0.36 (0.23)
Graduates	0.41 (0.23)
Translators	0.27 (0.20)

According to our results (Table 3.6):

- Rising evolution takes place, with a very substantial difference between the first and second years ($U = -144$, $p < 0.05$, Bonferroni corrected, $r = 0.52$), and a slight difference between the fourth year and the graduates.
- Major progression occurs between the first year and the graduates (0.31).

¹³. Relevant results corresponding to items from the questionnaire other than the five pairs analysed here are presented in PACTE (2014).

- There is a substantial fall from the graduates' value to that of the translators (0.14; $U = 238$, $p < 0.01$, one-tailed, $r = 0.38$).

Coherence coefficient of knowledge of translation

Table 3.7. Coherence coefficient of knowledge of translation

	Mean
1 st year	0.25 (0.29)
2 nd year	0.56 (0.36)
3 rd year	0.59 (0.31)
4 th year	0.50 (0.35)
Graduates	0.55 (0.34)
Translators	0.37 (0.33)

According to our results (Table 3.7):

- Mixed evolution takes place, with an extremely substantial rise between the first and second years ($U = -163.5$, $p < 0.05$ Bonferroni corrected, $r = 0.46$), a slight fall between the third and fourth years, and a slight rise between the fourth year and the graduates.
- Major progression occurs between the first year and the graduates (0.30).
- There is a substantial fall from the graduates' value to that of the translators (0.18).

3.2.5. Preliminary conclusions

On the basis of the data obtained in relation to this variable's indicators:

1. Type of evolution. While rising evolution takes place in the case of the dynamic index of knowledge of translation, the coherence of that knowledge undergoes mixed evolution, a non-linear process involving adjustments as TCA advances.

2. Level of dynamism between consecutive groups. The most substantial differences in both dynamism and its coherence occur between the first and second years. The difference in coherence is the greater of the two. The degree of dynamism and coherence of knowledge of translation appears to cease advancing as of the third year, at which level the subjects seem to have developed a dynamic concept of translation and be consistent in that regard. Standard deviation is high for both indicators, meaning that the degree in question varies slightly from one subject to the next.

3. Progression between the first year and the graduates. Major progression occurs where each of the two indicators is concerned. Both the dynamism and coherence of knowledge of translation increase greatly, having initially been very low.

4. Comparison between the graduates and the translators. The graduates' dynamism and coherence values exceed those of the professional translators. It is worth noting that the results of all the students, except the first-year group, reflect a greater degree of dynamism than the group of translators.

3.3. Translation project

This variable, which refers to procedural knowledge, provides data on the acquisition of the strategic sub-competence and, specifically, on one of its functions, that of planning a process and choosing the most appropriate method of carrying out a translation task.

3.3.1. Definition and indicators

We define this variable as a subject's approach to the translation of a specific text and

the units it comprises, within a specific context (see Table 3.8). It is related to the subject's expectations regarding how a particular text should be translated. For the purposes of our study, it consists of whether the subject's approach to a translation task is static or dynamic.

In our experiment on TC we validated our empirical hypothesis that *there is a relationship between the degree of TC and the existence of a translation project* (PACTE 2017g). In our research on TCA we also included two operational hypotheses related to translation project evolution and coherence (see Table 3.8).

The variable's indicators are:

- The dynamic index of the overall translation project, which reflects a subject's approach to the translation of a specific text.
- The dynamic index of the translation project for translation problems, which reflects a subject's approach to the translation of the text's units.
- The coherence coefficient of the translation project, which reflects consistency between a subject's overall approach to translating a text and their approach to translating each of its units.

Table 3.8. Translation project variable

TRANSLATION PROJECT	
Related to the strategic sub-competence	
Objective	To collect data on how subjects plan and implement their translation project, i.e. select the most appropriate translation method to carry out a translation task
Definition	The subject's approach (dynamic or static) to the translation of a text and of the units it comprises, within a specific context
Hypotheses	<p>Empirical hypothesis:</p> <p>There is a relationship between the degree of TC and the existence of a translation project.</p> <p>Operational hypotheses:</p> <p>1. Differences can be observed between levels of TCA in relation to the type of translation project chosen for the whole text and for the units that make up the text.</p>

	2. Differences can be observed between levels of TCA in relation to the coherence of the translation project for the whole text and for the units that make up the text.
Indicators	- Dynamic index of the overall translation project. Numerical indicator; values: -1 to 1 - Dynamic index of the translation project for translation problems. Numerical indicator; values: -1 to 1 - Coherence coefficient of the translation project. Numerical indicator; values: 0 to 1 Acceptability. Numerical indicator; values: 0 to 1.
Instruments	Translations, translation problems questionnaire
Source of data	Elements taken into account by the subject when translating a text; acceptability

Our data collection instrument for this variable was our translation problems questionnaire.

3.3.2. Instrument: translation problems questionnaire

We adapted the translation problems questionnaire we used to collect data for this variable from the one we had used in our TC experiment (see Hurtado 2017a, appendix III.3), removing questions that had failed to provide relevant information and, on the basis of experience and the data obtained, turning open questions into closed questions (see appendix 4).

The questionnaire focuses on the five rich points (RPs, i.e. source-text segments containing prototypical translation problems; see section 1.4.1) we selected in each text to be translated in our study.

We used the translation problems questionnaire to collect data on not only the translation project variable but also the identification and solution of translation problems variable (see article 4). It is designed to provide information on:

- Text translation (part I): subjects' perception of the difficulty of translating the text, their perception of the types of difficulties involved, and their proposed translation project.

- RP translation (part II): subjects' opinions about whether the RPs caused them difficulties, the nature of the difficulties they encountered, their proposed translation project, the procedures they followed to solve the problems they identified, and their satisfaction with their solutions.

The questionnaire contains a question about subjects' overall translation project and a question about their translation project for each RP:

- Part I (question 3): *What was your priority when translating the text?* (overall translation project)
- Part II (question 3): *What was your priority when translating it?* (translation project for translation problems)

Dynamic and static answers are available in each case.

3.3.3. Measurement of the indicators

To calculate the dynamic indices of the overall translation project and the translation project for translation problems, we established three categories, namely dynamic, static and none (no translation project). The questionnaire comprises multiple choice questions, and the subjects could choose only one of the options available.

Dynamic (D). Answers:

- Adapting it to meet the target reader's expectations
- Communicating the meaning of the source text

Static (S). Answers:

- Reproducing the lexis and morphosyntax of the source text
- Reproducing the structure and formal aspects of the source text

None. Answer:

- I didn't have a priority

We firstly calculated percentages of dynamic and static answers for each group. For statistical purposes we only took dynamic and static answers into account, omitting the answer 'I didn't have a priority' as very few subjects chose it.¹⁴ We then calculated the total dynamic index of the overall translation project.¹⁵

We assigned each subject a value of -1 if their overall translation project was static or of 1 if it was dynamic.

To calculate the dynamic index of the translation project for translation problems, we began by determining the percentage of dynamic answers for each RP. We then established three levels of dynamism and assigned them numerical values:

- Dynamic translation project for over 75% of RPs: 1
- Dynamic translation project for 25% - 75% of RPs: 0
- Dynamic translation project for under 25% of RPs: -1

We established the coherence coefficient by calculating the mean of the percentages corresponding to the translation project for translation problems and the overall translation project. On the basis of the resulting percentage of consistency between the two types of translation projects, we assigned the following coefficient values:

- 33% or below: 0
- 34% - 66%: 0.5

14. This confirms that the subjects thought about their answers.

15. In PACTE (2015) the dynamic index of the overall translation project is calculated on the basis of both direct and inverse translation.

- 67% or over: 1

3.3.4. Results

Our analysis is based on 125 students, because, as indicated previously, we excluded the few who chose the option ‘I didn't have a priority’. The number of valid subjects by group was 23 for the first year, 25 for the second, 27 for the third, 28 for the fourth, 22 for the graduates and 35 for the translators.

Dynamic index of the overall translation project

We firstly calculated each group's percentage of dynamic answers regarding their overall translation project. As in the case of declarative knowledge about translation, there is a major difference between the first-year students and the other groups of subjects (Table 3.9).

Table 3.9. Percentage of dynamic answers regarding the overall translation project

Percentage of dynamic answers	
1 st year	65.22%
2 nd year	92.00%
3 rd year	92.59%
4 th year	89.29%
Graduates	100.00%
Translators	87.51%

We then calculated the mean for each group (Table 3.10).

Table 3.10. Dynamic index of the overall translation project

Mean (-1/1)	
1 st year	0.30 (0.97)

2 nd year	0.84 (0.55)
3 rd year	0.85 (0.53)
4 th year	0.79 (0.63)
Graduates	1.00 (0.00)
Translators	0.74 (0.66)

According to our results:

- Mixed evolution takes place, with an extremely substantial rise between the first and second years (Fisher's exact test: $p < 0.05$, $V = 0.30$), a slight fall between the third and fourth years, and a very substantial rise between the fourth year and the graduates.
- Major progression occurs between the first year and the graduates (0.30).
- There is a very substantial fall from the graduates' value to that of the translators (0.26).

Dynamic index of the translation project for translation problems

We calculated each group's percentage of dynamic answers regarding their translation project for each RP (Table 3.11).

Table 3.11. Percentage of dynamic answers regarding the translation project for translation problems

	RP1	RP2	RP3	RP4	RP5
1 st year	70.83%	86.96%	81.82%	73.91%	78.26%
2 nd year	87.50%	79.17%	81.82%	75.00%	86.96%
3 rd year	96.30%	74.07%	80.77%	80.77%	96.15%
4 th year	89.66%	85.71%	96.55%	89.29%	93.33%
Graduates	95.24%	89.47%	95.24%	88.89%	95.24%
Translators	74.29%	68.57%	54.29%	74.29%	85.71%

-
- RP 1. Intentionality and textual problem
 - RP 2. Linguistic reformulation and extralinguistic problem
 - RP 3. Textual problem
 - RP 4. Textual and intentionality problem
 - RP 5. Intentionality and linguistic reformulation problem

In the cases of RP1 and RP5 (intentionality problems), dynamism increases constantly between the first and third years. We did not observe any clear patterns where the other RPs are concerned.

Next, we calculated the mean for each group (Table 3.12).

Table 3.12. Dynamic index of the translation project for translation problems

	Mean (-1/1)
1 st year	0.58 (0.58)
2 nd year	0.52 (0.65)
3 rd year	0.68 (0.55)
4 th year	0.83 (0.38)
Graduates	0.78 (0.42)
Translators	0.46 (0.70)

According to our results:

- Mixed evolution takes place, with a slight fall between the first and second years, a substantial rise between the second and third years, another substantial rise between the third and fourth years, and a slight fall between the fourth year and the graduates.
- Progression occurs between the first year and the graduates (0.20).
- There is an extremely substantial fall from the graduates' value to that of the translators (0.31).

Coherence coefficient of the translation project

The results we obtained are shown in Table 3.13.

Table 3.13. Coherence coefficient of the translation project

	Mean (0/1)
1 st year	0.72 (0.36)
2 nd year	0.76 (0.33)
3 rd year	0.83 (0.28)
4 th year	0.86 (0.30)
Graduates	0.78 (0.25)
Translators	0.79 (0.39)

According to our results:

- Mixed evolution takes place, with a slight rise between the second and third years, and a slight fall between the fourth year and the graduates ($\chi^2[2] = 6.46, p < 0.05, V = 0.36$).
- No progression occurs between the first year and the graduates (0.06).
- The graduates' value is similar to that of the translators (0.01).

3.3.5. Preliminary conclusions

On the basis of the data obtained in relation to this variable's indicators:

1. Type of evolution. The dynamism of the subjects' overall translation project, that of their translation project for translation problems and consistency between the two all undergo mixed evolution. It is worth highlighting that the mixed evolution of the translation project variable's two dynamic indices (overall and for translation problems)

is in contrast to the rising evolution the knowledge of translation variable's dynamic index undergoes.

2. Level of dynamism between consecutive groups. The only major increases in dynamism take place between the first and second years and between the fourth year and the graduates in the case of the subjects' overall translation project. The differences in the dynamism of their translation project for translation problems are smaller. Few differences occur in the evolution of coherence, where the highest values are attained in the third and fourth years.

Looking at the percentage of dynamic answers by problem type, the RPs that seemingly distinguish the groups from one another most clearly between the first and third years are related to intentionality problems (RP1 and RP5).

The dynamism values of the translation project variable, it should be noted, are higher than those of the knowledge of translation variable at all levels.

3. Progression between the first year and the graduates. The graduates' values are very high for all three indicators, and they actually attain the maximum level possible in the case of their overall translation project. There is progression in the level of dynamism of both the subjects' overall translation project and their translation project for translation problems, albeit on a smaller scale in the latter case. There is no progression in the level of consistency, the development of which does not seem to be linked to the advance of TCA. The students are apparently always confident and resolute in their approach to translation, as the level of consistency between their overall translation project and their translation project for translation problems is high from the first year onwards. It remains very stable throughout their training, despite tiny fluctuations between year groups, with a trend of slight growth up to the fourth year.

4. Comparison between the graduates and the translators. The dynamism of the graduates' overall translation project and their translation project for translation problems far exceeds that of the professional translators, particularly in the former case, where the graduates attain the maximum level possible. While all the students outscore the translators in terms of dynamism (except in the case of the first-year group's overall translation project), the trainees and professionals have similar coherence values.

3.4. Knowledge of translation and translation project: dynamic translation index

The indicators of the knowledge of translation and translation project variables yielded data on the subjects' acquisition of declarative and procedural knowledge about translation respectively. We brought that data together to calculate the dynamic translation index.

3.4.1. Measuring the dynamic translation index

In our research on TC and TCA we calculated three different dynamic indices, specifically those of:

- (4) Knowledge of translation (declarative knowledge).
- (5) The overall translation project (procedural knowledge).
- (6) The translation project for translation problems (procedural knowledge).

Together, they reflect how consistent subjects' concept of translation in general and their approach to specific translation problems are. We expressed that consistency through the dynamic translation index, which is the three indices' mean value.¹⁶

16. In PACTE (2015) the dynamic translation index is calculated on the basis of both direct and inverse translation.

To establish the relationship between the subjects' declarative and procedural knowledge, we calculated the mean of the dynamic index of knowledge of translation, the dynamic index of the overall translation project, and the dynamic index of the translation project for translation problems.

We brought our results for the dynamic translation index together with those we obtained for translation acceptability. Details of how we calculated translation acceptability can be found in article 2.

3.4.2. Results

Table 3.14. Dynamic translation index

	Mean (-1/1)
1 st year	0.33 (0.50)
2 nd year	0.56 (0.34)
3 rd year	0.64 (0.28)
4 th year	0.66 (0.32)
Graduates	0.73 (0.18)
Translators	0.49 (0.40)

According to our results (Table 3.14):

- Rising evolution takes place, with a very substantial difference between the first and second years, a slight difference between the second and third years, and another slight difference between the fourth year and the graduates.
- Major progression occurs between the first year and the graduates (0.30).
- There is a very substantial fall (0.24) from the graduates' value to that of the translators ($U = 192.5$, $p < 0.001$, one-tailed, $r = 0.52$).

Dynamic translation index and acceptability

From a descriptive point of view, a comparison of the groups on the basis of their respective mean dynamic translation index and translation acceptability values¹⁷ (see section 2.3.1) shows that rising evolution takes place in both cases; in other words, there is a parallelism in their evolution.

From a statistical perspective, we used the Spearman correlation coefficient to determine the relationship between the dynamic translation index and translation acceptability (Table 3.15).

Table 3.15. Spearman's correlation coefficients between dynamic translation index and acceptability

	r_s
1 st year	0.56
2 nd year	-0.10
3 rd year	-0.25
4 th year	0.22
Graduates	0.27
Translators	0.13

The first-year students' Spearman correlation coefficient is 0.56, meaning that in the case of this group there is a positive relationship between the dynamic translation index and translation acceptability, i.e. acceptability tends to increase as the dynamic translation index rises. We found no correlation for any of the other groups.

3.4.3. Preliminary conclusions

On the basis of the data obtained:

17. The groups' mean acceptability values are as follows: first year = 0.45; second year = 0.59; third year = 0.63; fourth year = 0.65; graduates = 0.70; translators = 0.73.

1. Type of evolution. Dynamism undergoes rising evolution. Despite the evolution of the dynamic indices related to the subjects' translation project (procedural knowledge) being mixed, rising evolution takes place in the case of the dynamic translation index (the mean of the three dynamic indices). Translation dynamism increases as TCA advances.

2. Level of dynamism between consecutive groups. The only very substantial difference observable is between the first and second years, influencing acceptability in just the first year.

3. Progression between the first year and the graduates. There is major progression in dynamism, which increases as TCA advances.

4. Comparison between the graduates and the translators. The graduates' dynamism value far exceeds that of the professional translators. All the students (except the first-year group) outscore the translators.

5. Relationship between the dynamic translation index and translation acceptability. From a descriptive perspective, there is a parallelism between the dynamic translation index and translation acceptability in the evolution that takes place between groups. Within each group, however, there is no correlation between the two (except in the first year). This may be due to the high level of variation within each group.

These results differ from those we obtained in our TC experiment, where triangulating data on direct and inverse translation gave a correlation of 0.34 (Pearson's r) for the group of translators (PACTE 2017h). That correlation, while moderate, indicated that the translators' translation acceptability levels increased as their dynamic translation index rose. When only direct translation is taken into account, however, there is no correlation for the group in question. It may therefore be that in inverse

translation, owing to subjects having a lower level of linguistic knowledge of the target language, dynamism plays a greater role in making it possible to find correct solutions. In other words, the more dynamism a subject has, the less closely they adhere to the source text and the more freely they transmit its meaning using the resources their level of competence in the target language allows them to.

3.5. Conclusions

Our results on the knowledge of translation (declarative knowledge) and translation project (procedural knowledge) variables provide data on two of the sub-competences in PACTE's model, the knowledge of translation and the strategic sub-competences respectively.

In our TC experiment (PACTE 2011a, 2017f, 2017g, 2017h) we concluded that TC implies a dynamic concept of and approach to translation. The experiment's results indicated a relationship between the knowledge of translation and translation project variables, and a close relationship between a dynamic concept of translation, a dynamic translation project for a given text and a dynamic translation project for the translation problems in that text. We coined the term 'dynamic translation index' to refer to the latter relationship.

The data we obtained from our TCA experiment appear to confirm our empirical and operational hypotheses regarding the acquisition of declarative and procedural knowledge (see Tables 3.1 and 3.8). There are differences between levels of TCA in relation to subjects' concept of translation and the coherence of their knowledge of translation. There are also differences in relation to the type of overall translation project and translation project for translation problems subjects choose, as well as to consistency between the two. There are similarities, meanwhile, between progression in

translation project type and progression in the nature of knowledge of translation, in that both are dynamic and become more so as training advances.

The following conclusions can be drawn on the basis of the results obtained:

1. Progression from a more static concept of and approach to translation to a more dynamic concept of translation seems to be a characteristic of TCA.
 - Where the acquisition of declarative knowledge about translation is concerned, the dynamism of subjects' concept of translation undergoes rising evolution, with major progression between the first year and the graduates.
 - As far as procedural knowledge (overall translation project and translation project for translation problems) is concerned, evolution is mixed. Progression in the dynamism of the subjects' approach to translation occurs between the first year and the graduates, and its scale is greatest in the case of their overall translation project.
 - With regard to the dynamic translation index (the mean of the declarative and procedural knowledge referred to above), dynamism undergoes rising evolution and there is major progression between the first year and the graduates.
2. The type of evolution that takes place in the process of acquiring declarative knowledge and that of acquiring procedural knowledge differs, being rising evolution in the former case and mixed evolution in the latter. It seems that the declarative knowledge acquisition process is linear, whereas that of procedural knowledge involves fluctuations, with various cognitive adjustments as the process advances.
3. The subjects' dynamism is always greater in the case of procedural knowledge than in that of declarative knowledge. It is also greater in the case of their overall translation project than in that of their translation project for translation problems. It

thus seems that their approach becomes less dynamic when applied to specific translation problems, possibly because of the influence of each problem's particular characteristics (linguistic aspects, subject, etc.), to which they adapt their translation project upon becoming aware of them.

4. There is a high level of consistency where the subjects' declarative knowledge and, in particular, their procedural knowledge about translation are concerned. Notably, there is a high degree of coherence in both types of knowledge in every year group (exceeding the degree of dynamism). The tiny fluctuations that take place between consecutive groups do not affect the coherence of the subjects' approach, given that they are consistent in that regard throughout their training. That consistency underlines our sample's validity for the purposes of our study.

5. The evolution of the consistency of declarative and procedural knowledge is non-linear. The knowledge of translation and translation project variables' coherence indices both undergo mixed evolution. Consistency where declarative and procedural knowledge about translation is concerned is seemingly restructured, with fluctuations, as the subjects become more experienced in translation and more confident in such knowledge.

6. In general, the students have a more dynamic concept of and approach to translation than the professional translators.

- The level of dynamism of the declarative and procedural knowledge acquired by the students matches that of our TC experiment's professional translators as of the second year of training. The graduates actually achieve the highest score possible in the case of procedural knowledge.
- Additionally, the students' dynamic translation index is higher than that of the professional translators as of the second year.

There are two possible explanations for our TC experiment's professional translators apparently having a less pronounced concept of and approach to translation than the students. One is that professional practice may lead translators to adopt a more cautious attitude in response to the demands of a labour market (agencies, intermediaries) that sometimes tends towards a static concept of translation. Another is that the students are part of a generation whose educational input places greater emphasis on dynamism (in keeping with current trends in Translation Studies) than that which previous generations may have received.

7. With regard to the relationship between the dynamic translation index and translation acceptability, both evolve in the same way and increase as TCA advances. We only detected a correlation between the two in the case of the first-year students. Other factors (such as documentation skills, linguistic knowledge of the two languages involved, and extralinguistic knowledge) seemingly play a greater role in solving problems correctly at all the other levels. As first-year students have yet to develop such skills and knowledge, it may be that a dynamic concept of and approach to translation are more crucial to enabling them to produce correct solutions than where the other groups are concerned. As mentioned previously, in our TC experiment we did detect a correlation between the dynamic translation index and translation acceptability in the case of the group of professional translators when we triangulated our data for direct and inverse translation.

8. Influence of training. We have verified that training is a factor of influence.

- In terms of the evolution of declarative knowledge, there are statistically significant differences between the first and second-year students, and the level of such knowledge continues to rise as training advances. When their second year of training starts, students at the UAB have studied practical translation for

just one semester and have yet to begin studying translation theory (a third-year subject). It would thus seem that they develop implicit theories about the dynamic nature of translation on the basis of their own experience of the activity. Those implicit theories are reinforced throughout their training and apparently become ingrained.

- As far as procedural knowledge is concerned, we observed differences between groups. In the case of the subjects' overall translation project, the difference between the first and second-year values is statistically significant.
- In relation to the dynamic translation index, we observed differences between the first and second-year groups, with slight rises thereafter.
- Progression occurs between the first year and the graduates in the case of every indicator except the coherence coefficient of the translation project.
- In relation to coherence, training appears to influence the consistency of declarative knowledge but seemingly has a smaller influence on that of procedural knowledge, in the case of which there are few differences between groups and no progression takes place.

Our TCA experiment results we have so far analysed seemingly confirm the importance of a dynamic concept of and approach to translation where both TC and TCA are concerned. They corroborate the theoretical models from the second half of the 20th century which introduced communicative and functionalist approaches to translation, such as dynamic equivalence (Nida 1964), equivalence of meaning (Seleskovitch 1968; Seleskovitch and Lederer 1984), functional equivalence (Reiss and Vermeer 1984; Nord 1991) and communicative translation (Hatim and Mason 1990). We must emphasise the

importance of these results, this being the first-time empirical proof of the aforementioned specific characteristic of TC and TCA has been obtained.

4. Translation competence acquisition. Identification and solution of translation problems

This article focuses on the identification and solution of translation problems variable in PACTE's experimental study on translation competence acquisition. The variable provides data on the way the strategic and knowledge of translation sub-competences work. It has four indicators related to the strategic sub-competence, namely the perception of difficulty coefficient, identification of prototypical translation problems, problem-solving procedures, and the satisfaction coefficient; and two related to the knowledge of translation sub-competence, namely characterisation of the text's main types of difficulties and characterisation of prototypical translation problems. We firstly describe the characteristics of the variable and its indicators, and then present our data collection instrument, our indicator measurement and our results. With regard to the indicators related to the strategic sub-competence, our results show a predominance of mixed evolution, shortcomings compared to professional translators, and the absence of any relationship between the indicators and translation quality. As for the indicators related to the knowledge of translation sub-competence, our results show linguistic reformulation difficulties to be the type of difficulty the students most often identify as problematic, and pragmatic difficulties to be that which they seem to consider least problematic. Lastly, we found the variable's indicators to be influenced by subjectivity.

The experiment was conducted in November 2011, when our first-year subjects had just begun their degree course; the graduates had completed their studies in June 2011.

Keywords: translation competence acquisition; translation problems; translation strategies; strategic sub-competence; knowledge of translation sub-competence

4.1. Introduction

This article presents our results for the identification and solution of translation problems variable in our experiment on translation competence acquisition (TCA). We define the variable as subjects' identification, characterisation and solution of difficulties

when carrying out a translation task (see Table 4.1).

The identification and solution of translation problems variable provides data on the acquisition of the strategic and knowledge of translation sub-competences. More specifically, it provides data on three of the strategic sub-competence's functions, namely identifying translation problems, evaluating the translation process and its results, and applying problem-solving procedures (use of strategies and automatic solution); and, as regards the knowledge of translation sub-competence, on how subjects conceptualise translation problems based on the difficulties they experience. It is thus a source of data on the acquisition of procedural and declarative knowledge.

We studied this variable to collect information on the process whereby the capability to identify, characterise, solve and evaluate proposed solutions to translation problems is acquired. In the texts our subjects translated from English, French or German, we identified five *rich points* (RPs), i.e. source-text segments containing prototypical translation problems (see section 1.4.1 and appendix 2). We gathered data on the difficulties the subjects experienced when translating each RP, how they conceptualised those difficulties, the problem-solving procedures they reported using, and their evaluation of their proposed solutions. To analyse the difficulties experienced, we used PACTE's categorisation of translation problems, the five categories of which are linguistic problems, extralinguistic problems, textual problems, intentionality problems, and problems relating to the translation brief and/or the target-text reader (see Table 1.2).

In our previous research on translation competence (TC), we validated our empirical hypotheses that there is a relationship between the degree of TC and the identification of translation problems and there is a relationship between the degree of TC and the solution of translation problems (PACTE 2017d). In our research on TCA

we added seven operational hypotheses (see Table 4.1) related to differences between levels of TC in terms of how translation problems are identified and characterised, the types of problem-solving procedures used, and satisfaction with proposed solutions.

The variable's indicators are:

- (7) Perception of difficulty coefficient: subjects' perception of the overall level of difficulty of translating the text.
- (8) Identification of prototypical translation problems: the prototypical translation problems subjects identify as difficulties when translating the text.
- (9) Problem-solving procedures: the procedures subjects report using to solve the text's prototypical translation problems.
- (10) Satisfaction coefficient: subjects' level of satisfaction with their proposed solutions to the text's prototypical translation problems.
- (11) Characterisation of the text's main types of difficulties: subjects' characterisation of the general nature of the problems the text's translation involves.
- (12) Characterisation of prototypical translation problems: subjects' characterisation of prototypical translation problems in the text.

The first four indicators provide data on the strategic sub-competence, and the final two on the knowledge of translation sub-competence. In addition to studying every indicator individually, we analysed the results we obtained for each of them (except characterisation of prototypical translation problems) in conjunction with our results on translation acceptability.

The instrument we used to collect data was our *translation problems questionnaire*.

Table 4.1. Identification and solution of translation problems variable

IDENTIFICATION AND SOLUTION OF TRANSLATION PROBLEMS	
Related to the strategic sub-competence and the knowledge of translation sub-competence	
Objective	To collect data on the process of identifying and solving translation problems
Definition	Subjects' identification, characterisation and solution of difficulties when carrying out a translation task
Hypotheses	<p>Empirical hypotheses:</p> <ol style="list-style-type: none"> 1. There is a relationship between the degree of TC and the identification of translation problems. 2. There is a relationship between the degree of TC and the solution of translation problems. <p>Operational hypotheses:</p> <ol style="list-style-type: none"> 1. Differences can be observed between levels of TCA in relation to the perception of the difficulty of translating a text. 2. Differences can be observed between levels of TCA in relation to the number of problems identified. 3. Differences can be observed between levels of TCA in relation to the types of problems identified. 4. Differences can be observed between levels of TCA in relation to the types of procedures used. 5. Differences can be observed between levels of TCA in relation to the degree of satisfaction with the results obtained. 6. Differences can be observed between levels of TCA in relation to the characterisation of the main types of difficulties a text's translation involves. 7. Differences can be observed between levels of TCA in relation to the characterisation of the nature of the problems identified.
Indicators	<ul style="list-style-type: none"> - Perception of difficulty coefficient. Numerical indicator; values: 0 to 1. - Identification of prototypical translation problems. Categorical indicator; two categories: YES/NO. - Problem-solving procedures. Categorical indicator; four categories: automatic solution; comprehension-oriented internal support strategies; reformulation-oriented internal support strategies; external support strategies. - Satisfaction coefficient. Numerical indicator; values: 0 to 1. - Characterisation of the text's main types of difficulties. Categorical indicator; eight categories: no difficulties; linguistic comprehension difficulties; linguistic reformulation difficulties; textual difficulties; extralinguistic difficulties of a cultural nature; extralinguistic difficulties of a thematic nature; intentionality difficulties; pragmatic difficulties. - Characterisation of prototypical translation problems. Categorical indicator; seven categories: linguistic comprehension difficulties; linguistic reformulation difficulties; textual difficulties; extralinguistic difficulties of a cultural nature; extralinguistic difficulties of a thematic nature; intentionality difficulties; pragmatic difficulties. <p>Acceptability. Numerical indicator; values: 0 to 1.</p>
Instruments	Translations, translation problems questionnaire
Sources of data	Problems identified; subjects' thoughts about the level of difficulty of the translation, the types of difficulties involved in translating the text and its prototypical translation problems, the problem-solving procedures used, and the result obtained; acceptability

4.2. Instrument: translation problems questionnaire

We collected data for this variable through our translation problems questionnaire (see

appendix 4), which we adapted from the equivalent questionnaire used in our TC experiment (see Hurtado 2017a, appendix III.3). Based on the information we obtained from the questionnaire and retrospective interviews in our TC experiment, we changed open questions into closed ones and removed questions that had not yielded relevant data.

The adapted questionnaire, which we also used to collect data for the translation project variable (see article 3), provides information on:

- Text translation (part I): subjects' perception of the level of difficulty of translating the text and of the types of difficulties involved, and their proposed translation project.
- RP translation (part II): subjects' answers to questions about whether the source text's five RPs caused them difficulties, the nature of the difficulties they experienced, their proposed translation project, the procedures they used to solve the problems they identified, and their level of satisfaction with their solutions.

With regard to the identification and solution of translation problems variable, the questionnaire contains two questions on the translation of the text and four on the translation of each RP:

PART I

- (question 1). *How difficult did you find translating the text?* (perception of difficulty coefficient).
- (question 2). *What general types of difficulties do you feel translating the text involved?* (characterisation of the text's main types of difficulties).

PART II

- (question 1). *Did the underlined segment of the text cause you difficulties?* (identification of prototypical translation problems).
- (question 2). *What types of translation difficulties could it cause?* (characterisation of prototypical translation problems).
- (question 4). *Explain what you did to translate it.* (problem-solving procedures).
- (question 5). *Are you satisfied with your solution?* (satisfaction coefficient).

4.3. Measurement of the indicators

We analysed the differences between groups, on the basis of their respective mean values, and established an evolution typology (non-evolution, rising evolution, falling evolution and mixed evolution); see section 1.4.4 for details of how we define each type of *evolution*. We also described the progression that takes place between the first year and the graduates.

For description purposes, in our comparisons between groups we established that, on a scale of 0 to 100, a difference of under 5 points represented no difference; 5 to 9 points a slight difference; 10 to 19 points a substantial difference; 20 to 29 points a very substantial difference; and 30 points or over an extremely substantial difference. To describe progression between the first year and the graduates, we established that a difference between the corresponding groups of 20 to 29 points represented progression; under 10 points no progression; 10 to 19 points little progression; and 30 points or over major progression. On a scale of 0 to 1, the corresponding values are 0.05, 0.10, 0.20, 0.30, etc.

As we explain later (see sections 4.3.5 and 4.3.6), we did not calculate the type of evolution or the progression involved in the two indicators related to problem

characterisation (characterisation of the text's main types of difficulties and characterisation of prototypical translation problems), due to their nature. We did not calculate the progression that occurs where the problem-solving procedures indicator is concerned either, owing to its data being distributed among three categories.

We brought our results for each of the variable's indicators, except characterisation of prototypical translation problems, together with those we obtained for translation acceptability (see article 2). In the case of this variable, we used multiple linear regression to estimate the effect on acceptability of the students' year, of each indicator's results, and of the interaction between both. To perform regressions, we verified that our data did not violate the assumptions of normality (the assumption that the dependent variable is normally distributed in each level of the independent variable), homoscedasticity (the assumption that the variance of the dependent variable is similar across the independent variable's levels) and linearity (the assumption that there is a linear relationship between the dependent and the independent variable) (Pardo and San Martín 2010). We omitted the group of professional translators who participated in our TC experiment from regressions, as its subjects were not part of the same sample as the students and, furthermore, the procedures we had used to calculate the relationship between the indicators and acceptability in our TC experiment were different (see PACTE 2017d). For the significance of the regression model, as well as that of the effect on acceptability of the students' year and the relevant indicator, we established an alpha level of 0.05.

4.3.1. Perception of difficulty coefficient

To measure this indicator, we converted the subjects' answers from the 30-point scale used in the questionnaire to values from 0 to 1, and then calculated each group's mean value.

4.3.2. Identification of prototypical translation problems

For this indicator, we firstly observed which RPs each group had identified (to determine the types of RPs identified). We then calculated the mean number of RPs identified by each group and, to measure differences between groups, divided it by five (the total number of RPs analysed) to convert it to a value on a scale of 0-1.

4.3.3. Problem-solving procedures

We did not analyse this indicator in our TC experiment. Our translation problems questionnaire for that experiment included an open question on the procedures the subjects had used to solve translation problems, but their answers to it, and those they gave in retrospective interviews, were vague and sometimes confusing. Additionally, instead of describing the problem-solving strategies they had used, some subjects explained their proposed solutions. Having failed to obtain clear data, we decided to omit the indicator from our analysis. Nonetheless, we identified certain trends that enabled us to modify the question for our TCA experiment (see appendix 4, part II, question 4).

We established four categories for our analysis of this indicator, namely automatic solution, comprehension-oriented internal support strategies, reformulation-oriented internal support strategies, and external support strategies. It should be noted that this indicator provides data on the procedures the subjects reported using. The procedures they actually used are dealt with in our analysis of the decision-making variable (see article 5).

To measure the indicator, we firstly calculated, for each RP, what percentage of each group's subjects answered:

- ‘I translated it automatically, without stopping to think about it’ (answer 1) [automatic solution].
- ‘I didn't consult any external sources but...’ (answer 2) [internal support strategies].
- ‘I consulted external sources...’ (answer 3) [external support strategies].

In the case of internal support strategies (answer 2), we also calculated what percentage of subjects chose:

- ‘I thought about what the segment might mean until I came to understand it’ [comprehension-oriented strategies].
- ‘I thought about various options until I settled on a way of reformulating the segment’ [reformulation-oriented strategies].

In addition to data from closed questions, we obtained 230 answers to open questions related to internal support, which are to be analysed in a future study and are thus not included in this indicator's results.

The numerical criteria we applied to measure differences between groups for this indicator are not the same as those we used elsewhere, the latter being inapplicable here owing to the division of the total percentage between three categories (automatic solution, internal support strategies and external support strategies). For each category, we calculated the five groups' overall mean percentage and took 10% of it as the basis for describing differences between groups. For example, the five groups' overall mean percentage for the automatic solution category (see Table 4.5) is 16.3, 10% of which is 1.6 (rounded down). We thus consider this figure (1.6) to represent a substantial difference between groups, half the figure (0.8) a slight difference, twice the figure (3.2)

a very substantial difference, and three times the figure (4.8) an extremely substantial difference. We are aware of the need to treat this data conversion with caution.

We did not analyse progression for any of the procedures. Given that the percentage is distributed between three categories, there would be no point in considering the progression reflected by a single set of results in isolation, as the three sets of results balance each other out.

4.3.4. Satisfaction coefficient

To measure this indicator, we firstly converted the answers *Yes*, *No* and *Partially* to the numerical values 1, 0 and 0.5 respectively (omitting cases in which subjects did not answer), for each RP. Secondly, we calculated each group's mean value.

4.3.5. Characterisation of the text's main types of difficulties

We did not analyse this indicator in our TC experiment. We included an open question on it in that experiment's translation problems questionnaire, but the subjects misunderstood the question and their answers were not very clear. Additionally, many subjects described the text's characteristics instead of its translation difficulties. Having failed to obtain precise data, we omitted the indicator from our analysis. Nonetheless, the data we collected enabled us to identify certain trends and change the open question into a closed one in our TCA experiment's questionnaire (see appendix 4, part I, question 2).

Categories

We analysed both the *characterisation of the text's main types of difficulties* and the *characterisation of prototypical translation problems* indicators on the basis of the same set of categories. In our TC experiment, we organised the difficulties the subjects

identified into five categories (PACTE 2017d, 175-176):

- *Linguistic difficulties.* Cases in which subjects referred to lexical or morphosyntactic difficulties. We distinguished between linguistic comprehension and linguistic reformulation difficulties to determine whether a specific difficulty was due to shortcomings in a subject's source or target language knowledge.
- *Textual difficulties.* Cases in which subjects referred to difficulties involving coherence, cohesion, text genres (genre conventions) or style. In this case we did not distinguish between comprehension and reformulation since we consider such difficulties to be due to the contrastive aspects of two languages.
- *Extralinguistic difficulties.* Cases in which subjects referred to difficulties relating to cultural or world knowledge or a specific field of knowledge (specialised concepts).
- *Intentionality difficulties.* Cases in which subjects referred to difficulties in understanding the information contained in the source text.
- *Difficulties relating to the function of the text and the target reader.* Cases in which subjects referred to problems relating to the function of the translated text (according to the translation brief) and/or the target reader.

These categories are related to PACTE's categories of translation problems (see Table 1.2), i.e. linguistic problems, textual problems, extralinguistic problems, intentionality problems, and problems relating to the translation brief and/or the target-text reader (pragmatic problems).

For ease of understanding, we decided to refer to the different types of difficulties as follows in our TCA questionnaire:

- Cultural difficulties. [extralinguistic difficulties of a cultural nature]
- Difficulties in terms of understanding the intended meaning (information conveyed, comprehension of main and secondary ideas, etc.) [intentionality difficulties]
- Lexical and morphosyntactic comprehension difficulties. [linguistic comprehension difficulties]
- Lexical and morphosyntactic reformulation difficulties. [linguistic reformulation difficulties]
- Difficulties in terms of producing a coherent, stylistically appropriate text. [textual difficulties]
- Difficulties related to the text's subject. [extralinguistic difficulties of a thematic nature]
- Difficulties related to the text's function, the characteristics of the translation brief and the target reader. [pragmatic difficulties]

Measurement of the indicator

To measure this indicator, we began by determining the percentage of subjects in each group who 'didn't notice any difficulties', which turned out to be zero in every case. Next, we calculated the frequency, as a percentage, with which each answer was chosen within each group.

We then established a hierarchy of answers for each group, to which end we assigned three points to each answer a subject chose as the main type of difficulty, two to each answer chosen in second place, and one to each answer chosen in third place.

We thus obtained a weighted value on a scale of 0-3 (0 = no difficulty), giving us weighted means for each group.

We did not calculate a type of evolution for this indicator because, in contrast to most of the other indicators, we did not use a standardised range (0-100 or 0-1) for its measurement. As the range of the weighted values was 0-3, the data were not directly comparable with those corresponding to standardised ranges. While we could have standardised the data (by dividing the value obtained by three, the range's highest value), we felt that doing so would entail excessive processing of subjective data that we had already converted once, and would thus be inappropriate.

It should be noted that two types of factors can affect subjects' characterisations of translation problems: (1) each subject's individual difficulties stemming from their personal shortcomings (lack of source and target language knowledge, of cultural knowledge, etc.); and (2) their level of *explanatory knowledge (know why)*, i.e. their capability to describe translation problems. Both are subjective and condition problem characterisation, making this indicator distinctly subjective in nature. On that basis, and also because of the complexity of the data collected, with subjects being able to choose and order up to three answers, we did not perform statistical tests to identify differences between pairs of groups for this indicator.

While prioritising one type of difficulty or another should not, in principle, have any implications in terms of solution acceptability, we decided to analyse the relationship between the two to check for any kind of connection.

4.3.6. Characterisation of prototypical translation problems

As mentioned previously, we used the same categories and system of measurement for this indicator as for the *characterisation of the text's main types of difficulties* indicator. The categories we used to analyse each RP were, thus, linguistic comprehension

difficulties, linguistic reformulation difficulties, textual difficulties, extralinguistic difficulties of a cultural nature, extralinguistic difficulties of a thematic nature, intentionality difficulties, and pragmatic difficulties. In PACTE's characterisation of the source text's RPs, we considered all of them to be affected by pragmatic factors.

As in the case of the characterisation of the text's main types of difficulties indicator, we did not perform statistical tests to identify differences between pairs of groups for the characterisation of prototypical translation problems indicator, due to its subjective nature and the complexity of the data collected. We did not bring its results together with those we obtained for translation acceptability for the same reasons, and also because we had found the characterisation of the text's main types of difficulties indicator to have no bearing on acceptability in the regressions we performed with it. Similarly, we did not calculate a type of evolution due to not having used a standardised range for its measurement.

The question designed to collect information on this indicator in our TC experiment's translation problems questionnaire was open and did not ask the subjects to order the types of difficulties involved in each RP. Thus, having collected data in a different way, we deemed it methodologically inappropriate to compare the two experiments' results for this indicator.

4.4. Results

Our analysis is based on 129 students (TCA experiment) and 35 professional translators (TC experiment). In the case of the indicators related to problem characterisation, some subjects chose more than the maximum number of options permitted (three) and we thus excluded them from our analysis. Consequently, the total number of valid subjects for the characterisation of the text's main types of difficulties indicator was 107 (22 first-year students, 20 second-year students, 22 third-year students, 25 fourth-year students

and 18 graduates). As for the characterisation of prototypical translation problems indicator, the number of valid subjects varied according to the RP involved (see Table 4.2).

Table 4.2. Valid subjects for the characterisation of prototypical translation problems indicator

	RP1	RP2	RP3	RP4	RP5
1 st year	22	23	23	22	22
2 nd year	21	22	22	24	21
3 rd year	24	24	24	23	26
4 th year	25	27	28	26	24
Graduates	19	20	21	21	19

RP 1. Intentionality and textual problem

RP 2. Linguistic reformulation and extralinguistic problem

RP 3. Textual problem

RP 4. Textual and intentionality problem

RP 5. Intentionality and linguistic reformulation problem

When presenting our results, we show standard deviation in brackets. While we performed statistical tests for every pair of consecutive groups (except in the case of the characterisation of the text's main types of difficulties and characterisation of prototypical translation problems indicators), we omit all non-significant results. The significance level we set was 0.05. See appendix 5 for the results of all our statistical tests.

4.4.1. Perception of difficulty coefficient

Table 4.3. Perception of difficulty coefficient

	Mean
1 st year	0.36 (0.22)
2 nd year	0.50 (0.14)
3 rd year	0.37 (0.19)
4 th year	0.33 (0.14)

Graduates	0.41 (0.14)
Translators	0.28 (0.14)

According to our results (Table 4.3):

- Mixed evolution takes place, with a substantial rise between the first and second years, a substantial fall between the second and third years, and a slight rise between the fourth year and the graduates.
- The perception of difficulty is highest among the second-year students, followed by the graduates.
- The difficulty perceived at the start of training is the same as in the third and fourth years.
- The difficulty perceived remains high among the graduates.
- There is no progression between the first year and the graduates (0.05).
- There is a substantial fall from the graduates' value to that of the translators (0.13): $U = 230$, $p < 0.001$, one-tailed, $r = 0.69$. The graduates' perception of the translation's difficulty differs considerably from that of the translators, with the former perceiving more difficulties when translating than the latter.

Perception of difficulty coefficient and acceptability

From a descriptive perspective, comparing the groups on the basis of their respective mean perception of difficulty coefficient and acceptability values¹⁸ (see section 2.3.1) shows that while acceptability increases as TC is acquired, the perception of difficulty undergoes mixed evolution and no progression occurs between the first year and the

18. Mean acceptability results by group: first year = 0.45; second year = 0.59; third year = 0.63; fourth year = 0.65; graduates = 0.70; translators = 0.73.

graduates. Notably, the first, third and fourth-year students perceive similar levels of difficulty but the third and fourth-year students have higher levels of acceptability. The perception of the difficulty of translating the text and translation acceptability thus seem to develop differently and be unrelated.

In our quantitative statistical analysis, we performed a multiple linear regression to predict acceptability based on the students' year and perception of difficulty coefficient. We found a significant regression equation ($F(2, 124) = 12.034, p < 0.001$), with an r^2 of 0.163. Students' predicted acceptability is equal to $0.384 + 0.060$ (year), 95% CI [0.036; 0.085] + 0.116 (perception of difficulty coefficient), 95% CI [-0.080; 0.311]. While the year is a significant predictor of acceptability ($p < 0.001$), the perception of difficulty coefficient is not ($p = 0.244$).

We thus observed no relationship between the perception of the difficulty of translating the text and translation quality, as was also the case in our TC experiment (see PACTE 2017d).

4.4.2. Identification of prototypical translation problems

Table 4.4 shows, for each group, the percentage of subjects who identified each RP, the mean number of RPs identified, and the mean converted for expression on a scale of 0-1 for the purpose of calculating the type of evolution involved.

Table 4.4. Identification of prototypical translation problems

	RP1 (%)	RP2 (%)	RP3 (%)	RP4 (%)	RP5 (%)	Mean no. of RPs identified	Mean on scale of 0-1
1 st year	95.83%	75.00%	75.00%	75.00%	75.00%	3.96 (0.91)	0.79
2 nd year	100.0%	96.00%	84.00%	72.00%	84.00%	4.36 (0.76)	0.87
3 rd year	92.86%	100.0%	71.43%	75.00%	82.14%	4.21 (0.83)	0.84

4 th year	96.67%	80.00%	76.67%	70.00%	83.33%	4.07 (1.08)	0.81
Graduates	95.45%	95.45%	72.73%	81.82%	81.82%	4.27 (0.98)	0.85
Translators	62.86%	51.43%	54.29%	40.00%	22.86%	2.31 (1.28)	0.46

RP1. Intentionality and textual problem.

RP2. Linguistic reformulation and extralinguistic problem.

RP3. Textual problem.

RP4. Textual and intentionality problem.

RP5. Intentionality and linguistic reformulation problem.

On the basis of the converted mean number of RPs identified by each group:

- Rising evolution takes place, involving just one slight difference, specifically between the first and second years.
- There is no progression between the first year and the end of training (0.06).
- There is an extremely substantial fall from the graduates' value to that of the translators (0.39): $U = 92$, $p < 0.001$, one-tailed, $r = 0.76$.

As regards each RP's identification:

In the case of RP1 (intentionality and textual problem):

- Falling evolution takes place, involving just one slight difference, specifically between the second and third years.
- There is no progression between the first year and the graduates (0.38).
- There is an extremely substantial difference between the graduates and the translators (32.59).

In the case of RP2 (linguistic reformulation and extralinguistic problem):

- Mixed evolution takes place, with a very substantial rise between the first and second years, a very substantial fall between the third and fourth years, and a substantial rise between the fourth year and the graduates.

- There is progression between the first year and the graduates (20.45).
- There is an extremely substantial difference between the graduates and the translators (44.02).

In the case of RP3 (textual problem):

- Mixed evolution takes place, with a slight rise between the first and second years, a substantial fall between the second and third years, and a slight rise between the third and fourth years.
- There is no progression between the first year and the graduates (2.27).
- There is a substantial difference between the graduates and the translators (18.44).

In the case of RP4 (textual and intentionality problem):

- Mixed evolution takes place, with a slight fall between the third and fourth years, and a substantial rise between the fourth year and the graduates.
- There is no progression between the first year and the graduates (6.82).
- There is an extremely substantial difference between the graduates and the translators (41.82).

In the case of RP5 (intentionality and linguistic reformulation problem):

- Rising evolution takes place, involving just one slight difference, specifically between the first and second years.
- There is no progression between the first year and the graduates (6.82).
- There is an extremely substantial difference between the graduates and the translators (58.96).

On the basis of our results:

1. RP identification distribution. RP1 (intentionality, textual) is the RP identified most often in every year except the third, as well as by the translators.

2. Type of evolution. While the mean number of RPs identified undergoes rising evolution, RP5 (intentionality, linguistic reformulation) is the only RP for which rising evolution actually takes place, involving just a single difference between groups (a slight difference between the first and second years). The evolution of the rest of the RPs is mixed, apart from RP1 (intentionality, textual), where falling evolution takes place. There thus seems to be no clear pattern of evolution according to RP type.

3. Differences between groups. With the exception of RP4 (textual, intentionality), the frequency with which each RP is identified increases between the first and second years. The increase is most marked in the case of RP2 (linguistic reformulation, extralinguistic).

4. Level at start of training. RP1 (intentionality, textual) is the most frequently identified RP.

5. Level upon completion of training. RP1 (intentionality, textual) is again the most frequently identified RP, along with RP2 (linguistic reformulation, extralinguistic). The RP identified least often is RP3 (textual).

6. Progression between the first year and the graduates. There is only progression in the case of RP2 (linguistic reformulation, extralinguistic).

7. Comparison between the graduates and the translators. The behaviour of the graduates differs greatly from that of the translators where all the RPs are concerned, with the graduates identifying far more problems when translating. There are significant differences between the graduates and the translators. The RP for which the difference involved is smallest is RP3 (textual). RP5 (intentionality, linguistic reformulation) is the

RP the translators identify least often but the second most frequently identified among the graduates, and also the one for which the difference between the two groups is largest. Intentionality problems continue to cause difficulties upon completion of training.

Identification of prototypical translation problems and acceptability

From a descriptive perspective, comparing the groups on the basis of their respective mean identification of prototypical translation problems and acceptability values (see section 2.3.1) shows that while acceptability increases as TC is acquired, the frequency with which prototypical translation problems are identified increases only a little between the first and second years and remains unchanged thereafter. While the graduates and the professional translators have similar acceptability values, the former identify more problems.

In our quantitative statistical analysis, we performed a multiple linear regression to predict acceptability based on the students' year and the percentage of prototypical translation problems they identified. We found a significant regression equation ($F(2, 125) = 11.139, p < 0.001$), with an r^2 of 0.138. Students' predicted acceptability is equal to $0.337 + 0.056 (\text{year}), 95\% \text{ CI } [0.031; 0.081] + 0.001 (\text{percentage of prototypical translation problems identified}), 95\% \text{ CI } [-0.001; 0.003]$. While the year is a significant predictor of acceptability ($p < 0.001$), the percentage of prototypical translation problems identified is not ($p = 0.189$). There is, thus, no relationship between problem identification and translation acceptability. We found no clear relationship between the two in direct translation in our TC experiment either.

4.4.3. Problem-solving procedures

As stated previously (see section 4.3.3), we did not analyse this indicator in our TC

experiment, ruling out comparisons between the students' behaviour and that of the translators. It is also worth emphasising that this indicator deals with the procedures the subjects reported using (those they actually used are covered in our analysis of the decision-making variable; see article 5).

Table 4.5 shows our results for this indicator's four categories, i.e. automatic solution, comprehension-oriented internal support strategies, reformulation-oriented internal support strategies, and external support strategies. As explained in section 4.3.3, due to the total percentage being spread over three categories we did not use the same measurement criteria to analyse differences between groups as we did for other indicators,¹⁹ nor did we calculate the progression that takes place.

Table 4.5. Problem-solving procedures

19. The overall mean and the values on the basis of which we describe differences between groups for each procedure are specified below. Automatic solution: mean, 16.3 (rounded up); slight difference, 0.8; substantial difference, 1.6; very substantial difference, 3.2; extremely substantial difference, 4.8. Internal support strategies: mean, 17.2; slight difference, 0.9 (rounded up); substantial difference, 1.7; very substantial difference, 3.4; extremely substantial difference, 5.1. External support strategies: mean, 66.5; slight difference, 3.4 (rounded up); substantial difference, 6.7; very substantial difference, 13.4; extremely substantial difference, 20.1.

	Automatic solution	Internal support strategies (comprehension; reformulation)	External support strategies
1 st year	23.5% (22.6)	10.2% (17.8) (comprehension = 7.5%; reformulation = 2.7%)	66.3% (29.7)
2 nd year	11.2% (14.2)	16.1% (19.5) (comprehension = 5.6%; reformulation = 10.5%)	72.7% (23.2)
3 rd year	13.9% (16.2)	15.9% (20.7) (comprehension = 5.2%; reformulation = 10.7%)	70.2% (26.1)
4 th year	18.2% (25.4)	24.3% (24.0) (comprehension = 8.2%; reformulation = 16.2%)	57.5% (32.9)
Graduates	14.5% (18.7)	19.5% (21.3) (comprehension = 5.7%; reformulation = 13.8%)	66.0% (29.3)

According to our results (Table 4.5):

1. Problem-solving procedure distribution. External support strategies are the procedures all the groups report using most. The second, third and fourth-year students and the graduates report using internal support strategies more than automatic solution, and reformulation-oriented more than comprehension-oriented internal support strategies. The first-year students, in contrast, report using automatic solution more than internal support strategies, and comprehension-oriented more than reformulation-oriented internal support strategies.

2. Type of evolution. The use of automatic solution undergoes mixed evolution, with an extremely substantial fall between the first and second years, a substantial rise between the second and third years, a very substantial rise between the third and fourth years, and a very substantial fall between the fourth year and the graduates.

The use of internal support strategies undergoes mixed evolution, with extremely substantial rises between the first and second years and between the third and fourth years, and a very substantial fall between the fourth year and the graduates.

The use of external support strategies undergoes mixed evolution, with a slight rise between the first and second years, a substantial fall between the third and fourth years, and a substantial rise between the fourth year and the graduates.

Mixed evolution thus takes place in every category.

3. Differences between groups.

- Automatic solution. The reported use of automatic solution is at its highest in the first year. It decreases in the second year and there are no huge differences thereafter.
- Internal support strategies. The reported use of internal support strategies is at its lowest in the first year. It increases in the second year and between the third and fourth years, peaking in the fourth. Comprehension-oriented strategies are used more than reformulation-oriented strategies in the first year. This changes as of the second year, with the rest of the groups reporting greater use of reformulation-oriented strategies than comprehension-oriented strategies, particularly the fourth-year students and the graduates.
- External support strategies. These are the strategies each group reports using most. Their use is at its highest in the second and third years. In the fourth year and among the graduates their use is reportedly more balanced with that of internal support strategies and automatic solution.

4. Problem-solving procedures at the start of training. At the beginning of training, the subjects report little use of internal support strategies and greater use of automatic solution, probably because they lack cognitive resources for identifying problems.

5. Problem-solving procedures upon completion of training. The graduates report using internal support strategies more than automatic solution, probably because they have more cognitive resources for identifying and solving problems at their disposal.

Problem-solving procedures and acceptability

From a descriptive perspective, comparing the groups on the basis of their respective mean problem-solving procedures and acceptability values (see section 2.3.1) shows that while acceptability increases as TC is acquired, the evolution of the use of automatic solution, internal support strategies and external support strategies is mixed. There is thus no parallelism between the evolution of the two indicators. It is worth noting that while the first-year students make the greatest use of automatic solution, they do not use it effectively, given that they are the group with the lowest acceptability results.

We wish to reiterate that this indicator provides data on the problem-solving procedures the subjects reported using and thus has an element of subjectivity. In our article on the decision-making variable in this publication (see article 5), we deal with the procedures the subjects actually used and bring the corresponding results together with those we obtained for translation acceptability.

We performed a multiple linear regression to predict acceptability based on the students' year and their use, as a percentage, of each problem-solving procedure. We obtained the following results:

- Use of automatic solution: $F(2, 125) = 11.188, p < 0.001, r^2 = 0.138$; year = 0.056 ($p < 0.001$; 95% CI [0.031; 0.081]); use of automatic solution = -0.001 ($p = 0.179$; 95% CI [-0.003; 0.001]).

- Use of internal support strategies: $F(2, 125) = 11.034, p < 0.001; r^2 = 0.138$; year = 0.054 ($p < 0.001$; 95% CI [0.029; 0.079]); use of internal support strategies = 0.001 ($p = 0.214$; 95% CI [-0.001; 0.003]).
- Use of external support strategies: $F(2, 125) = 10.133, p < 0.001$; $r^2 = 0.126$; year = 0.057 ($p < 0.001$; 95% CI [0.032; 0.082]); use of external support strategies = 0.000001 ($p = 0.915$; 95% CI [-0.001; 0.001]).

There is thus no relationship between the use of problem-solving procedures and translation acceptability.

4.4.4. Satisfaction coefficient

Table 4.6. Satisfaction coefficient

	Mean
1 st year	0.57 (0.30)
2 nd year	0.54 (0.28)
3 rd year	0.59 (0.26)
4 th year	0.60 (0.27)
Graduates	0.66 (0.20)
Translators	0.83 (0.21)

According to our results (Table 4.6):

- Rising evolution takes place, with slight differences between the second and third years and between the fourth year and the graduates.
- There are no major differences between groups. The level of satisfaction is at its highest among the graduates, possibly because they are more confident in their translations than the other groups' subjects.
- There is no progression between the first year and the end of training (0.09).

- There is a substantial rise from the graduates' value to that of the translators (0.17): $U = 312.5, p < 0.001$, one-tailed, $r = 0.59$. The graduates' level of satisfaction with their proposed solutions is far lower than that of the translators, suggesting that the former lack confidence in the translations they produce.

Satisfaction coefficient and acceptability

From a descriptive perspective, comparing the groups on the basis of their respective mean satisfaction coefficient and acceptability values (see section 2.3.1) shows that while acceptability rises as TC is acquired, there are no major differences between groups where their level of satisfaction is concerned. The first-year students' level of satisfaction is very similar to that of the second, third and fourth-year students, but their level of acceptability is lower. There is, thus, no parallelism between the two indicators.

In our quantitative statistical analysis, we performed a multiple linear regression to predict acceptability based on the students' year and satisfaction coefficient. We found a significant regression equation ($F(2, 125) = 10.443, p < 0.001$), with an r^2 of 0.143. Students' predicted acceptability is equal to $0.412 + 0.056(\text{year})$, 95% CI [0.031; 0.081] + $0.048(\text{satisfaction coefficient})$, 95% CI [-0.080; 0.176]. While the year is a significant predictor of acceptability ($p < 0.001$), the satisfaction coefficient is not ($p = 0.462$).

These results corroborate those we obtained in our TC experiment, where we found no relationship between subjects' personal satisfaction with the quality of their solutions to translation problems and real acceptability.

4.4.5. Characterisation of the text's main types of difficulties

As explained previously (see section 4.3.2), we did not calculate the type of evolution or

the progression that occurs between the first year and the graduates for this indicator, due to its nature. Having omitted it from our analysis in our TC experiment, we have not compared its data to those of the professional translators.

None of the subjects chose the ‘I didn't notice any difficulties’ option, meaning that the text caused them all translation difficulties.

Table 4.7 shows the weighted value we obtained for each group.

Table 4.7. Characterisation of the text's main types of difficulties

Type of difficulty	1 st year	2 nd year	3 rd year	4 th year	Graduates
Cultural (extralinguistic)	0.36 (0.85)	0.15 (0.67)	0.05 (0.21)	0.00 (0.00)	0.33 (0.84)
Intentionality	0.27 (0.63)	0.40 (0.99)	0.18 (0.50)	0.28 (0.79)	0.11 (0.32)
Linguistic comprehension	0.64 (1.05)	0.95 (1.23)	0.68 (1.13)	0.04 (0.20)	0.56 (0.92)
Linguistic reformulation	1.77 (1.31)	1.70 (1.17)	1.86 (1.13)	2.20 (1.12)	1.56 (1.25)
Textual	0.73 (1.12)	0.45 (0.89)	1.09 (1.27)	0.80 (1.12)	0.83 (1.20)
Thematic (extralinguistic)	0.82 (1.37)	1.25 (1.25)	1.27 (1.35)	1.04 (1.27)	1.56 (1.50)
Pragmatic	0.23 (0.75)	0.15 (0.67)	0.18 (0.59)	0.48 (0.87)	0.22 (0.55)

According to our results, each group identified linguistic reformulation as the main type of difficulty, followed by the text's subject (a computer virus) and then, except in the second year, by textual difficulties. This highlights the difficulty caused by reformulation in the target language.

It thus seems that, in general, the students successfully identified the text's fundamental difficulties, i.e. its reformulation difficulties and those stemming from its subject. It should be noted that standard deviation is generally high, indicating a wide spread within each group.

Characterisation of the text's main types of difficulties and acceptability

As stated earlier, we consider that, in principle, characterisation of difficulty type should not influence acceptability, as each subject's conceptualisation of the difficulties they experience is personal to them and depends on their individual shortcomings. Nonetheless, we used regression to carry out a quantitative statistical analysis for verification purposes.

We performed a multiple linear regression to predict acceptability based on the students' year and their characterisation of the text's translation difficulties. We found that the students' year has an effect on acceptability, but their characterisation of the text's translation difficulties does not:

- Cultural difficulties: $F(2, 125) = 10.339, p < 0.001, r^2 = 0.128$; year = 0.057 ($p < 0.001$; 95% CI [0.32; 0.82]); cultural difficulties = 0.026 ($p = 0.547$; 95% CI [-0.059; 0.112]).
- Intentionality difficulties: $F(2, 125) = 11.876, p < 0.001, r^2 = 0.146$; year = 0.056 ($p < 0.001$; 95% CI [0.31; 0.80]); intentionality difficulties = 0.070 ($p = 0.085$; 95% CI [-0.010; 0.149]).
- Linguistic comprehension difficulties: $F(2, 125) = 10.259, p < 0.001, r^2 = 0.127$; year = 0.058 ($p < 0.001$; 95% CI [0.32; 0.83]); linguistic comprehension difficulties = -0.017 ($p = 0.634$; 95% CI [-0.089; 0.055]).
- Linguistic reformulation difficulties: $F(2, 125) = 10.853, p < 0.001, r^2 = 0.134$; year = 0.057 ($p < 0.001$; 95% CI [0.32; 0.82]); linguistic reformulation difficulties = -0.047 ($p = 0.265$; 95% CI [-0.129; 0.036]).
- Textual difficulties: $F(2, 125) = 10.130, p < 0.001, r^2 = 0.126$; year = 0.057 ($p < 0.001$; 95% CI [0.32; 0.82]); textual difficulties = -0.003 ($p = 0.936$; 95% CI [-0.071; 0.066]).

- Thematic difficulties: $F(2, 125) = 10.542, p < 0.001, r^2 = 0.131$; year = 0.056 ($p < 0.001$; 95% CI [0.30; 0.81]); thematic difficulties = -0.029 ($p = 0.399$; 95% CI [-0.098; 0.039]).
- Pragmatic difficulties: $F(2, 125) = 10.139, p < 0.001, r^2 = 0.126$; year = 0.057 ($p < 0.001$; 95% CI [0.32; 0.82]); pragmatic difficulties = -0.006 ($p = 0.884$; 95% CI [-0.087; 0.075]).

These results confirm that there is no relationship between the characterisation of a text's main types of translation difficulties and translation quality.

4.4.6. Characterisation of prototypical translation problems

As stated previously (see section 4.3.6), due to this indicator's nature and our use of weighted values, we did not calculate the type of evolution or the progression it involves, nor did we bring its results together with those we obtained for translation acceptability (our results for the characterisation of the text's main types of difficulties indicator showed the absence of any relationship). We neither performed statistical tests for this indicator, nor compared its results to those of the group of translators in our TC experiment, due to differences in the way we collected data.

Our results for each RP are set out below. PACTE's characterisation of each RP appears in brackets. Each table of results includes the hierarchical order (in bold) of the types of difficulties identified for each group.

Rich point 1: title (intentionality and textual problem)

Table 4.8. Characterisation of rich point 1 - title

Type of difficulty	1 st year	2 nd year	3 rd year	4 th year	Graduates
Cultural (extralinguistic)	0.09 (0.43)	0.10 (0.44)	0.17 (0.64)	0.12 (0.60)	0.11 (0.46)
Intentionality	1.32 (1.39)	0.62 (1.16)	0.46 (0.98)	0.64 (1.11)	0.79 (1.18)
Linguistic comprehension	0.00 (0.00)	0.48 (1.08)	0.13 (0.45)	0.24 (0.83)	0.21 (0.71)
Linguistic reformulation	1.45 (1.44)	2.19 (1.17)	2.00 (1.14)	2.04 (1.24)	1.89 (1.37)
Textual	0.64 (1.05)	0.52 (1.12)	1.17 (1.37)	0.96 (1.24)	0.95 (1.13)
Thematic (extralinguistic)	0.27 (0.88)	0.14 (0.48)	0.17 (0.48)	0.08 (0.40)	0.21 (0.71)
Pragmatic	0.23 (0.75)	0.33 (0.73)	0.42 (0.97)	0.32 (0.75)	0.53 (0.77)

According to our results (Table 4.8):

- In the first year, RP1 is characterised as mainly involving linguistic reformulation difficulties. It is least frequently characterised as involving linguistic comprehension difficulties.
- Among the graduates, RP1 continues to be characterised as mainly involving linguistic reformulation difficulties. It is least frequently characterised as involving cultural difficulties.
- Every group characterises RP1 as mainly involving linguistic reformulation difficulties.
- There is a large difference between the first and second years in the case of linguistic comprehension difficulties, which rise from seventh to fourth position.

Rich point 2: technical term (linguistic reformulation and extralinguistic problem)

Table 4.9. Characterisation of rich point 2 - technical term

Type of difficulty	1 st year	2 nd year	3 rd year	4 th year	Graduates
Cultural (extralinguistic)	0.22 (0.74)	0.27 (0.88)	0.63 (1.13)	0.11 (0.58)	0.35 (0.88)
Intentionality	0.57 (1.16)	0.23 (0.75)	0.63 (1.17)	0.63 (1.21)	0.50 (1.10)
Linguistic comprehension	0.87 (1.36)	1.50 (1.44)	0.83 (1.34)	0.41 (0.93)	0.85 (1.35)
Linguistic reformulation	0.74 (1.18)	1.50 (1.19)	1.54 (1.32)	1.15 (1.35)	1.15 (1.27)
Textual	0.17 (0.58)	0.18 (0.66)	0.04 (0.20)	0.37 (0.84)	0.30 (0.66)
Thematic (extralinguistic)	0.26 (0.86)	0.36 (0.95)	0.29 (0.86)	0.56 (1.09)	1.05 (1.36)
Pragmatic	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.05 (0.22)

According to our results (Table 4.9):

- In the first year, RP2 is characterised as mainly involving linguistic comprehension difficulties. It is least frequently characterised as involving pragmatic difficulties.
- Among the graduates, RP2 is characterised as mainly involving linguistic reformulation difficulties. It continues to be least frequently characterised as involving pragmatic difficulties.
- Other than among the graduates, RP2 is virtually never characterised as involving pragmatic difficulties.
- Up until the graduate stage, the position of linguistic comprehension difficulties in the order descends as TC is acquired.

Rich point 3: reference (textual problem)

Table 4.10. Characterisation of rich point 3 - reference

Type of difficulty	1 st year	2 nd year	3 rd year	4 th year	Graduates
Cultural (extralinguistic)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.11 (0.57)	0.14 (0.65)
Intentionality	0.78 (1.35)	0.73 (1.28)	0.42 (0.93)	0.46 (1.07)	0.14 (0.48)
Linguistic comprehension	0.52 (1.04)	0.82 (1.18)	0.42 (1.02)	0.43 (1.07)	0.57 (1.21)
Linguistic reformulation	1.30 (1.43)	1.55 (1.41)	1.38 (1.44)	1.43 (1.40)	1.38 (1.50)
Textual	0.22 (0.74)	0.41 (0.91)	0.54 (1.02)	0.46 (0.96)	0.90 (1.04)
Thematic (extralinguistic)	0.04 (0.21)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.14 (0.48)
Pragmatic	0.09 (0.42)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.05 (0.22)

According to our results (Table 4.10):

- In the first year, RP3 is characterised as mainly involving linguistic reformulation difficulties. It is least frequently characterised as involving cultural difficulties.
- Among the graduates, RP3 continues to be characterised as mainly involving linguistic reformulation difficulties. It is least frequently characterised as involving pragmatic difficulties.
- Linguistic reformulation difficulties are the type of difficulty RP3 is most often identified as involving, in every group.
- Pragmatic difficulties are the type of difficulty RP3 is least often identified as involving.
- Cultural difficulties take on greater relevance as TC is acquired (rising from seventh to fourth position).
- Intentionality difficulties decrease as TC is acquired (falling from second position in the first year to fourth among the graduates), except in the fourth year, where they are in second position.

Rich point 4: element in apposition (textual and intentionality problem)

Table 4.11. Characterisation of rich point 4 - element in apposition

Type of difficulty	1 st year	2 nd year	3 rd year	4 th year	Graduates
Cultural (extralinguistic)	0.10 (0.44)	0.00 (0.00)	0.26 (0.75)	0.23 (0.82)	0.00 (0.00)
Intentionality	0.48 (1.08)	0.50 (1.14)	0.61 (1.20)	0.42 (1.03)	0.24 (0.77)
Linguistic comprehension	0.76 (1.26)	0.79 (1.28)	0.35 (0.93)	0.62 (1.17)	0.19 (0.60)
Linguistic reformulation	1.00 (1.26)	1.33 (1.27)	1.04 (1.36)	1.12 (1.31)	0.86 (1.24)
Textual	0.10 (0.44)	0.42 (0.97)	0.35 (0.83)	0.04 (0.20)	0.57 (1.08)
Thematic (extralinguistic)	0.38 (0.97)	0.17 (0.56)	0.48 (0.99)	0.27 (0.83)	1.52 (1.50)
Pragmatic	0.14 (0.65)	0.00 (0.00)	0.09 (0.42)	0.00 (0.00)	0.14 (0.48)

According to our results (Table 4.11):

- In the first year, RP4 is characterised as mainly involving linguistic reformulation difficulties. It is least frequently characterised as involving cultural and textual difficulties.
- Among the graduates, RP4 is characterised as mainly involving thematic difficulties. It is least frequently characterised as involving cultural difficulties.
- Linguistic reformulation difficulties are the type of difficulty RP4 is most often identified as involving, except among the graduates (who place them in second position).
- In general, pragmatic difficulties are the type of difficulty RP4 is least often identified as involving.

Rich point 5: element involving difficulties in terms of comprehension and reformulation (intentionality and linguistic reformulation problem)

Table 4.12. Characterisation of rich point 5 - element involving difficulties in terms of comprehension and reformulation

Type of difficulty	1 st year	2 nd year	3 rd year	4 th year	Graduates
Cultural (extralinguistic)	0.23 (0.75)	0.52 (1.12)	0.81 (1.27)	0.00 (0.00)	0.53 (0.96)
Intentionality	0.64 (1.22)	0.76 (1.18)	0.73 (1.25)	0.75 (1.22)	0.42 (1.02)
Linguistic comprehension	0.68 (1.21)	0.71 (1.19)	0.85 (1.22)	0.46 (0.98)	0.58 (1.17)
Linguistic reformulation	0.73 (1.16)	1.24 (1.30)	0.85 (1.19)	1.50 (1.41)	1.05 (1.13)
Textual	0.45 (1.01)	0.19 (0.68)	0.27 (0.67)	0.50 (0.98)	0.63 (1.12)
Thematic (extralinguistic)	0.27 (0.88)	0.43 (0.87)	0.12 (0.59)	0.21 (0.59)	0.37 (0.96)
Pragmatic	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.42 (1.02)

According to our results (Table 4.12):

- In the first year, RP5 is characterised as mainly involving linguistic reformulation difficulties. It is least frequently characterised as involving pragmatic difficulties.
- Among the graduates, RP5 is again characterised as mainly involving linguistic reformulation difficulties. It is least frequently characterised as involving thematic difficulties.
- In general, pragmatic difficulties are the type of difficulty RP5 is least often identified as involving.

Preliminary conclusions

When interpreting the conclusions we have drawn from our analysis of this indicator, it must be borne in mind that it is highly marked by subjectivity (see section 4.3.5), as

underlined by the generally high level of variability in subjects' answers within each group and for each RP.

1. Linguistic reformulation difficulties are the type of difficulty identified most frequently for every RP and in the majority of the groups. At the start of training, every RP except RP2 is most often characterised as involving linguistic difficulties. Upon completion of training, the same applies to every RP except RP4. Students thus experience reformulation difficulties throughout their training.

2. Pragmatic difficulties are the type of difficulty the students appear to find least problematic, to the extent that most of the groups do not even recognise them as difficulties where the majority of the RPs are concerned.

3. There is no clear pattern of evolution in terms of the subjects' characterisation of problems involving intentionality (RP1, RP4 and RP5), except in the case of RP1, where intentionality difficulties drop from second to third position over the course of training.

4. For each of the RPs that PACTE characterises as involving more than one type of difficulty (i.e. RP1, RP2, RP4 and RP5), at least one of the types of difficulty identified by PACTE is also identified by the students. The students' characterisations and those of PACTE match most closely in the case of the RPs including linguistic reformulation problems (RP2 and RP5).

The graduates are the group whose characterisations seem most similar to those of PACTE (except where intentionality difficulties are concerned), on the basis of them identifying RP2 as involving thematic difficulties and RP3 and RP4 as involving textual difficulties. The only total match occurs in the case of RP2 (linguistic reformulation, extralinguistic). The subjects appear better able to characterise the types of problems they encounter upon completion of training.

4.5. Conclusions

In relation to the identification and solution of translation problems variable, in our TC experiment (PACTE 2017d, 187-189) we found that:

- Translation experience influenced the subjects' perception of the difficulty of translating the text (the more experienced they were, the less difficulty they perceived).
- There was no relationship between the subjects' perception of the difficulty of translating the text, their satisfaction with their proposed solutions and the quality of their translations.
- The identification and description of translation problems involved an element of subjectivity stemming from each subject's attributes (linguistic and extralinguistic knowledge, etc.).
- Translation problem characterisation did not appear to be a defining trait of TC, although, as already mentioned, there were methodological problems in our analysis of the corresponding indicator.

With regard to the TC experiment's design, the variable's results confirmed the homogeneity of the English, French and German source texts, given that the subjects experienced similar difficulties in each language combination; the suitability of our chosen RPs, given that their translation caused all the subjects difficulties; and the multidimensional nature of the translation problems, given that the subjects used different categories to describe each of them.

The results we obtained for this variable in our TCA experiment seem to point in the same direction and confirm our empirical hypotheses (see Table 4.1).

Our results for this variable provide data on the acquisition of two sub-competences in PACTE's TC model, namely the strategic and the knowledge of translation sub-competences. Our results confirm our operational hypotheses (see Table 4.1) corresponding to the indicators related to the strategic sub-competence (procedural knowledge), as we observed differences between groups in terms of the perception of the difficulty of translating the text, the number and types of problems identified, the problem-solving procedures used, and satisfaction with the results obtained, albeit only slight differences where the number of problems identified and satisfaction are concerned. Our results also confirm our operational hypotheses corresponding to the indicators related to the knowledge of translation sub-competence (declarative knowledge), as we observed differences between groups in their description of the text's main types of translation difficulties and its prototypical problems.

With regard to the indicators related to the **strategic sub-competence**, the following conclusions can be drawn:

1. Predominance of mixed evolution. Mixed evolution takes place in the case of all the indicators except the satisfaction coefficient, and is particularly clear where the perception of difficulty coefficient and the problem-solving procedures indicator's three categories (automatic solution, internal support strategies and external support strategies) are concerned. It follows that the perception of the difficulty of translating a text fluctuates during the TCA process. The same applies to the use of problem-solving procedures, which is restructured as TCA advances and translation experience is built up, with cognitive resources (linguistic and extralinguistic knowledge, knowledge of translation, assimilated cognitive strategies, etc.) and external documentation resources balancing each other out.

There is no clear pattern of evolution according to translation problem type. This conclusion is based on the identification of prototypical translation problems indicator, where mixed evolution takes place for three of the RPs and little evolution occurs in the other two cases.

There is no clear evolution in terms of satisfaction with proposed solutions, given the absence of major differences between groups. The satisfaction level is at its highest upon completion of training, possibly because having greater experience of translating gives the graduates more confidence in their solutions.

2. Lack of progression between the first year and the graduates. There is no progression in the case of the perception of difficulty coefficient, identification of prototypical translation problems (progression only occurs for a single RP) and satisfaction coefficient indicators (i.e. those for which we were able to measure progression).

The use of automatic solution, a sign of expertise in any field, does not become more frequent as TCA advances. Its level is very high in the first year, probably due to students having fewer cognitive resources (less linguistic and extralinguistic knowledge and fewer capabilities in terms of applying strategies) and external resources to call on to solve translation problems. It decreases in the second year, probably because, through performing translation tasks, students have acquired resources that enable them to apply more internal and external support strategies. It increases only slightly between the second and fourth years, and then drops a little among the graduates. The use of this procedure can thus be said to be restructured during TCA.

3. Shortcomings compared to the professional translators upon completion of training. The graduates behave very differently from the professional translators in relation to each of the indicators for which we were able to compare the two groups

(perception of difficulty coefficient, identification of prototypical translation problems and satisfaction coefficient). The graduates have a higher perception of the difficulty of translating the text and identify more translation problems than the translators. The differences between the two groups appear to be most marked in the case of problems involving intentionality, which the professionals find easier to deal with. Intentionality problems thus continue to cause difficulties upon completion of training.

Additionally, the graduates' level of satisfaction with their translations is much lower than that of the professional translators, despite the two groups' acceptability values being similar. This suggests that the graduates lack confidence in their output, probably due to not having professional experience.

4. No relationship with acceptability. We did not detect a relationship between any of the indicators and translation acceptability. Acceptability increases as TC is acquired, reaching a level very similar to that of the professional translators. Apart from the satisfaction coefficient, however, the identification and solution of translation problems variable's indicators undergo mixed evolution. There is thus no parallelism between the acquisition of the capabilities corresponding to the indicators in question and the acquisition of those required to produce acceptable translations.

Our results for the perception of difficulty coefficient, identification of prototypical translation problems and satisfaction coefficient indicators corroborated those we obtained in our TC experiment, where we found no relationship between the indicators in question and translation quality either. This may be linked to the psycho-physiological components in PACTE's TC model, i.e. the subjects' self-esteem, capacity for self-criticism, etc.

Certain aspects of our analysis of the relationship between the identification and solution of translation problems variable's indicators and translation acceptability

corroborate the absence of parallelism between translation quality and the acquisition of the capabilities corresponding to the variable's indicators. Firstly, while the graduates' acceptability value is similar to that of the professional translators, the former identify more problems. This difference could be due to the graduates lacking confidence, although the fact that their training (involving translation reports, commented translations, etc.) is still fresh in their minds might also be a factor. Secondly, the first-year students are the group that uses automatic solution to the greatest extent, but they do not use the procedure effectively, given that they are also the group with the lowest acceptability score. Lastly, despite their lower acceptability value, the first-year students' level of satisfaction with their translations is very similar to that of the second, third and fourth-year students. This may be because the first-year students lack awareness of translation solution quality standards and of the real difficulty of the text.

5. Influence of training. In the case of each of the three indicators for which we were able to measure progression between the first year and the graduates, we detected none. Training's influence is only visible in the evolution of certain aspects of the perception of difficulty coefficient, identification of prototypical translation problems and problem-solving procedures indicators.

The perception of the difficulty of translating the text appears to be restructured as TCA advances. The second-year students perceive the greatest difficulty, probably because, having spent a term performing translation tasks, they are more aware of translation problems than the first-year students but still lack the translation principles and strategies (which help solve difficulties) at the disposal of the students in the years above them. The third and fourth-year students, perhaps owing to the training they have received, are more capable of solving translation problems and identify fewer difficulties. They perceive the same level of difficulty as the first-year students, but as a

result of having acquired translation principles and strategies that help them solve problems, rather than as a consequence of the lack of resources for identifying and solving problems characteristic of the first-year students. The graduates behave differently (they are the group with the second highest perception of difficulty, perceiving more difficulty than the fourth-year students), possibly due to greater concern for the labour market's quality requirements.

With regard to the identification of translation problems, the training subjects have received seems to be a factor in the increase in the number of problems identified between the first and second years (there is no progression thereafter). There does not appear to be a clear pattern of evolution according to problem type, so no conclusions can be drawn as to training's influence in that respect.

Where problem-solving procedures are concerned, training's influence is reflected in the change of pattern which takes place between the first and second years. Specifically, automatic solution is used more often than internal support strategies in the first year, and vice versa in the second year, probably due to students having assimilated more cognitive resources through training. The change in the application of internal support strategies which occurs as of the second year (and becomes particularly pronounced as of the fourth), when the use of reformulation-oriented strategies overtakes that of comprehension-oriented strategies, may be due to training increasing awareness of the importance of end product quality.

The fact that the use of external support strategies is at its greatest in the second and third years is probably a result of students having studied basic aspects of translation technologies. It diminishes in the fourth year and among the graduates, balancing out with increased use of automatic solution and internal support strategies acquired through greater translation experience.

Nonetheless, as stated previously, automatic solution is a sign of expertise and, thus, would ideally be used more frequently at the end of training. This is a point translator training ought to take into consideration.

Training appears to have less of an influence on these indicators than on those of other variables. This is probably because of their subjective nature. As already mentioned, they are conditioned to a large extent by each subject's individual characteristics in terms of their knowledge, skills and shortcomings. The indicators in question are also related to subjects' capacity for critical thinking and self-criticism, their perception, their ability to reason logically, their self-esteem, etc. (the *psycho-physiological components* of PACTE's TC model), which should thus receive greater attention in training.

As regards the indicators related to the **knowledge of translation sub-competence**, owing to their nature we did not calculate the type of evolution corresponding to either of them, as explained previously. We were thus able to identify few clear trends in their development. Nonetheless, we reached the following conclusions:

1. Linguistic reformulation difficulties are the type of difficulty the students most often identify as problematic. They are the type of difficulty to which the students in every group refer most frequently in their characterisations of the difficulties involved in translating both the text as a whole and its RPs. This may be due to their awareness of the importance of proficiency in the target language and insecurity stemming from having to produce a linguistically adequate text in it, rather than to a poor command of their mother tongue.

The fact that linguistic reformulation remains a source of difficulties at the end of training is indicative of the graduates' concern for quality; in other words, they are aware of the difficulty that producing a well reformulated translation involves and

continue to find doing so difficult. The graduates' reformulation difficulties are an issue that ought to be reflected upon in relation to translator training.

2. Pragmatic difficulties are the type of difficulty every group's students seem to consider least problematic. Their view might be influenced by the lack of cultural problems requiring adaptation to the target audience in the source text.

3. There is no clear pattern of evolution where most of the translation problems involving intentionality are concerned. This could be because such problems are very difficult to identify and solve, resulting in the students tending to class them as reformulation difficulties due to being unable to reformulate them. It seems that the capability to identify and describe them is restructured as TCA advances.

4. The graduates' translation problem characterisations are the closest to those proposed by PACTE. This suggests that *explanatory knowledge* (i.e. *know-why* related to theoretical knowledge) may make up a larger part of their *implicit theories* (knowledge acquired implicitly on the basis of association and through experience) at the end of training.

5. Influence of training. With the subjects still receiving training or having only recently completed the process, it seems that their declarative knowledge concerning the characterisation of translation problems has yet to fully bed in and is conditioned by their individual traits and translation experience, which affects their implicit theories.

We have confirmed that subjectivity influences all the identification and solution of translation problems variable's indicators. Training appears to have less of an influence on them than on the indicators of other variables, probably because of their subjective nature. The subjects identify problems, describe their characteristics, use procedures to solve them and evaluate their proposed solutions on the basis of their abilities, their

level of knowledge (linguistic and extralinguistic knowledge, knowledge of types of translation problems, assimilation of translation principles and problem-solving strategies, etc.) and their shortcomings therein. This is likely to be related to the distinction established by Nord (1988/1991) between ‘translation difficulties’ (subjective in nature) and ‘translation problems’ (objective in nature). It also highlights the influence the psycho-physiological components in PACTE's TC model have on the way TC works and is acquired, and, thus, the importance that ought to be attributed to so-called *generic competences* in translator training.

5. Translation competence acquisition. Decision-making. The use of internal and external support

This article focuses on the decision-making variable in PACTE's experimental study on translation competence acquisition. We define the variable, which provides data on the way the strategic and instrumental sub-competences from PACTE's translation competence model work, as decisions made during the translation process which involve the use of automatised and non-automatised cognitive resources (internal support) and of different sources of documentation (external support) to solve translation problems. It has two indicators, sequences of actions and type of internal support. We distinguish between four types of sequences of actions, specifically internal support, predominantly internal support, predominantly external support, and simple external support; and between two types of internal support, namely automatised and non-automatised internal support. Our results show that the students in our sample use the internal support sequence much less, and the simple external support and predominantly external support sequences much more, than the professional translators from our translation competence experiment. The students' results are poorer than those of the translators when using internal support and predominantly internal support, but better when using simple external support and predominantly external support.

The experiment was conducted in November 2011, when our first-year subjects had just begun their degree course; the graduates had completed their studies in June 2011.

Keywords: translation competence acquisition; decision-making; internal and external support; strategic sub-competence; instrumental sub-competence

5.1. Introduction

This article presents our measurement of and results for decision-making, a study variable in PACTE's experiment on translation competence acquisition (TCA) (see Table 5.1).

The decision-making variable is related to the strategic sub-competence and provides data on one of its most important functions, that of activating different sub-competences and compensating for shortcomings in any of them. It also provides data on the instrumental sub-competence, as well as on interaction between the two specified sub-competences, the activation of which involves both internal and external support (Alves 1995, 1997).²⁰

We studied the decision-making variable to determine how the use of internal and external support evolves in the TCA process and is related to translation quality. We define it as decisions made during the translation process which involve the use of automatised and non-automatised cognitive resources (internal support) and of different sources of documentation (external support) to solve translation problems.

We define internal support as recourse to automatised and non-automatised cognitive resources, i.e. linguistic knowledge, all kinds of extralinguistic (cultural, thematic, world) knowledge, knowledge of translation, and cognitive strategies for solving translation problems (contextualising words, identifying key elements of a text which provide information, drawing inferences, drawing analogies, formulating hypotheses about meaning, comparing different solutions, etc.). For the purposes of our

20. See PACTE 2009, 2017i for the results we obtained for this variable in our TC experiment.

study, the use of internal support produces definitive solutions without the use of external support. We distinguish between automatised and non-automatised (i.e. controlled) internal support. Given that any learning process involves gradual automatisation in problem-solving (see section 1.1.1), the evolution of that automatisation is of particular relevance to the study of TCA. This is a matter of great importance in the case of basically procedural knowledge, such as translation competence (TC), as it is essentially processed automatically (see, among others, Anderson 1983, Pozo and Postigo 1993). Additionally, expertise studies show that *deliberate practice*, i.e. regular, well structured engagement in specific activities in a particular domain, results in a greater degree of automatisation in experts' mental processes (see, for instance, Ericsson and Crutcher 1990).

We define external support as recourse to external resources of all kinds. For the purposes of our study, the use of external support involves consulting different resources in different languages, including non-specialist dictionaries; language-specific reference works (dictionaries of synonyms and/or antonyms, style guides, grammars); general reference works (encyclopaedias, manuals, informative texts); specialist dictionaries, glossaries and databases; parallel texts (web pages, corpora, texts); and search engines.

In our previous research on TC, we validated our empirical hypothesis that *there is a relationship between the degree of TC and making certain decisions specific to the translation process to solve translation problems* (PACTE 2017i). In our research on TCA we added two operational hypotheses related to differences between levels of TCA as regards the use of sequences of actions to solve translation problems and the use of automatised and non-automatised cognitive processes (see Table 5.1).

The variable's indicators are:

- Sequences of actions: groups of actions used to obtain a definitive solution to a translation problem. We identified four different types of sequences (PACTE 2017i), namely internal support, predominantly internal support, predominantly external support, and simple external support.²¹
- Type of internal support: automatised internal support and non-automatised internal support.

We also used the acceptability of our subjects' translations as an indicator.

Our data sources were the subjects' translations and *Camtasia* recordings. We used the subjects' translations to determine the acceptability of their solutions to translation problems. Having used *Camtasia* to record all the subjects' actions in real time during the translation process, we subsequently viewed the recordings and used the data obtained to complete forms specifically designed for the purpose.

Table 5.1. Decision-making variable

DECISION-MAKING	
Related to the strategic sub-competence and the instrumental sub-competence	
Objective	To collect data on the decision-making process and the interaction between sub-competences when carrying out a translation task.
Definition	Decisions made during the translation process which involve the use of automatised and non-automatised cognitive resources (internal support) and of different sources of documentation (external support) (Alves 1995, 1997) to solve translation problems.
Hypotheses	Empirical hypothesis: There is a relationship between the degree of TC and making certain decisions specific to the translation process to solve translation problems. Operational hypotheses: 1. Differences can be observed between levels of TCA in relation to the use of certain sequences of actions to solve a translation problem. 2. Differences can be observed between levels of TCA in relation to the use of automatised and non-automatised cognitive processes.
Indicators	- Sequences of actions. Categorical indicator; four categories: internal support; predominantly internal support; predominantly external support; simple external support.

21. In PACTE 2009 and 2017i, we referred to simple external support as 'external support'.

	- Type of internal support. Categorical indicator; two categories: automatised internal support; non-automatised internal support (this indicator is only analysed when internal support is actually used). Acceptability. Categorical indicator; three categories: acceptable solution; semi-acceptable solution; non-acceptable solution. Numerical indicator; values: 0 to 1.
Instruments and tools	Translations and <i>Camtasia</i> screen recordings.
Sources of data	Sequences of actions; acceptability.

5.2. Measurement of the indicators

To facilitate the data collection and analysis process, we focused on the rich points (RPs), i.e. specific segments containing prototypical translation problems, in each text to be translated (see section 1.4.1 and appendix 2).

We used the acceptability of solutions to determine the nature of the relationship between our results for the indicators and the quality of the subjects' translations (see article 2 for an explanation of how we calculated acceptability).

5.2.1. Sequences of actions

Based on our prior exploratory and pilot studies, in our TC experiment we established four different categories of sequences of actions according to the main type of support (internal, external) used in finding a definitive solution (PACTE 2009, 2017i). These sequences include different types of internal and external support strategies for solving translation problems.

In the case of external support, we consider consultations in terms of the degree of cognitive involvement they entail and the point at which they take place. If a consultation is made after a definitive solution has been established, we deem it to be for confirmation purposes since it does not change the solution adopted. We divide consultations into three different categories based on degrees of cognitive involvement:

- (13) Consultation of bilingual resources: non-specialist bilingual dictionaries, specialist bilingual dictionaries and glossaries; and bilingual and multilingual

databases in general. We deem subjects' cognitive involvement low in this category, as it is limited to accepting or rejecting the variant offered as a possible solution. We subdivide this category into: (a) consultation of bilingual resources with acceptance of the variant offered in the translation; and (b) consultation of bilingual resources without acceptance of the variant offered in the translation.

- (14) Consultation of alternative resources: all other types of consultations. We deem subjects' cognitive involvement greater in this case, as they have to choose between different possible solutions (arrived at without using bilingual resources).
- (15) No consultations.

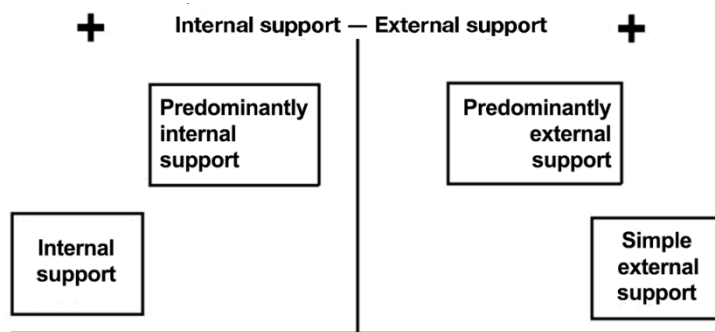
The four categories of sequences we identified are (see Figure 5.1):

- Internal support (IS): the definitive solution is based exclusively on internal support, with no consultation prior to it being adopted. Examples: definitive solution; provisional solution → definitive solution.
- Predominantly internal support (PIS): the definitive solution is based predominantly on internal support, i.e. any combination of consultations that does not include consultations of bilingual resources from which a solution is adopted in the translation. Example: provisional solution → consultation of alternative resources → consultation of alternative resources → consultation of bilingual resources (without acceptance of the solution offered in the translation) → definitive solution.
- Predominantly external support (PES): the definitive solution is based predominantly on external support, i.e. any combination of consultations that

includes consultations of bilingual resources from which a solution is adopted in the translation. Example: provisional solution → consultation of alternative resources → consultation of alternative resources → consultation of bilingual resources (with acceptance of the solution offered in the translation) → definitive solution.

- Simple external support (SES): the definitive solution is based exclusively on consultation of bilingual resources from which a solution is adopted in the translation. Example: consultation of bilingual resources (with acceptance of the solution offered in the translation) → definitive solution.

Figure 5.1. Sequences of actions (adapt. PACTE 2009, 2017i, 198)



5.2.2. Type of internal support: automatised and non-automatised

For the purposes of our study, we distinguish between two types of internal support, which we identified in our work on TC:

- Automatised internal support (AIS): when a RP does not cause difficulties and is solved using internal support.
- Non-automatised internal support (NAIS): when a RP causes difficulties and is solved using internal support. This would suggest that subjects use cognitive resources, by applying their linguistic and extralinguistic knowledge and knowledge of translation, and activate cognitive strategies to solve their

problem, by contextualising, applying their knowledge of translation or comparing alternative solutions, for example.

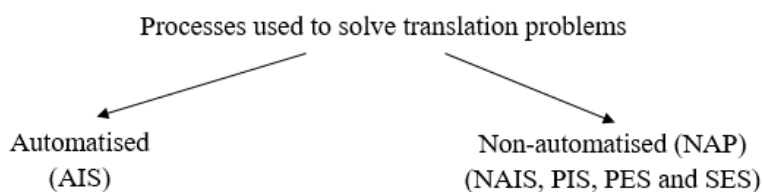
We used data obtained via our translation problems questionnaire to determine whether or not RPs caused the subjects difficulties (see appendix 4, part II, question 1).

5.2.3. *Automatised vs. non-automatised processes*

Results from our study of TC contributed to the identification of two types of problem-solving processes used by subjects (see Figure 5.2):

- Automatised processes (AIS): when a definitive solution is obtained immediately, without the use of external support. This would suggest that subjects experience no difficulty in finding a solution to the problem and do so without any cognitive effort.
- Non-automatised processes (NAP): when a definitive solution is not obtained immediately and different actions (strategies) are used to solve the problem. This category comprises non-automatised internal support (NAIS), predominantly internal support (PIS), predominantly external support (PES), and simple external support (SES). The use of these strategies would suggest that subjects experience some difficulty in solving the problem.

Figure 5.2. Processes used to solve translation problems (PACTE 2017i, 199)



With a view to observing the distribution of automatised and non-automatised processes in decision-making when translating, we compared the use of automatised processes

(AIS) and that of the other sequences.

5.2.4. Measurement of the indicators

We treated sequences of actions as a categorical indicator with four categories, namely internal support, predominantly internal support, predominantly external support, and simple external support. We obtained five items of data (one per RP) per subject.

We treated type of internal support as a categorical indicator with two categories, namely automatised internal support and non-automatised internal support. We only analysed this indicator when a subject used internal support to find a solution to a RP. The number of items of data we obtained per subject therefore varied.

We used descriptive analysis to determine:

- The frequency with which each sequence of actions was used.
- The relationship between the different sequences of actions and the acceptability of the solutions found for each RP.
- The frequency with which each type of internal support was used.
- The relationship between the type of internal support used and the acceptability of the solutions found for each RP.

We also compared the use of automatised and non-automatised processes, and analysed their relationship with acceptability.

To analyse differences between groups, we considered their respective mean values and established an evolution typology (non-evolution, rising evolution, falling evolution and mixed evolution). See section 1.4.4 for definitions of the various types of evolution and details of the values on which our descriptions of differences between groups and progression are based.

In the case of this variable's indicators and our comparison of automatised and non-automatised processes, the numerical criteria we applied to describe differences between groups are not the same as those we used for other variables, as each group has more than one mean value due to its total percentage being distributed among various categories. Specifically, we calculated the five groups' overall mean for each category and took 10% of it as the basis for describing differences between groups. For example, the five groups' overall mean value for the internal support sequence is 13.6, 10% of which is 1.4 (rounded up). We consider the figure in question (1.4) to represent a substantial difference between groups, half the figure (0.7) a slight difference, twice the figure (2.8) a very substantial difference, and three times the figure (4.2) an extremely substantial difference.

We did not analyse the progression that occurs between the first year and the graduate stage for this indicator's variables. As the percentage is distributed between various categories, considering the progression reflected by a single set of results in isolation would be pointless because the different sets of results balance each other out.

Given the qualitative nature of the variable's indicators, we were unable to use correlation-based methods to analyse their relationship with translation acceptability. We calculated each group's mean acceptability value for each category.

Where the type of internal support indicator and our comparison of automatised and non-automatised processes are concerned, owing to the number of cases involved being very small we did not perform statistical tests or analyse the relationship between the type of evolution identified and translation acceptability.

5.3. Results

Our analysis is based on 129 students and the 35 professional translators who participated in our TC experiment. As some *Camtasia* recordings proved unusable, our

body of valid subjects comprised 118 students (21 first-year students, 24 second-year students, 27 third-year students, 28 fourth-year students and 18 graduates) and 34 translators.

In the following sections we present descriptive statistics for each indicator, with standard deviation shown in brackets. While we performed statistical tests for every pair of successive groups, we only report differences between groups which are statistically significant. The significance level we established was 0.05. See appendix 5 for the results of all our statistical tests.

Notably, the external resources the subjects used were nearly all electronic. While they were able to consult printed resources and note down details related to doing so on a form provided to that end, they only actually used such resources for four out of 1425 consultations (0.28%).

5.3.1. Sequences of actions

Table 5.2 shows our results on the use of sequences of actions.²²

Table 5.2. Mean percentage by sequence and group

	IS	PIS	PES	SES
1 st year	17.3%	40.4%	19.2%	23.1%
2 nd year	11.0%	57.6%	22.0%	9.3%
3 rd year	8.9%	34.8%	31.9%	24.4%

22. The overall mean and the values on the basis of which we describe differences between groups for each sequence (see section 5.2.4) are specified below. IS: mean, 13.6; slight difference, 0.7; substantial difference, 1.4; very substantial difference, 2.8; extremely substantial difference, 4.2. PIS: mean, 40.1; slight difference, 2.0; substantial difference, 4.0 (rounded down); very substantial difference, 8.0; extremely substantial difference, 12.0. PES: mean, 27.6; slight difference, 1.4; substantial difference, 2.8 (rounded up); very substantial difference, 5.6; extremely substantial difference, 8.4. SES: mean, 18.8; slight difference, 1.0 (rounded up); substantial difference, 1.9 (rounded up); very substantial difference, 3.8; extremely substantial difference, 5.7.

4 th year	18.6%	28.6%	33.6%	19.3%
Graduates	12.2%	38.9%	31.1%	17.8%
Translators	36.5%	42.4%	15.3%	5.9%

IS: internal support

PIS: predominantly internal support

PES: predominantly external support

SES: simple external support

According to our results, each group's sequence distribution is as follows:

- First year: PIS, SES, PES, IS. There is a notable difference²³ between the first and second most used sequences (PIS and SES respectively).
- Second year: PIS, PES, IS, SES. There is a very large difference between the first and second most used sequences (PIS and PES respectively). The difference between PES and IS is smaller but nonetheless notable.
- Third year: PIS, PES, SES, IS. The differences between the first, second and third most used sequences (PIS, PES and SES respectively) are very small. The only notable difference is between the third and fourth most used sequences (SES and IS respectively).
- Fourth year: PES, PIS, SES, IS. There are no notable differences between sequences.
- Graduates: PIS, PES, SES, IS. The only notable difference is between the second and third most used sequences (PES and SES respectively).
- Translators: PIS, IS, PES, SES. There is a very large difference between the second and third most used sequences (IS and PES respectively).

As regards evolution in the use of the sequences of actions:

23. We considered a difference of 10 or more percentage points to constitute a difference in a group's use of sequences.

- In the case of IS, mixed evolution takes place, with an extremely substantial fall between the first and second years, a substantial fall between the second and third years, an extremely substantial rise between the third and fourth years ($\chi^2[1] = 5.158, p < 0.05$), and an extremely substantial fall between the fourth year and the graduates ($\chi^2[1] = 6.081, p < 0.05$). There is an extremely substantial rise between the graduates and the translators ($\chi^2[1] = 35.630, p < 0.001$).
- In the case of PIS, mixed evolution takes place, with an extremely substantial rise between the first and second years ($\chi^2[1] = 6.145, p < 0.05$), an extremely substantial fall between the second and third years, a substantial fall between the third and fourth years, and a very substantial rise between the fourth year and the graduates. There is a slight rise between the graduates and the translators ($\chi^2[1] = 12.794, p < 0.001$).
- In the case of PES, mixed evolution takes place, with a substantial rise between the first and second years, an extremely substantial rise between the second and third years ($\chi^2[1] = 4.188, p < 0.05$), a slight rise between the third and fourth years, and a slight fall between the fourth year and the graduates ($\chi^2[1] = 4.813, p < 0.05$). There is an extremely substantial fall between the graduates and the translators ($\chi^2[1] = 8.374, p < 0.01$).
- In the case of SES, mixed evolution takes place, with an extremely substantial fall between the first and second years ($\chi^2[1] = 4.829, p < 0.05$), an extremely substantial rise between the second and third years ($\chi^2[1] = 11.000, p < 0.001$), a very substantial fall between the third and fourth years, and a slight fall between the fourth year and the graduates. There is an extremely substantial fall between the graduates and the translators ($\chi^2[1] = 6.287, p < 0.01$).

Sequences of actions and acceptability

Table 5.3. Sequences of actions and mean acceptability

	IS	PIS	PES	SES
1 st year	0.47 (0.40)	0.54 (0.40)	0.55 (0.36)	0.27 (0.29)
2 nd year	0.46 (0.48)	0.59 (0.42)	0.67 (0.37)	0.59 (0.44)
3 rd year	0.63 (0.38)	0.67 (0.39)	0.56 (0.44)	0.67 (0.43)
4 th year	0.56 (0.43)	0.78 (0.34)	0.69 (0.37)	0.50 (0.48)
Graduates	0.64 (0.39)	0.66 (0.42)	0.80 (0.34)	0.84 (0.30)
Translators	0.73 (0.38)	0.79 (0.36)	0.73 (0.38)	0.45 (0.37)

IS: internal support

PIS: predominantly internal support

PES: predominantly external support

SES: simple external support

From a descriptive perspective, our results show the following (Table 5.3):

- First year: acceptability is highest with PES/PIS, followed by IS, and then SES.
There is a notable difference between the sequences in second (IS) and third (SES) place.
- Second year: acceptability is highest with PES, followed by PIS/SES, and then IS. The only notable difference is between the sequences in second (PIS/SES) and third (IS) place.
- Third year: acceptability is highest with PIS/SES, followed by IS, and then PES.
There are no notable differences between the sequences.
- Fourth year: acceptability is highest with PIS, followed by PES, then IS, and then SES. The only notable difference is between the sequences in second (PES) and third (IS) place.

- Graduates: acceptability is highest with SES, followed by PES, then PIS, and then IS. The only notable difference is between the sequences in second (PES) and third (PIS) place.
- Translators: acceptability is highest with PIS, followed by IS/PES, and then SES. There is a large difference between the sequences in second (IS/PES) and third (SES) place.

As regards the evolution of translation acceptability according to sequence type:

- In the case of IS, mixed evolution takes place, with a substantial rise between the second and third years, a slight fall between the third and fourth years, and a slight rise between the fourth year and the graduates. There is a slight rise between the graduates and the translators ($\chi^2[2] = 22.219, p < 0.001$).
- In the case of PIS, mixed evolution takes place, with a slight rise between the first and second years, another between the second and third years ($\chi^2[2] = 12.330, p < 0.01$), a substantial rise between the third and fourth years ($\chi^2[2] = 26.759, p < 0.001$), and a substantial fall between the fourth year and the graduates ($\chi^2[2] = 24.720, p < 0.001$). There is a substantial rise between the graduates and the translators ($\chi^2[2] = 52.505, p < 0.001$).
- In the case of PES, mixed evolution takes place, with a substantial rise between the first and second years, a substantial fall between the second and third years, a substantial rise between the third and fourth years ($\chi^2[2] = 10.067, p < 0.01$), and another between the fourth year and the graduates ($\chi^2[2] = 26.000, p < 0.001$). There is a slight fall between the graduates and the translators ($\chi^2[2] = 27.444, p < 0.001$).

- In the case of SES, mixed evolution takes place, with an extremely substantial rise between the first and second years, a slight rise between the second and third years ($\chi^2[2] = 9.045, p < 0.05$), a substantial fall between the third and fourth years ($\chi^2[2] = 12.100, p < 0.01$), and an extremely substantial rise between the fourth year and the graduates ($\chi^2[2] = 11.488, p < 0.01$). There is an extremely substantial fall between the graduates and the translators ($\chi^2[2] = 32.764, p < 0.001$).

Preliminary conclusions

The following conclusions can be drawn on the basis of the data we obtained:

1. Distribution of sequences of actions. In general, the sequence used most frequently is PIS; PES and SES are, respectively, the second and third most frequently used sequences; and IS is the least frequently used sequence.

2. Differences between groups as regards the distribution of sequences of actions and where acceptability according to sequence type is concerned.

In every group, the sequence used most frequently is PIS (except in the fourth year, where it is PES, albeit with a very small difference in relation to PIS) and that used least often is IS (except in the second year, where it is SES, although the difference between the two is negligible). The second most used sequence is SES in the first year, and PES thereafter (except in the fourth year, where, as mentioned above, PES is the sequence used most frequently). The differences between the sequences are smallest in the fourth year and among the graduates, and it is also in the fourth year that the use of the sequences is most balanced. In the first year, the order of the sequences in terms of frequency of use is PIS, SES, PES, IS, and upon completion of training it is PIS, PES, SES, IS. The sequences used most and least frequently are thus the same (PIS and IS respectively) at both stages.

The distribution of the sequences of actions according to the acceptability values obtained using them differs in each group:

- In both the first and second years, PES gives the highest acceptability value. However, the sequence that gives the lowest acceptability value in the first year is SES, whereas in the second it is IS.
- In the third year, there is a tie between PIS and SES as the sequences that give the highest acceptability values, and PES is that which gives the lowest acceptability value, although the differences between the sequences are very small. This is the group in which the balance among the sequences is the greatest.
- In the fourth year, PIS gives the highest acceptability value and SES the lowest (albeit with only a very small difference in relation to IS).
- Among the graduates, SES gives the highest acceptability value (albeit with only a very small difference in relation to PES) and IS the lowest (albeit with only a very small difference in relation to PIS).

3. Type of evolution. The frequency of use of each sequence of actions undergoes mixed evolution, as does the level of translation acceptability achieved using each sequence.

4. Comparison between the graduates and the translators. The order of the sequences in terms of frequency of use among the graduates is PIS, PES, SES, IS. The equivalent order among the translators is PIS, IS, PES, SES. IS is the sequence the graduates and, in general, all the year groups alike use least, with levels of use far below that of the professionals. PIS is the sequence for which the graduates' score comes

closest to that of the translators. The graduates and every year group use PES and SES much more often than the professionals.

As far as acceptability is concerned, the graduates' values are lower than those of the translators with IS and PIS, but higher with PES and SES, especially the latter, where there is an extremely substantial difference (almost double) between the two groups.

The sequence with which the graduates achieve their highest acceptability value is SES, the one with which the translators score lowest. The sequence that gives the lowest acceptability value in the case of the graduates is IS (with a very small difference in relation to PIS), whereas IS and PIS are the sequences with which the translators perform best.

5.3.2. Type of internal support

The data in this section refer to the distribution of IS.²⁴ It should be borne in mind that in some cases the percentage corresponding to the use of IS is very low, meaning that few subjects and sequences are involved (n = number of sequences). On that basis, we did not perform statistical tests on this indicator or analyse the evolution of translation acceptability in relation to it.

Table 5.4. Type of internal support

	AIS	NAIS
1 st year	44.4% (n = 8)	55.6% (n = 10)

24. The overall mean and the values on the basis of which we describe differences between groups for each type of internal support (see section 5.2.4) are specified below. AIS: mean, 29.6; slight difference, 1.5; substantial difference, 3.0; very substantial difference, 6.0; extremely substantial difference, 9.0. NAIS: mean, 70.4; slight difference, 3.5; substantial difference, 7.0; very substantial difference, 14.0; extremely substantial difference, 21.0.

2 nd year	23.1% (n = 3)	76.9% (n = 10)
3 rd year	25.0% (n = 3)	75.0% (n = 9)
4 th year	19.2% (n = 5)	80.8% (n = 21)
Graduates	36.4% (n = 4)	63.6% (n = 7)
Translators	69.4% (n = 43)	30.6% (n = 19)

AIS: automatised internal support

NAIS: non-automatised internal support

According to our results on the use of IS (Table 5.4):

- Every group of students uses NAIS more than AIS. The translators use AIS more than twice as much as NAIS.
- In the first year, the difference between the use of NAIS and that of AIS is not particularly marked. It increases in the second and third years, peaks in the fourth year, and decreases again among the graduates. The graduates' use of AIS and NAIS is distributed in a way completely opposite to that of the translators, in that the graduates use NAIS much more than AIS (nearly twice as much).

With regard to the evolution of the use of IS:

- In the case of AIS, mixed evolution takes place, with an extremely substantial fall between the first and second years, a slight rise between the second and third years, a very substantial fall between the third and fourth years, and an extremely substantial rise between the fourth year and the graduates. There is an extremely substantial rise between the graduates and the translators.
- In the case of NAIS, mixed evolution takes place, with an extremely substantial rise between the first and second years, a slight rise between the third and fourth

years, and a very substantial fall between the fourth year and the graduates.

There is an extremely substantial fall between the graduates and the translators.

Type of internal support and acceptability

Table 5.5. Type of internal support and mean acceptability (n = number of sequences)

	Acceptability		
	Overall group mean	AIS	NAIS
1 st year	0.45 (0.40) (n = 115)	0.63 (0.44) (n = 8)	0.35 (0.34) (n = 10)
2 nd year	0.59 (0.42) (n = 125)	0.67 (0.29) (n = 3)	0.40 (0.52) (n = 10)
3 rd year	0.63 (0.41) (n = 140)	0.67 (0.29) (n = 3)	0.61 (0.42) (n = 9)
4 th year	0.65 (0.41) (n = 150)	0.70 (0.27) (n = 5)	0.52 (0.46) (n = 21)
Graduates	0.70 (0.40) (n = 110)	0.63 (0.25) (n = 4)	0.64 (0.48) (n = 7)
Translators	0.73 (0.38) (n = 175)	0.65 (0.33) (n = 43)	0.89 (0.43) (n = 19)

AIS: automatised internal support

NAIS: non-automatised internal support

From a descriptive perspective, our results show the following (Table 5.5):

- On the few occasions the first, second, third and fourth-year students use AIS, their acceptability results are better than with NAIS.
- The graduates achieve a better balance between their acceptability results with AIS and with NAIS than the other groups.

5.3.3. Automatised vs. non-automatised processes

The trends we detected when comparing the use of AIS and that of the other sequences of actions are the same as those we identified in our previous comparison of the use of

AIS and NAIS, although the percentages involved are more extreme.²⁵ As already mentioned, we did not perform statistical tests or analyse the evolution of acceptability as part of this comparison.

Table 5.6. Automatised vs. non-automatised processes (n = number of sequences)

	Automatised processes (automatised internal support – AIS)	Non-automatised processes (NAP: NAIS, PIS, PES, SES)
1 st year	7.7% (n = 8)	92.3% (n = 96)
2 nd year	2.5% (n = 3)	97.5% (n = 115)
3 rd year	2.2% (n = 3)	97.8% (n = 132)
4 th year	3.6% (n = 5)	96.4% (n = 135)
Graduates	4.4% (n = 4)	95.6% (n = 86)
Translators	25.3% (n = 43)	74.7% (n = 127)

According to our results (Table 5.6):

- There is an extremely substantial fall in the use of automatised processes between the first and second years.
- The students' level of automatisation is very low, and far below that of the translators.

As regards evolution:

- In the case of AIS, mixed evolution takes place, with an extremely substantial fall between the first and second years, a slight fall between the second and third

25. The overall mean and the values on the basis of which we describe differences between groups for each category (see section 5.2.4) are specified below. AIS: mean, 4.1; slight difference, 0.2; substantial difference, 0.4; very substantial difference, 0.8; extremely substantial difference, 1.2. NAP: mean, 95.9; slight difference, 4.8; substantial difference, 9.6 (rounded up); very substantial difference, 19.2; extremely substantial difference, 28.8.

years, an extremely substantial rise between the third and fourth years, and a very substantial rise between the fourth year and the graduates. There is an extremely substantial rise between the graduates and the translators.

- In the case of NAP, rising evolution takes place, involving just one slight rise, specifically between the first and second years. There is a very substantial fall between the graduates and the translators.

Automatised vs. non-automatised processes and acceptability

Comparing the acceptability achieved with automatised and non-automatised processes confirms the trends we observed in our comparison of AIS and NAIS.

Table 5.7. Mean acceptability with automatised and non-automatised processes

	Automatised processes (AIS)	Non-automatised processes (NAP)
1 st year	0.63 (0.44) (n = 8)	0.45 (0.38) (n = 96)
2 nd year	0.67 (0.29) (n = 3)	0.59 (0.42) (n = 115)
3 rd year	0.67 (0.29) (n = 3)	0.63 (0.42) (n = 132)
4 th year	0.70 (0.27) (n = 5)	0.65 (0.41) (n = 135)
Graduates	0.63 (0.25) (n = 4)	0.74 (0.38) (n = 86)
Translators	0.65 (0.33) (n = 43)	0.77 (0.39) (n = 127)

According to our results (Table 5.7):

- On the few occasions the first, second, third and fourth-year students use AIS, their acceptability results are better than with non-automatised processes.

- In general, the acceptability results achieved with non-automatised processes improve as TCA advances, and the graduates perform at almost the same level as the translators.
- The graduates and the translators obtain their best results with non-automatised processes.

5.4. Conclusions

The decision-making variable provides data on the acquisition of and interaction between two sub-competences from PACTE's TC model, namely the strategic and instrumental sub-competences, the activation of which requires the use of internal and external support. To observe what decisions are made to solve translation problems, we established four categories of sequences of actions (internal support, predominantly internal support, predominantly external support, and simple external support), which encompass different types of strategies. We also distinguished between automatised and non-automatised processes in decision-making.

As in our TC experiment, the data we obtained confirm our empirical hypothesis regarding the existence of differences in decision-making depending on subjects' degree of TCA. We have also confirmed our operational hypotheses, as we detected differences between levels of TCA in terms of the use of sequences of actions and of automatised and non-automatised processes (see Table 5.1).

Additionally, we made the following findings in relation to the **use of sequences of actions** to solve translation problems:

1. Predominantly internal support is the sequence that every group of students except the fourth-year group uses most frequently, and internal support is the least used sequence in almost every case. The students, it seems, do little in terms of mobilising

their cognitive resources, i.e. linguistic knowledge, all kinds of extralinguistic (cultural, thematic, world) knowledge, knowledge of translation, and cognitive strategies (contextualising words, identifying key elements of a text which provide information, drawing inferences, drawing analogies, formulating hypotheses about meaning, comparing different solutions, etc.), to solve translation problems.

2. The use of each of the sequences of actions undergoes mixed evolution. The subjects' use of the sequences appears to change as the range of internal (cognitive) and external resources at their disposal grows.

The use of the different sequences is at its most balanced in the fourth year and, to a slightly lesser extent, among the graduates. Experience of translating seems to enable the subjects to call upon more internal and external resources, contributing to the balance in question.

3. The trends in sequence use we observed change when acceptability results are taken into consideration. The sequences that give the highest acceptability values are predominantly external support, predominantly internal support, and simple external support. While predominantly internal support is the sequence used most frequently, it does not always lead to the best acceptability scores. The students achieve better acceptability values when they use external support more.

4. Relationship with acceptability. With regard to acceptability according to sequence type, the evolution that takes place is, again, mixed for every sequence. It is worth noting that with external support, and simple external support in particular, the subjects' acceptability values are initially very low and subsequently improve to become very good.

Within each group, acceptability differs depending on the sequences used. In the first and second years, predominantly external support and predominantly internal

support give the highest acceptability values, although the level of acceptability attained is low. Acceptability is highest with predominantly internal support and simple external support (with equal scores) in the third year, predominantly internal support in the fourth year, and simple external support and predominantly external support in the case of the graduates. The evolution that takes place thus involves a shift from more frequent use of cognitive resources to more frequent use of simple external support, suggesting that the ability to make effective use of bilingual resources improves as TCA advances. At any rate, the genre and topic of the source text (a news item about a computer virus) lend themselves to standard solutions found in bilingual resources and, therefore, may have influenced our results.

5. Shortcomings compared to the professional translators. The graduates and all the year groups use internal support to a much lower extent and with poorer acceptability results than the professionals; and the simple external support and predominantly external support sequences to a greater extent and with better acceptability results than the professionals.

Upon completion of training, there are still differences between the graduates and the professional translators in terms of sequence use. Predominantly internal support is the sequence both groups use most frequently, but while internal support is in second position in the case of the translators, it is the sequence the graduates use least. The sequence the translators use least is simple external support. The graduates thus use cognitive resources to translate much less than the translators. The professionals mainly use cognitive resources (internal support), probably because they have consolidated knowledge of translation and cognitive strategies for solving translation problems, and less need to use bilingual resources, owing to their experience of translating.

Among the graduates, acceptability is highest with simple external support and predominantly external support. In contrast, the translators achieve their best acceptability results with predominantly internal support, followed by internal support / predominantly external support. The graduates' acceptability values are lower than those of the professionals when using internal support and predominantly internal support, but higher when using predominantly external support and simple external support²⁶ (see Table 5.3). This seems to indicate that, due to their greater experience in translation, the professionals have less need to resort to external support and are better able to make decisions using more internal support (predominantly internal support, predominantly external support, internal support). It is worth noting that the sequences that produce the lowest acceptability results are simple external support in the case of the translators and internal support and predominantly internal support in that of the graduates.

We carried out our TC experiment between 2005 and 2006, and our TCA experiment in 2011. This is relevant because in the five years between the two, the bilingual resources available to translators improved greatly in terms of variety and features, which, evidently, may have affected our results.

6. Influence of training. The training received by the subjects is a factor in the increase in the internal and external resources they are able to call upon, and makes them better able to combine both types of resources to obtain acceptable solutions. Training's influence is reflected in improved acceptability. The sequences that give the highest acceptability values change at each stage of training as the internal and external resources at the students' disposal increase and, consequently, the use of such resources

26. These data must be compared with those corresponding to the use of instrumental resources variable to determine how efficiently, in terms of quantity and nature, consultations were performed (see article 7).

to find acceptable solutions becomes more balanced. The differences in question may stem from training in not only direct and inverse translation but also technologies, L2, etc.

The influence of training is particularly visible in the increase between the first and second years in the acceptability achieved with predominantly external support and simple external support (the sequences that give the best acceptability results upon completion of training), which is probably directly due to two of the subjects' first-year courses, introduction to translation and ICT. Training's effect can also be seen in the use of internal support, which is greater in the first year than in the second and third, possibly because of the first-year students' unfamiliarity with external resources. The frequency with which internal support is used falls in the second year and again in the third, probably as students build up greater knowledge of external resources. Internal support is used more frequently at the end of training (among the fourth-year students and the graduates), by which point students have acquired greater knowledge of translation and more cognitive strategies, and are therefore more confident in their internal support.

Additionally, the greater balance we observed in the use of the different sequences at the end of training could be indicative of the students combining internal and external resources more.

As regards the **type of internal support** used (automatised and non-automatised), our analysis of the results we obtained led to the following findings:

1. Low level of use of automatised internal support and predominance of non-automatised cognitive resources at every stage of TCA. There is little automatisation in the students' solution of translation problems.

2. Mixed evolution in the use of automatised internal support and non-automatised internal support. The use of automatised processes and the mobilisation of cognitive resources to solve translation problems appear to fluctuate as the internal and external resources available thanks to training are adjusted.

3. Greater acceptability with automatised internal support. Acceptability is better with automatised internal support, on the few occasions it is used, than with non-automatised internal support in every group except the graduates, whose acceptability scores with both types of internal support are more balanced. It seems that while few subjects use automatised internal support to solve translation problems, those who actually do so are capable of solving them acceptably. In any case, given that the number of subjects involved is very small, as indicated previously, our results cannot be deemed conclusive.

4. Shortcomings compared to the professional translators. In every year and upon completion of training, the subjects' level of automatised internal support is much lower than that of the translators. The students' level of use of automatised internal support is very low. In our TC experiment we saw that the translators use automatised internal support more than twice as much as non-automatised internal support, and there is thus a higher level of automatised internal support in their translation process. It appears that, due to their experience in translation, they encounter fewer difficulties and solve them without cognitive effort. Upon completing their training, the graduates use automatised internal support far less than the translators.

Where acceptability is concerned, the graduates' results are poorer than those of the translators when using non-automatised internal support. In our TC experiment we saw that the translators achieve better results with non-automatised internal support than with automatised internal support; in other words, using cognitive resources leads them

to more appropriate solutions. The graduates' acceptability scores are similar with both types of internal support, putting them a long way behind the translators in the case of non-automatised internal support and on a par with them in that of automatised internal support. The graduates appear to have less of the cognitive baggage that makes it possible to mobilise knowledge and reflect in order to improve acceptability than the translators.

5. Influence of training. Following a term-long translation subject, there is a sharp fall in automatisation and an increase in cognitive resource mobilisation between the first and second years, probably due to training leading to the acquisition of cognitive resources that make students aware of translation problems.

The first-year students have a relatively high level of automatisation, but also the lowest acceptability value of all the groups. Their level of automatisation can be attributed to their lack of experience and, thus, of cognitive resources they can apply to identify and solve translation problems, resulting in a lower degree of cognitive effort being required. Automatisation owing to such shortcomings decreases as the students acquire TC. Their level of automatisation subsequently rises again due to them being able to identify and solve translation problems with greater ease, entailing a lower degree of cognitive effort, which, in this case, is a consequence of having built up experience in translation.

As far as the use of **automatised and non-automatised processes** is concerned, we observed the same trends as in our comparison of the use of automatised internal support and non-automatised internal support, albeit with more extreme values.

1. Very low level of use of automatised processes. According to our results, at every stage of TCA automatised processes are used to solve translation problems only rarely, and less frequently than among the professional translators.

2. Different type of evolution depending on process type. While the use of automatised internal support and that of non-automatised internal support undergo mixed evolution, the use of non-automatised processes undergoes rising evolution. In other words, when the subjects use different types of sequences, which encompass different types of knowledge and internal and external support strategies, there appears to be an increase in such knowledge and strategies as TCA advances.

3. Increasing acceptability in the use of non-automatised processes. In our comparison of the use of automatised internal support and that of the other sequences of actions, we observed that, in general, the acceptability achieved using non-automatised processes rises as TCA advances, reaching a level similar to that of the professional translators.

4. Shortcomings compared to the professional translators. The graduates use automatised processes far less than the translators. It is important to emphasise that the graduates and all the year groups use automatised processes to solve translation problems much less frequently than the professionals. Solving such problems entails a greater cognitive effort for them, and their ability to solve them and the ease and effectiveness with which they do so are limited in comparison to the professionals, who seek out solutions in a much more automatised fashion. In any case, as already stated, the very small number of subjects involved means that our results cannot be generalised.

The data we obtained in our TCA experiment show that the students make much less use of internal support and automatised processes, and far more of simple external support and predominantly external support, than the professional translators from our TC experiment. The students' acceptability results are lower than those of the translators

with internal support and predominantly internal support, but higher with simple external support and predominantly external support. As mentioned previously, the students mainly used electronic resources to perform searches.

It should be stressed that we collected our TC experiment data between October 2005 and March 2006. Between then and 2011, ICTs and documentation resources became more widely used in translation, with the appearance of new tools and resources offering greater accessibility, quality (greater contextualisation) and efficacy (being faster, easier to browse and more user-friendly), and took on a more significant role in training. Furthermore, the younger generations are more familiar with ICTs. The factors in question may have influenced the results we obtained in our TCA experiment in comparison to the data from our TC experiment.

6. Translation competence acquisition. Efficacy of the translation process

This article presents our results for the efficacy of the translation process variable in PACTE's experiment on translation competence acquisition (TCA). We define this variable as the relationship between the time taken to complete a translation task, its distribution between stages, and solution acceptability. Efficacy of the translation process is one of the experiment's variables that provide information on the acquisition of the strategic sub-competence. We consider translation process efficacy to entail an optimal relationship between solution acceptability and time, i.e. achieving maximum acceptability in minimum time. Our initial premise was that students need less time to come up with acceptable solutions as TCA advances. We begin the article by defining efficacy in the translation process and then describe how we conducted our analysis. We subsequently set out our results, according to which, as translation competence is acquired, there are fluctuations in the time taken to translate and its distribution between stages, as well as in the behaviour of each group's most efficient subjects. Nonetheless, a comparison of the different groups' mean time and acceptability values shows that translation process efficacy appears to increase little by little as TCA takes place, albeit without reaching the level of the professional translators.

The experiment was conducted in November 2011, when our first-year subjects had just begun their degree course; the graduates had completed their studies in June 2011.

Keywords: translation competence acquisition; translation acceptability; time taken; efficacy of the translation process; strategic sub-competence

6.1. Introduction

In this article we present our results for efficacy of the translation process, a dependent study variable in PACTE's experiment on translation competence acquisition (TCA).²⁷

We consider translation process efficacy to entail an optimal relationship between solution acceptability and time, i.e. achieving maximum acceptability in minimum time. We started out with the premise that coming up with acceptable solutions ought to take less time as translation competence (TC) is acquired. The efficacy of the translation process variable provides information on the acquisition of the strategic sub-competence, the functions of which include planning translation processes and guaranteeing their efficacy (PACTE 2003, 2017a).

In our previous research on TC, we validated our empirical hypothesis that *there is a relationship between the degree of TC and the efficacy of the translation process*. In our research on TCA we added three operational hypotheses concerning differences between levels of TCA in the time taken to perform a translation, the distribution of that time in stages, and the relationship between the time taken and solution acceptability (see Table 6.1).

The variable's indicators are:

27. For an extended version of this variable's results, including both direct and inverse translation, see PACTE in press a.

- (16) Total time taken: the total amount of time spent performing the translation task.
- (17) Time taken at each stage: the distribution of the total time taken between three stages (based on the distinction made in Jakobsen 2002), namely orientation (from receiving the text to beginning to translate it), development (from beginning to write to reaching the end of the text) and revision (from reaching the end of the text to the point at which the translation task is deemed completed and the document closed).
- (18) Acceptability: translation product quality.

For data collection, we used *Camtasia* to record the subjects' actions while they were translating the text, and subsequently studied our recordings to see how much time they had taken and how it was distributed. Additionally, we analysed the subjects' translations to determine their acceptability. Each group's subjects all began working at the same time. While we recommended they spend approximately an hour on their translations, we allowed them as much time as they needed to complete the task. Our recommendation may have influenced the maximum time taken, but not the minimum time or the distribution of time between stages.

Table 6.1. Efficacy of the translation process variable

EFFICACY OF THE TRANSLATION PROCESS	
Related to the strategic sub-competence	
Objective	To collect data on time organisation and distribution when carrying out a translation task, and on the relationship between the time taken and acceptability.
Definition	The relationship between the time taken to complete a translation task, its distribution between stages, and the acceptability of solutions.
Hypotheses	<p>Empirical hypothesis:</p> <p>There is a relationship between the degree of TC and the efficacy of the translation process.</p> <p>Operational hypotheses:</p> <ol style="list-style-type: none"> 1. Differences can be observed between levels of TCA in relation to the time taken. 2. Differences can be observed between levels of TCA in relation to the distribution between stages of the time taken.

	3. Differences can be observed between levels of TCA in relation to the time taken and the acceptability of results.
Indicators	<ul style="list-style-type: none"> - Total time taken. Numerical indicator; values: minutes. - Time taken at each stage (orientation, development, revision). Numerical indicator; values: minutes (absolute time) and percentages (relative time). Acceptability. Numerical indicator; values: 0 to 1.
Instruments and tools	Translations and screen recordings.
Sources of data	Total time taken; time taken at each stage; acceptability.

6.2. Measurement of the indicators

As in the case of the experiment's other variables, we analysed the differences between groups on the basis of their respective mean values, established an evolution typology (non-evolution, rising evolution, falling evolution and mixed evolution), and described progression between the first year and the graduates. See section 1.4.4 for definitions of the various types of evolution and details of the values on which our descriptions of differences between groups and progression are based.

6.2.1. Total time taken

We expressed our measurement of the total time taken to translate the text (a quantitative indicator) not only in hours and minutes but also as a percentage of the maximum time spent on the task. As the second-year students were the group that took the longest to complete the translation, we used their mean time of 62 minutes as the maximum time on the basis of which we calculated each group's percentage.

We used both the mean times in hours and minutes and the percentages to compare the first-year group and the graduates. Being standardised on a scale of 0 to 100, the percentages allowed us to apply the criteria we had established for describing types of evolution. When comparing between groups we considered a difference of under 5 points to represent no difference; 5 to 9 points a slight difference; 10 to 19 points a substantial difference; 20 to 29 points a very substantial difference; and 30

points or over an extremely substantial difference. For describing the progression that occurs between the first year and the graduates, we considered a difference between the corresponding groups of 20 to 29 points to constitute progression; under 10 points no progression; 10 to 19 points little progression; and 30 points or over major progression.

We used only the mean times in hours and minutes to compare the graduates and the translators. We did not calculate percentages for the translators as their maximum time (71 minutes) was not the same as that of the students. This would have affected the process of conversion to percentages, which we would have had to calculate using a different scale, thus ruling out comparisons.

We based the statistical tests we performed to detect differences between groups on the mean times in hours and minutes. This enabled us to extrapolate the results of the tests to the percentages in the case of differences between the groups of students (as the conversion to percentages was based on the same maximum time of 62 minutes), but not to draw comparisons with the translators, for whom we did not calculate percentages, as explained above.

6.2.2. Time taken at each stage

We divided the translation process into the stages of orientation, development and revision, and measured the time taken at each of them. We calculated the time corresponding to each stage as a percentage of the total time taken by each group.

In the case of this indicator, owing to each group having more than one mean value due to the total time taken being distributed between three stages, the numerical criteria we used to measure differences between groups were not the same as those we applied to the previous indicator. Specifically, we calculated the five groups' overall mean for each stage and took 10% of that mean as the basis for describing differences between groups. For example, the overall mean percentage of time the five groups

spend on the orientation stage is 6.9, 10% of which is 0.7 (rounded up). We thus consider this figure (0.7) to represent a substantial difference between groups, and then half the figure (0.4; rounded up) a slight difference, twice the figure (1.4) a very substantial difference, and three times the figure (2.1) an extremely substantial difference.

We did not analyse progression between the first year and the graduates for this indicator. As the total time is distributed between three stages, considering the progression reflected by a single set of results in isolation would be pointless because the three sets of results balance each other out. We decided against performing statistical tests for the same reason.

6.2.3. Acceptability

In our analysis of the acceptability of the subjects' translations, we focused on rich points (RPs), i.e. specific source text segments containing prototypical translation problems (see section 1.4.1 and appendix 2 for a description of the RPs we selected), and followed the same procedures as in our TC experiment (see article 2 for details of our measurement of and results on acceptability).

To analyse translation process efficacy, we examined the relationship between acceptability and the time taken from a descriptive perspective and, using correlations, from a statistical perspective. We obtained information on the nature of the relationship between the two indicators within each group through the correlations, and a general insight into their relationship among the groups through our descriptive analysis.

We calculated correlation coefficients to find out whether the total time taken and acceptability were associated in any way. As in our TC experiment, we deemed bringing the results we obtained for the acceptability and time taken at each stage together to be methodologically inappropriate due to each stage's standard deviation

being high, indicating numerous individual differences between subjects. Furthermore, we had already identified trends in the relationship between time and acceptability through our results on the association between the total time taken and acceptability.

6.3. Results

Our analysis of translation process efficacy is based on 119 students and the 35 professional translators from our TC experiment. For the time-related indicators, with 10 *Camtasia* recordings of students proving unusable, the number of valid subjects by group was 22 for the first year, 24 for the second, 27 for the third, 28 for the fourth, and 18 for the graduates. In the case of acceptability, the total number of valid subjects was 128, comprising 23 for the first year, 25 for the second, 28 for the third, 30 for the fourth, and 22 for the graduates.

When presenting our results, we show standard deviation in brackets. While we performed statistical tests to determine the difference between every pair of consecutive groups (except in the case of the time taken at each stage), we omit statistically non-significant differences. The significance level we established was 0.05. See appendix 5 for the results of all our statistical tests.

6.3.1. Total time taken

Our results for this indicator consist of the mean total time each group spent on the translation, expressed in hours and minutes and as a percentage of the maximum time taken to perform the task (Table 6.2). As mentioned previously, we did not calculate percentages for the professional translators due to their maximum time being different from that of the students.

Table 6.2. Mean total time taken, in hh:mm format and as a percentage

	hh:mm	%
1 st year	00:50 (00:13)	80.65%
2 nd year	01:02 (00:05)	100.00%
3 rd year	00:56 (00:08)	90.32%
4 th year	00:47 (00:12)	75.80%
Graduates	00:58 (00:08)	93.55%
Translators	00:48 (00:12)	-

According to our results:

- Based on the percentages, mixed evolution takes place, with a very substantial rise between the first and second years ($U = 120.5$, $p < 0.001$, Bonferroni corrected, $r = 0.54$), a slight fall between the second and third years, a substantial fall between the third and fourth years, and a substantial rise between the fourth year and the graduates ($U = 102.5$, $p < 0.001$, Bonferroni corrected, $r = 0.60$).
- The groups that work fastest are the first and fourth-year students. The second-year students have the highest mean time value.
- Little progression occurs between the first year and the graduates (12.9). The graduates take slightly more time than the first-year students.
- The graduates spend more time on the task than the translators. The difference between the two groups is statistically significant ($U = 153.5$, $p < 0.001$, one-tailed, $r = 0.51$).

6.3.2. Time taken at each stage

As stated in section 6.2.2, we did not analyse progression between the first year and the graduates for this indicator. Table 6.3 shows the mean time each group spent on each

stage, expressed in minutes and as percentages.²⁸

Table 6.3. Mean time taken at each stage, in minutes and percentages

	Orientation		Development		Revision		
	1 st	3	6.	3	72	1	20
year		.09 (2.39)	4% (4.0%)	6.36 (13.26)	.7% (12.8%)	0.18 (7.06)	.9% (13.5%)
	2 nd	4	7.	4	77	9.	15
year		.63 (5.63)	4% (8.7%)	8.04 (9.45)	.3% (12.7%)	42 (5.98)	.3% (9.6%)
	3 rd	4	8.	3	61	1	29
year		.74 (2.64)	5% (5.1%)	5.22 (11.78)	.6% (15.2%)	6.33 (6.97)	.9% (14.2%)
	4 th	1	3.	3	66	1	29
year		.86 (2.32)	8% (3.9%)	1.43 (10.57)	.5% (14.6%)	4.07 (8.12)	.7% (15.3%)
	Gradu	4	8.	3	63	1	28
ates		.94 (2.46)	4% (3.4%)	6.50 (7.82)	.1% (12.2%)	6.78 (8.02)	.5% (12.4%)
	Transl	4	8.	2	52	1	38
ators		.57 (5.22)	8% (8.2%)	5.48 (11.95)	.8% (18.9%)	8.23 (10.28)	.4% (19.6%)

In terms of stage distribution, the data we obtained show the following:

- Orientation. After rising until the third year, the time spent on this stage falls sharply in the fourth. Orientation is the stage with the greatest number of substantial differences between consecutive groups, and also the one with the smallest difference between the graduates' value and that of the translators.

28. The values we established for each stage are specified below. Orientation: mean, 6.9; slight difference, 0.4 (rounded up); substantial difference, 0.7 (rounded up); very substantial difference, 1.4; extremely substantial difference, 2.1. Development: mean, 68.2; slight difference, 3.4; substantial difference, 6.8 (rounded down); very substantial difference, 13.6; extremely substantial difference, 20.4. Revision: mean, 24.9; slight difference, 1.3 (rounded up); substantial difference, 2.5 (rounded up); very substantial difference, 5; extremely substantial difference, 7.5.

- Development. The first and second-year students are the groups that spend the longest on this stage. All the groups of students devote more time than the translators to development.
- Revision. The second-year students are the group that spends least time on this stage. None of the groups of students devotes as much time to revision as the translators.

Development is the stage on which every group spends the most time, followed by revision and then orientation, mirroring the patterns we saw in our TC experiment.

The evolution of the time spent on each stage is mixed in every case:

- Orientation. The mixed evolution that takes place here involves a substantial rise between the first and second years, another between the second and third years, an extremely substantial fall between the third and fourth years, and an extremely substantial rise between the fourth year and the graduates. There is a slight rise between the graduates and the translators.
- Development. The mixed evolution that takes place here involves a slight rise between the first and second years, a very substantial fall between the second and third years, a slight rise between the third and fourth years, and a slight fall between the fourth year and the graduates. There is a substantial fall between the graduates and the translators.
- Revision. The mixed evolution that takes place here involves a very substantial fall between the first and second years, an extremely substantial rise between the second and third years, and a slight fall between the fourth year and the graduates. There is an extremely substantial rise between the graduates and the translators.

The differences between the graduates' values and those of the translators are greatest in the development and revision stages, on which, compared to the professionals, the graduates spend more time and much less time respectively.

6.3.3. Total time taken and acceptability

Here, we describe the relationship between the total time taken and acceptability, based on the results we obtained.

Acceptability. Our results for translation acceptability are as shown in Table 6.4 (see section 2.3).

Table 6.4. Acceptability by group

	Mean
1 st year	0.45 (0.19)
2 nd year	0.59 (0.24)
3 rd year	0.63 (0.18)
4 th year	0.65 (0.17)
Graduates	0.70 (0.18)
Translators	0.73 (0.20)

According to our results, acceptability undergoes rising evolution. The level of acceptability starts increasing in the second year and subsequently climbs steadily until the graduate stage.

Relationship based on each group's mean values. While rising evolution takes place in the case of translation acceptability, the total time taken undergoes mixed evolution.

Analysing the relationship between time and acceptability on the basis of each group's mean values shows the following:

1. The nature of the relationship in question differs from group to group:

- The first-year students translate quickly, but are the group with the lowest level of acceptability.
- The second-year students spend more time on the task than any other group, but do not solve the translation problems well.
- There is a reduction in the time taken in the third year, but acceptability does not increase very much.
- The fourth-year students take the least time to translate the text and their acceptability results are good, entailing a higher level of translation process efficacy than the previous groups.
- The graduates outscore the other groups in terms of acceptability, although they take a lot longer to translate the text than the fourth-year students.

2. Progression between the first year and the graduates. There is no reduction in the time taken to translate. The graduates actually spend longer on the task than the first-year students, but achieve a higher level of acceptability.

3. Comparison between the graduates and the translators. The graduates take more time to translate than the professionals. The two groups' values are closer in the case of acceptability, however.

Correlations. We calculated Spearman correlation coefficients to see if there is any kind of association between the total time taken and translation acceptability (Table 6.5).

Table 6.5. Spearman's correlation coefficients between total time taken and acceptability

	r_s
1 st year	0.41

2 nd year	-0.39
3 rd year	-0.07
4 th year	0.40
Graduates	-0.54
Translators	-0.28

We found the following moderate correlations between time and acceptability:

- First year: a positive correlation.
- Second year: a negative correlation.
- Fourth year: a positive correlation.
- Graduates: a negative correlation, with the highest Spearman correlation coefficient calculated.

In summary, there is a *positive* correlation (more time, greater acceptability) in the first and fourth years, a *negative* correlation (less time, greater acceptability) in the second year and in the case of the graduates, and no correlation at all in the third year. It should be noted that, in keeping with our initial premise, a *negative* correlation is the ideal result as far as translation process efficacy in TCA is concerned.

6.4. Conclusions

As stated in the introduction to this article, the efficacy of the translation process variable provides data on the strategic sub-competence, the functions of which, in PACTE'S TC model (PACTE 2003, 2017a), include planning translation processes and guaranteeing their efficacy.

The empirical hypothesis on which we based our research on this variable is that *there is a relationship between the degree of TC and the efficacy of the translation process*. In our TC experiment, we observed greater translation process efficacy among the group of translators than among the group of language teachers, with the former

achieving a better acceptability value despite the two groups spending a similar amount of time on the task (PACTE 2017j).

The data we obtained in our TCA experiment show differences in translation process efficacy at each level of the TCA process, and thus appear to support our empirical hypothesis. They also seem to support most of our operational hypotheses, given that we observed differences between levels of TCA in relation to the time taken and its distribution between stages. Our hypothesis regarding the relationship between time and acceptability has only been partially confirmed, however. Our premise that coming up with acceptable solutions should take less time as TC is acquired was not borne out in our study, although we did identify groups in which acceptability is higher when less time is taken.

With regard to the **time taken and its distribution between stages**, our results lead to the following conclusions:

1. Predominance of the development stage. Development is the stage on which each group spends the most time, followed by revision and then orientation, mirroring the behaviour of the professional translators in our TC experiment. The stage with the greatest number of changes between consecutive groups is orientation; it thus seems that adjustments are made as TCA advances.

2. Mixed evolution. The total time spent on the translation process undergoes mixed evolution, apparently changing as the students' ability to identify problems improves and the range of internal resources (i.e. cognitive resources: linguistic and extralinguistic knowledge, knowledge of translation, cognitive strategies) and external resources they can use to solve them grows.

The time spent on each stage of the translation process undergoes mixed evolution too. This points to the distribution of time between the three stages being

adjusted as students acquire TC, become more capable of identifying translation problems and obtain more resources for solving them.

3. No progression between the first year and the graduates in terms of the time taken to translate. The graduates actually take longer to perform the task than the novices.

4. Need for more time to translate upon completion of training. The graduates take longer to translate than the fourth-year students, probably due to their greater experience of translating making them more aware of quality requirements.

5. Distance between the graduates and the professional translators. The graduates take longer to perform the translation task than the professionals.

In terms of the time devoted to each stage of the translation process, the graduates, like the rest of the students, spend more time on development and less on revision than the translators. The fact that they spend longer on development than the professionals can be attributed to them requiring more time to solve problems and produce a translation. They may consider revision less important due to a lower level of concern for the quality of their end product and to having needed to exert themselves more in the development stage. Additionally, every group of students devotes less time to orientation than the professionals.

The difference between the graduates' values and those of the translators is at its greatest in the revision stage.

6. Influence of training. The students' introduction to the practice of translating seemingly results in an increase in the time they take to translate. The increase occurs in the second year, by which point they have studied a single-semester introductory subject on direct translation. Their experience of translating appears to heighten their awareness of translation problems, which they take longer to solve because they still lack sufficient

(internal and external) resources. There is a reduction in the time taken between the second and third years, probably because the students have more translation experience under their belt by then, enabling them to use a wider range of resources more adeptly and, thus, to solve translation problems faster.

Analysing **translation process efficacy** in TCA, based on the relationship between the time taken to translate and solution acceptability, shows the following (PACTE in press a).

1. Differences between groups based on their respective mean time and acceptability values: translation process efficacy in each group. Translation process efficacy appears to increase as TC is acquired. There are differences between groups and they may be linked to the assimilation of internal and external resources as TCA advances.

As the group with the second fastest time, the first-year students translate quickly. They are also the group with the lowest acceptability score, however, and their level of translation process efficacy thus seems very low.

The second-year students are the group that takes the most time to perform the task. The single-semester introductory subject on direct translation they have studied appears to enable them to identify translation problems and increase their concern for target text quality. However, despite the amount of time they take, they fail to come up with good solutions, probably because they still lack some of the resources necessary to solve such problems. Even so, there seems to be a certain degree of translation process efficacy, given that the level of acceptability is higher than in the first year.

While the time taken drops in the third year, acceptability rises very little, indicating a lack of progress in terms of translation process efficacy.

The fourth-year students are the group that performs the task fastest and comes closest to matching the speed of the professional translators. Translation process efficacy is thus greater at this stage of training, as the students not only work faster but also score well in terms of acceptability. They are, seemingly, the most efficient of the groups.

The graduates take considerably more time than the fourth-year students, with just a small rise in acceptability to show for it. Translation process efficacy does not seem to improve between the fourth year and the graduate stage, although the graduates' mean acceptability value is the highest of all the groups.

2. Differences *within* each group based on time and acceptability (correlations): the most efficient subjects in each group. We found a moderate correlation between the time taken and acceptability in every group except the third year, being *positive* (more time, greater acceptability) in the first and fourth years and *negative* (less time, greater acceptability) in the second year and among the graduates. This alternating occurrence of positive and negative correlations might be linked to the mixed evolution of the total time taken at the different levels of TCA. It shows that the relationship between time and acceptability alters, probably as the subjects' ability to identify translation problems improves and the range of resources they can use to solve them grows.

In the first year, the students who spend longer on the task obtain more acceptable solutions. The subjects require more time to solve translation problems acceptably at this stage of training.

In the second year, in direct contrast to the first, it is the students who take less time to translate who come up with more acceptable solutions.

There is no correlation between time and acceptability in the third year.

In the fourth year, the students who take longer to perform the task obtain more acceptable solutions. It is probably the case that they can call upon a greater number of resources and are more aware of both translation problems and quality requirements, resulting in them devoting more time to their work.

Upon completing their training, the graduates who spend less time translating obtain more acceptable solutions. While the correlation remains moderate, their coefficient is higher than not only those of the other groups of students but also that of the professional translators. The graduates' results are probably attributable to them having a greater range of resources at their disposal and being able to use them faster to find acceptable solutions.

3. Low level of progression between the first year and the graduates. Progression takes place in the case of acceptability, given that it increases, but not in that of the time taken to translate. Translation process efficacy therefore appears to rise only a little.

4. Low level of translation process efficacy upon completion of training. Acceptability rises at the end of training, reaching its peak among the graduates, but the time taken to translate increases too. The graduates apparently still need longer to find better solutions to translation problems.

5. Distance between the graduates and the professional translators. The two groups' acceptability values are similar, but the graduates spend more time on the task than the translators. Their level of translation process efficacy is thus lower than that of the professionals.

6. Influence of training. The slight increase in translation process efficacy which, from a descriptive perspective, appears to occur between the groups as TCA advances can be attributed to the subjects' training. The same applies to the moderate negative correlation between time and acceptability among the graduates (a certain tendency to

achieve greater acceptability when taking less time to translate, although there is considerable variation between the group's individual subjects), whose correlation coefficient is higher than that of any other group. In any case, while training seems to be a factor in acceptability rising, it does not appear to improve the speed with which subjects come up with acceptable solutions.

The statistically significant substantial rise in the total time taken between the first and second years is also likely to be due to the training received by the students, specifically a semester-long introductory translation subject in the first year.

Our results for this variable highlight the fluctuation that takes place in the TCA process where the time taken to translate and its distribution in stages are concerned, as well as in the case of the correlation between time and acceptability, with positive and negative correlations alternating as TCA advances. Nonetheless, we have seen, on the basis of the groups' respective mean time and acceptability values, that translation process efficacy increases as TC is acquired, albeit only slightly and without reaching the same level as the professional translators upon completion of training.

The results we obtained do not bear out our premise that greater acceptability ought to be achieved in less time as TCA advances, as there is steady improvement in the level of acceptability but not in the time taken to find acceptable solutions. Our results show that the relationship between time and acceptability is not purely binary (effective vs ineffective), but rather that there are different degrees and combinations of efficacy to distinguish between. Further studies are necessary to analyse the relationship in question in greater depth.

It should be stressed that our TCA experiment's conditions could have influenced our analysis of the total time taken indicator, in that we recommended that

the subjects spend an hour on the translation task, although we allowed them as much time as they needed to complete their work. In any case, as mentioned in the introduction to this article, our recommendation could only have influenced the maximum time taken, not the minimum time or the distribution of time between stages. The possibility of the subjects' use of time being affected by their individual traits (psycho-physiological components in PACTE's TC model), in particular their ability to perform tasks quickly, must also be borne in mind.

7. Translation competence acquisition. Use of instrumental resources

This article focuses on the use of instrumental resources variable in PACTE's experimental study of translation competence acquisition (TCA). Defined as documentation strategies used when consulting resources in electronic format, the variable provides data on the acquisition of the instrumental sub-competence from PACTE's (2003) translation competence (TC) model. Its indicators are the total time spent on searches, the time spent on searches at each stage, the variety of resources used, and the number and the variety of searches performed. We firstly describe the variable's characteristics and indicators, and then present our data collection procedure and measurements. According to our results, throughout TCA there are no major changes in the time spent on searches, the variety of resources used or the number of searches performed. As the process advances, however, the distribution between stages of the time spent on searches evolves, tending towards greater balance at the end of training, and the variety of searches performed increases. While we found no statistical correlation with translation acceptability in any of the groups, our descriptive analysis showed that the subjects seem to use external resources more effectively as they acquire TC, although this could be due to other factors.

The experiment was conducted in November 2011, when our first-year subjects had just begun their degree course; the graduates had completed their studies in June 2011.

Keywords: translation competence acquisition; documentation strategies; electronic resources; instrumental sub-competence

7.1. Introduction

In this article we present our results for the use of instrumental resources variable in PACTE's experiment on translation competence acquisition (TCA).²⁹ We define the variable in question as documentation strategies used when consulting resources in electronic format (websites, dictionaries and encyclopaedias on CD-ROM, etc.). Our analysis focuses on resources used in non-specialised translation, and therefore does not include other aspects of the instrumental sub-competence, such as computer-assisted translation resources, machine translation (except in cases of Google Translate being used to search for equivalents in two languages), terminology database management programs or post-editing programs (see Table 7.1).

The variable provides data on the acquisition of the instrumental sub-competence from PACTE's (2003) translation competence (TC) model. We studied it with a view to collecting information on the time spent performing searches and its distribution between the stages of the translation process (orientation, development and revision), the variety of resources used, and the number and variety of searches performed, at each level of TCA. The variable also provides complementary data on the use of external support in the decision-making process (see article 5) and on the total time taken to complete the translation task (see article 6).

In our previous research on TC, we validated our empirical hypothesis that *there is a relationship between the degree of TC and the use of external resources* (Kuznik 2017a). In our research on TCA we added five operational hypotheses (see Table 7.1) concerning differences between levels of TCA in relation to the variety of types of

29. An initial version of our analysis of this variable for both direct and inverse translation has been published in Kuznik and Olalla-Soler (2018).

resources used, the number and variety of searches performed, and the time spent on searches.

The variable's indicators are:

- (19) Total time spent on searches: the total time spent performing searches to solve translation problems.
- (20) Time spent on searches at each stage: the distribution of the time spent performing searches to solve translation problems between the three stages of the translation process (based on the distinction made in Jakobsen 2002), i.e. orientation (from receiving the text to beginning to translate it), development (from beginning to write to reaching the end of the text) and revision (from reaching the end of the text to the point at which the translation task is deemed completed and the document closed).
- (21) Variety of resources: the variety of types of resources used to solve translation problems.³⁰
- (22) Number of searches: the number of searches performed to solve translation problems.
- (23) Variety of searches: the variety of types of searches performed to solve translation problems.

We brought our results for most of the above indicators together with those we obtained for translation acceptability.

As we did in our TC experiment, we collected data for this variable by focusing on selected rich points (RPs), i.e. specific source text segments containing prototypical

30. This indicator is called 'number of resources' in Kuznik (2017a) and Kuznik and Olalla-Soler (2018).

translation problems (see section 1.4.1), in each text to be translated. We used *Camtasia* to record the subjects' actions as they translated, and then analysed the recordings to obtain the following data: (1) the stage in which each search was performed; (2) the time spent (start/end) on each search; (3) the category of each resource used; and (4) the variety of resources used (which provided information on the variety of searches performed). We established a database with an entry corresponding to each search performed by each subject for each RP. In total, we registered 1425 searches.

Table 7.1. Use of instrumental resources variable

USE OF INSTRUMENTAL RESOURCES Related to the instrumental sub-competence	
Objective	To collect data on the use of resources in electronic format when carrying out a translation task.
Definition	Documentation strategies used when consulting resources in electronic format (websites, dictionaries and encyclopaedias on CD-ROM, etc.).
Hypotheses	Empirical hypothesis: There is a relationship between the degree of TC and the use of external resources. Operational hypotheses: 1. Differences can be observed between levels of TCA in relation to the time spent on searches. 2. Differences can be observed between levels of TCA in relation to the distribution between stages of the time spent on searches. 3. Differences can be observed between levels of TCA in relation to the variety of resources consulted. 4. Differences can be observed between levels of TCA in relation to the number of searches performed. 5. Differences can be observed between levels of TCA in relation to the variety of searches performed.
Indicators	- Total time spent on searches. Numerical indicator; values: minutes. - Time spent on searches at each stage (orientation, development, revision). Numerical indicator; values: minutes and percentages. - Variety of resources. Categorical indicator: eight categories. - Number of searches. Numerical indicator; values: number of searches. - Variety of searches. Categorical indicator measured in two steps. Step one: 13 categories. Step two: five categories. Acceptability. Numerical indicator; values: 0 to 1.
Instruments and tools	Translations, screen recordings.
Sources of data	Types of resources; search duration (from start to finish); stage in which each search is performed; number of searches; types of searches; acceptability.

7.2. Measurement of the indicators

We measured this variable's indicators in the same way as in our TC experiment (Kuznik 2017a).

Additionally, as we did with our TCA experiment's other variables, we analysed differences between groups on the basis of their respective mean values and, for most of the variable's indicators, established an evolution typology (non-evolution, rising evolution, falling evolution and mixed evolution) and described the progression that occurs between the first year and the graduates. For description purposes, when comparing between groups we considered a difference of under 5 points to represent no difference; 5 to 9 points a slight difference; 10 to 19 points a substantial difference; 20 to 29 points a very substantial difference; and 30 points or over an extremely substantial difference. When describing progression between the first year and the graduates, we considered a difference of between 20 and 29 points to represent progression; under 10 points no progression; between 10 and 19 points little progression; and 30 points or over major progression. See section 1.4.4 for definitions of the various types of *evolution*.

For most of the variable's indicators, we brought the mean values we obtained together with our translation acceptability results and examined them jointly from both a descriptive perspective and, using correlations, a statistical perspective. See article 2 for details of our measurement of and results for translation acceptability.

7.2.1. Total time spent on searches

The time spent on searches is part of the total time taken to complete the translation task, which we measured in our analysis of the efficacy of the translation process variable (see article 6). We measured the time spent on searches by adding up the amount of time in minutes each subject devoted to each search they performed to find solutions to RPs, and then calculated each group's mean value.

To analyse differences between groups, we converted the time spent on searches from minutes to percentages so as to obtain a standardised range of 0-100 (relative time

spent on searches). The percentages represent the time spent on searches as a proportion of the total time taken to perform the translation task.

7.2.2. Time spent on searches at each stage

We obtained data for this indicator by recording the amount of time spent on each search and the stage at which it was performed. We then calculated the total amount of time spent on searches at each stage as a proportion of the total time spent on searches.

For this indicator, the numerical criteria we applied to measure differences between groups were not the same as in other cases, owing to the division of the total percentage between three categories (orientation, development and revision). For each category, we calculated the five groups' overall mean percentage and took 10% of it as the basis for describing differences between groups. For instance, the five groups' overall mean percentage for orientation is 3.3, 10% of which is 0.3 (rounded down). We deem this figure (0.3) to represent a substantial difference between groups, half the figure (0.2; rounded up) a slight difference, twice the figure (0.6) a very substantial difference, and three times the figure (0.9) an extremely substantial difference. The overall mean values for development and revision are 78.2 and 18.6 respectively.

We did not calculate progression between the first year and the graduates for this indicator. With the percentage being distributed between three categories, there would be little point in considering the progression reflected by any single set of results in isolation, as the three sets of results balance each other out.

From a statistical perspective, and as was the case in our TC experiment, we felt it would be methodologically inappropriate to correlate the results we obtained for the acceptability and time spent on searches at each stage indicators due to each stage's high standard deviation, indicating many individual differences between subjects.

Furthermore, our descriptive analysis of the relationship between the total time spent on

searches and acceptability indicators had already revealed certain trends in the relationship between the time devoted to searching and translation acceptability.

7.2.3. *Variety of resources*

In our TC experiment, after viewing our *Camtasia* recordings, we categorised the types of electronic resources the subjects had consulted as follows:

- (24) Search engines (chiefly Google).
- (25) Bilingual dictionaries (Larousse, WordReference, OneLook, Lexilogos, Foreignword, etc.).
- (26) Monolingual dictionaries (Diccionario de la Real Academia Española, Oxford Dictionary, Trésor de la Langue Française, Petit Robert, Duden, Slabý, etc.).
- (27) Dictionaries of synonyms (WordReference, Linguee, etc.).
- (28) Encyclopaedias (Britannica, Enciclopedia Universal Larousse, Encyclopaedia Universalis, Enciclopèdia Catalana, Wikipedia, etc.).
- (29) Databases (Termcat, Eurodicautom, Grand Dictionnaire Terminologique, etc.).
- (30) Corpora (RAE, Collins, Google used as a corpus, etc.).
- (31) Specialised or field-specific portals (mainly sources of news items, tourist information, or information on viruses related to the subject of the texts to be translated).

Using the same categories, in our TCA experiment we counted the number of types of electronic resources each subject consulted to solve RPs, and then calculated the mean number of types of resources each group used.

To analyse differences between groups, we converted each mean to a percentage, taking the maximum number of types of resources (eight) as a basis for conversion. We thus obtained a comparable value within a standardised range of 0-100

for each group. We could not perform the same calculation for the group of professional translators since we measured this indicator differently in our TC experiment, where, rather than counting the number of types of resources each subject used, we counted the number of times each subject used resources, regardless of the type involved, so the maximum value was higher than eight (Kuznik 2017a, 225-226). We were therefore unable to compare the students and the translators on the basis of mean values or percentages.

7.2.4. Number of searches

To measure this indicator, we counted the number of searches the subjects performed to find solutions to RPs. We could not calculate differences between consecutive groups because of the absence of a standardised maximum value for every group, which made converting the number of searches performed into values in a standardised range of 0-1 or 0-100 impossible. We therefore did not determine the type of evolution involved or progression between the first year and the graduates.

7.2.5. Variety of searches

As we did in our TC experiment, we measured this indicator in two steps, looking firstly at *types of searches* and then *combinations of types of searches*.

Step one: types of searches. We began by calculating the frequency of use of the following 13 types of searches,³¹ which we identified previously in our TC experiment (Kuznik 2017a, 223):

31. We established this catalogue on the basis of the types of searches subjects performed in our exploratory and pilot tests on TC (PACTE 2017k).

- (32) Searches using keywords. Searches performed via a search engine, regardless of the number of words entered at once and whether they are separated by spaces or Boolean connectors (+/-; AND, OR, NOT, etc.).
- (33) Exact searches. Searches performed using inverted commas to specify an exact search string.
- (34) Searches for equivalents. Searches for equivalent words performed using resources in both L1 and L2.
- (35) Searches for definitions. Searches for definitions of words performed using resources in only one language.
- (36) Searches for synonyms. Searches for synonyms of words performed using resources in the same language.
- (37) Searches in encyclopaedias for clarification. Searches performed, mainly in Wikipedia, to clarify polysemy.
- (38) Searches in context. Use of electronic corpora, or of search engines as corpora, to determine how to use or the frequency of use of words in context.
- (39) Searches on websites. Searches performed using CTRL+F to find information on a website.
- (40) Cache searches. Searches in which a cached page (a copy of a web page as it was when the search engine loaded it on a previous occasion) is used to obtain information.
- (41) Searches using preferred region. Searches performed using the 'Google Advanced Search - narrow your results by region' option.
- (42) Searches using preferred language. Searches performed using the 'Google Advanced Search - narrow your results by language' option.

- (43) Searches using preferred date. Searches performed using the ‘Google Advanced Search - narrow your results by last update’ option.
- (44) Searches followed by correction. Searches in which a solution suggested by the search engine (‘Search instead for...’) is accepted and used to correct the results of the initial search.

Using these categories, we counted the number of types of searches each subject performed to solve RPs, and then calculated the mean number of types of searches each group used.

To analyse differences between groups, we converted the mean number of types of searches each group performed to a percentage, taking the maximum number of types of searches (13) as a basis for conversion. We thus obtained a comparable value within a standardised range of 0-100 for each group.

Step two: combinations of types of searches. Secondly, we calculated the frequency, for each group, with which searches from the 13 categories described above were combined in the following five ways:³²

- (45) None: no searches of any type are performed.
- (46) Simple: searches of only one type are performed, e.g. searches using keywords, or searches for equivalents, or searches for definitions, etc.
- (47) Double: two types of searches are performed, e.g. searches using keywords + searches for definitions; or searches using keywords + exact searches; etc.

32. These five categories are specific to this variable. They are not the same as those we used to analyse data in the case of the decision-making variable, which are based on the main type of support used (internal or external) (see article 5).

- (48) Triple+:³³ three, four or five types of searches are performed, e.g. searches using keywords + exact searches + searches for equivalents; or searches using keywords + searches using preferred region + searches in context + cache searches; etc.
- (49) Multiple: six or more types of searches are performed.

The numerical criteria we applied to measure differences between groups for this indicator were not the same as in other cases, owing to the division of the total percentage between five categories. As we did with the time spent on searches at each stage indicator, for each category we calculated the five groups' overall mean percentage and took 10% of it as the basis for describing differences between groups.

For this indicator, as in the case of the time spent on searches at each stage indicator, we did not calculate progression between the first year and the graduates, owing to its results being divided into different sets that balance each other out. Similarly, we did not bring our results for this indicator together with those we obtained for translation acceptability, as dividing the overall number of cases between five categories would have meant a low number of cases in each category, possibly distorting results.

7.3. Results

Our analysis of this variable is based on 118 students (TCA experiment) and 35 professional translators (TC experiment). While the total number of students in our sample was 129, the number of valid subjects was 11 fewer due to some of our *Camtasia* recordings being incomplete. The number of valid subjects per group was 21

33. This combination is called 'combined' in Kuznik (2017a) and Kuznik and Olalla-Soler (2018).

for the first year, 24 for the second, 27 for the third, 28 for the fourth, and 18 for the graduates.

When setting out our results, we show standard deviation in brackets and omit our statistical tests' non-significant results. The significance level we established was 0.05. See appendix 5 for the results of all our statistical tests.

7.3.1. Total time spent on searches

Table 7.2 shows each group's mean total time spent on searches, in minutes and as a percentage of the time devoted to the entire translation task.

Table 7.2. Total time spent on searches

	Mean (minutes, in decimal format)	Relative time spent on searches
1 st year	9.52 (4.19)	19.5% (7.26)
2 nd year	11.25 (3.63)	18.7% (5.94)
3 rd year	8.96 (3.59)	17.0% (7.76)
4 th year	8.36 (4.91)	17.8% (8.28)
Graduates	9.72 (4.75)	17.3% (7.75)
Translators	8.06 (5.87)	16.24% (10.28)

According to our results:

- No evolution takes place. The total time spent on searches remains more or less the same throughout training.
- The first-year students are the group that devotes the largest proportion of time to searching.
- No progression occurs between the first year and the graduates.
- There are no differences between the graduates and the translators.

Total time spent on searches and acceptability

From a descriptive perspective, comparing the groups on the basis of their respective mean values for the total time spent on searches and acceptability (see section 2.3.1)³⁴ shows that while acceptability increases as TC is acquired, the overall time spent on searches remains virtually the same.

From a statistical perspective, according to the data we obtained by correlating our results for acceptability and the total time spent on searches, there is no association between the two (see Table 7.3).

Table 7.3. Spearman's correlation coefficients between total time spent on searches and acceptability

	r_s
1 st year	-0.13
2 nd year	-0.04
3 rd year	-0.01
4 th year	0.27
Graduates	0.07
Translators	-0.04

The results indicate that each group includes subjects who achieve a high level of quality with very little time spent on searches, and others whose quality level is low despite spending a lot of time on searches, two trends that balance each other out. The absence of a correlation applies in the case of the translators too.

7.3.2. Time spent on searches at each stage

Table 7.4 shows our results concerning the time spent on searches at each stage of the translation process. As stated previously, the numerical criteria we used to measure

34. Mean acceptability results by group: first year = 0.45; second year = 0.59; third year = 0.63; fourth year = 0.65; graduates = 0.70; translators = 0.73.

differences between groups³⁵ for this indicator are not the same as in other cases, owing to its characteristics, and we neither calculated progression nor brought its results together with those we obtained for acceptability (see section 7.2.2).

Table 7.4. Time spent on searches at each stage

	Orientation	Development	Revision
1 st year	0.0% (0.0)	81.7% (23.1)	18.3% (23.1)
2 nd year	10.9% (18.7)	84.4% (18.5)	4.7% (8.8)
3 rd year	2.6% (9.9)	72.9% (20.0)	24.5% (16.6)
4 th year	2.3% (10.8)	75.5% (29.5)	22.3% (28.4)
Graduates	0.7% (3.1)	76.4% (18.1)	23.2% (17.6)
Translators	16.0% (27.1)	48.0% (39.7)	36.0% (39.1)

According to our results:

- In the case of orientation, mixed evolution takes place, with an extremely substantial rise between the first and second years ($U = 157.5$, $p < 0.001$, Bonferroni corrected, $r = 0.38$), an extremely substantial fall between the second and third years ($U = 233.0$, $p < 0.05$, Bonferroni corrected, $r = 0.28$), a substantial fall between the third and fourth years, and an extremely substantial fall between the fourth year and the graduates. The second-year students are the

35. The overall mean and the values on the basis of which we describe differences between groups for each stage are specified below. Orientation: mean, 3.3; slight difference, 0.2 (rounded up); substantial difference, 0.3 (rounded down); very substantial difference, 0.6; extremely substantial difference, 0.9. Development: mean, 78.2; slight difference, 3.9; substantial difference, 7.8 (rounded down); very substantial difference, 15.6; extremely substantial difference, 23.4. Revision: mean, 18.6; slight difference, 1.0 (rounded up); substantial difference, 1.9 (rounded up); very substantial difference, 3.8; extremely substantial difference, 5.7.

group that devotes the largest percentage of time to searches in this stage. There is an extremely substantial rise between the graduates and the translators.

- In the case of development, falling evolution takes place, with a substantial fall between the second and third years ($U = 169.0, p < 0.05$, Bonferroni corrected, $r = 0.48$). The groups that devote the largest percentages of time to searches in this stage are the second and first-year students. There is an extremely substantial fall between the graduates and the translators ($U = 139.0, p < 0.05$, one-tailed, $r = 0.56$).
- In the case of revision, mixed evolution takes place, with an extremely substantial fall between the first and second years, an extremely substantial rise between the second and third years ($U = 119.0, p < 0.01$, Bonferroni corrected, $r = 0.63$), and a substantial fall between the third and fourth years. The groups that devote the largest percentages of time to searches in this stage are the third-year students and the graduates, followed by the fourth-year students. There is an extremely substantial rise between the graduates and the translators.

The following conclusions can be drawn on the basis of our results:

1. Distribution of time spent on searches: most time spent on searches in the development stage. Development is the stage in which every group devotes the most time to searches. In general, revision is the stage in which the second greatest amount of time is spent on searches, with orientation, when very little time is devoted to searching, in last position. The second-year students are an exception in that regard, as they spend more time performing searches in the orientation stage and much less in the revision stage. Also of note is the complete absence of searches in the orientation stage in the first year.

2. Type of evolution: mixed and falling evolution. The amount of time spent on searches undergoes mixed evolution in the orientation and revision stages. Falling evolution takes place in the case of development, however, reflecting a gradual reduction in the proportion of time devoted to searches in the stage in question.

3. Differences between groups. The behaviour of the first-year students is notable in that they perform no searches in the orientation stage. The behaviour of the second-year students stands out too, in that they have the highest and lowest percentages of searches performed in the orientation and revision stages respectively.

4. At the beginning of training, no searches are performed in the orientation stage. Upon completion of training, however, searches are performed in each of the three stages.

5. Comparison between the graduates and the translators: marked difference in behaviour. The translators distribute the time they spend on searches between the three stages much more evenly than the graduates. The most striking difference is in the orientation stage, when the translators devote far more time to searches than the graduates.

7.3.3. *Variety of resources*

The data we obtained for the variety of resources indicator are set out in Table 7.5. As stated previously, we calculated the translators' values for this indicator differently in our TC experiment, and therefore could not compare their mean with those of the students or convert it to a percentage (see section 7.2.3).

Table 7.5. Variety of resources

	Mean	Percentage
1 st year	2.62 (1.12)	32.75% (13.96)

2 nd year	3.71 (1.46)	46.37% (18.24)
3 rd year	3.44 (1.28)	43.00% (16.01)
4 th year	3.00 (1.33)	37.50% (16.67)
Graduates	3.72 (0.96)	46.50% (11.98)

According to our results:

- Mixed evolution takes place, with a substantial rise between the first and second years ($U = 120.0$, $p < 0.01$, Bonferroni corrected, $r = 0.52$), a slight fall between the third and fourth years, and a slight rise between the fourth year and the graduates.
- The second and third-year students and the graduates are the groups that use the greatest variety of resources, with very similar percentages. The first-year students are the group that uses the least varied range of resources, followed by the fourth-year students.
- Little progression occurs between the first year and the graduates (13.8).

Variety of resources and acceptability

From a descriptive perspective, comparing the groups on the basis of their respective mean variety of resources and acceptability values shows that while acceptability increases as TC is acquired, the evolution of the variety of resources used is mixed. It is worth highlighting that the range of resources the second-year students use is as varied as that of the graduates, but this does not result in the former group scoring well in terms of acceptability.

The data we obtained by correlating our results for the acceptability and variety of resources indicators show differences within some groups (Table 7.6). There are moderate *positive* correlations in the first and fourth years.

Table 7.6. Spearman's correlation coefficients between variety of resources and acceptability

	r_s
1 st year	0.55
2 nd year	-0.07
3 rd year	0.29
4 th year	0.36
Graduates	-0.08

In the first year, the students who use a wider variety of resources achieve greater acceptability. The same applies to the fourth year, but not to the graduates. There is thus no clear pattern in the relationship between the variety of resources used and acceptability. There was no correlation in the case of the translators (Kuznik 2017a).

7.3.4. Number of searches

Our results for the number of searches indicator are shown in Table 7.7. As mentioned previously, owing to the lack of an established maximum value for this indicator we were unable to calculate percentages and, thus, did not analyse its evolution or progression.

Table 7.7. Number of searches

	Mean
1 st year	11.95 (7.67)
2 nd year	14.96 (5.28)
3 rd year	11.04 (5.13)
4 th year	10.36 (6.60)

Graduates	12.61 (6.43)
Translators	20.51 (19.38)

A comparison of the groups' mean values shows that the number of searches performed is similar throughout training, although the second-year students stand out as the group that carries out the most searches. There is a notable difference between the graduates and the translators, with the latter performing far more searches.

Number of searches and acceptability

Comparing the groups on the basis of their respective mean values for the number of searches and acceptability shows that while acceptability rises as TC is acquired, the number of searches performed remains more or less the same, except in the second year.

According to the data we obtained by correlating our results for the number of searches performed and acceptability (Table 7.8), there is no correlation in any of the groups.

Table 7.8. Spearman's correlation coefficients between number of searches and acceptability

	r_s
1 st year	0.04
2 nd year	0.10
3 rd year	0.03
4 th year	0.27
Graduates	-0.01
Translators	0.17

The results indicate that each group includes subjects who perform very few searches and achieve a high level of quality, and others whose quality level is low despite performing many searches, two trends that balance each other out.

7.3.5. Variety of searches

Our results concerning types of searches and combinations of types of searches are set out below.

Types of searches

Table 7.9 shows our results for the types of searches performed.

Table 7.9. Types of searches

	Mean	Percentage
1 st year	2.43 (1.08)	18.70% (8.31)
2 nd year	3.29 (1.43)	25.31% (11.00)
3 rd year	2.85 (0.99)	21.92% (7.62)
4 th year	2.75 (1.29)	21.15% (9.92)
Graduates	3.11 (0.90)	23.92% (6.92)
Translators	3.09 (1.90)	23.76% (14.62)

According to our results:

- Rising evolution takes place, with a slight rise between the first and second years.
- The range of types of searches performed is at its least varied in the first year.
The graduates' range is more varied, although their value is similar to that of the second-year students.
- No progression occurs between the first year and the graduates.
- There is no difference between the graduates and the translators.

Types of searches and acceptability

Comparing the groups on the basis of their respective mean types of searches and acceptability values shows that both acceptability and, albeit to a lesser degree, the number of types of searches performed increase as TC is acquired.

According to the data we obtained by correlating our results for acceptability and types of searches, there are only correlations in the first and third years and among the translators, all of them moderate and *positive* (Table 7.10).

Table 7.10. Spearman's correlation coefficients between types of searches and acceptability

	r_s
1 st year	0.49
2 nd year	0.09
3 rd year	0.39
4 th year	0.23
Graduates	-0.20
Translators	0.37

The results indicate that performing more types of searches is associated with greater acceptability in the first and third years and in the case of the translators. There is no such association within the other groups.

Combinations of types of searches

Table 7.11 shows our results for combinations of types of searches.³⁶ As stated earlier,

36. The overall mean and the values on the basis of which we describe differences between groups for each category (see section 7.2.5) are specified below. Simple: mean, 11.4; slight difference, 0.6 (rounded up); substantial difference, 1.1 (rounded down); very substantial difference, 2.2; extremely substantial difference, 3.3. Double: mean, 25.6; slight difference, 1.3; substantial difference, 2.6 (rounded up); very substantial difference, 5.2; extremely substantial difference, 7.8. Triple+: mean, 61.0; slight difference, 3.1 (rounded up); substantial difference, 6.1; very substantial difference, 12.2; extremely

owing to the division of data between five categories, in this case we neither calculated progression nor brought our results together with those we obtained for acceptability.

Table 7.11. Combinations of types of searches

	None (%)	Simple (%)	Double (%)	Triple+ (%)	Multiple (%)
1 st year	0.0% (n = 0)	14.3% (n = 3)	42.9% (n = 9)	38.1% (n = 8)	4.8% (n = 1)
2 nd year	0.0% (n = 0)	8.3% (n = 2)	20.8% (n = 5)	66.7% (n = 16)	4.2% (n = 1)
3 rd year	0.0% (n = 0)	7.4% (n = 2)	29.6% (n = 8)	63.0% (n = 17)	0.0% (n = 0)
4 th year	0.0% (n = 0)	21.4% (n = 6)	17.9% (n = 5)	60.7% (n = 17)	0.0% (n = 0)
Graduates	0.0% (n = 0)	5.6% (n = 1)	16.7% (n = 3)	77.8% (n = 14)	0.0% (n = 0)
Translators	8.6% (n = 3)	5.7% (n = 2)	34.3% (n = 12)	40.0% (n = 14)	11.4% (n = 4)

According to our results:

- None combination. No students use this category, although some of the translators do.
- Simple combination. Mixed evolution takes place, with an extremely substantial fall between the first and second years, a slight fall between the second and third years, an extremely substantial rise between the third and fourth years, and an extremely substantial fall between the fourth year and the graduates. The fourth-year students are the group that makes the greatest use of this combination. There is no difference between the graduates and the translators.
- Double combination. Mixed evolution takes place, with an extremely substantial fall between the first and second years, an extremely substantial rise between the

substantial difference, 18.3. Multiple: mean, 1.8; slight difference, 0.1; substantial difference, 0.2 (rounded up); very substantial difference, 0.4; extremely substantial difference, 0.6.

second and third years, and an extremely substantial fall between the third and fourth years. The first-year students are the group that makes the greatest use of this combination. There is an extremely substantial rise between the graduates and the translators.

- Triple+ combination. Mixed evolution takes place, with an extremely substantial rise between the first and second years, a slight fall between the second and third years, and a very substantial rise between the fourth year and the graduates. The graduates are the group that makes the greatest use of this combination. There is an extremely substantial fall between the graduates and the translators.
- Multiple combination. Falling evolution takes place, with an extremely substantial fall between the second and third years. The first-year students are the group that makes the greatest use of this combination, which the third and fourth-year students and the graduates do not use at all. There is an extremely substantial rise between the graduates and the translators.

The following conclusions can be drawn on the basis of our results:

1. Distribution of combinations of types of searches. In general, triple+ is the combination used most frequently, followed by double and simple. The multiple combination is used much less often, to the extent that three of the groups (from the third year onwards) do not use it all. It is worth stressing that all the students performed searches.

2. Type of evolution: predominance of mixed evolution. The use of each combination undergoes mixed evolution, apart from that of the multiple combination, which undergoes falling evolution.

3. Differences between groups. Notably, as of the second year every group uses the triple+ combination more than the double combination, with large differences

between the two categories. The first-year students, however, use the double combination more than the triple+ combination, with a small difference between the two categories. They are also the group that makes the greatest use of the multiple combination.

4. Comparison between the graduates and the translators. All the graduates performed searches, whereas some of the translators did not. The translators make far greater use of the double and multiple combinations than the graduates, and much less use of the triple+ combination.

7.4. Conclusions

The use of instrumental resources variable provided us with data on the acquisition of the instrumental sub-competence from PACTE's TC model, specifically in relation to documentation strategies used when consulting resources in electronic format. In our study of TC (Kuznik 2017a, 241), a comparison of the behaviour of professional translators and that of language teachers showed that the former spent more time on searches, used more resources, and performed a greater number and a wider variety of searches. The results in question underlined the importance of the instrumental sub-competence among all the sub-competences characteristic of TC.

The data we obtained in our TCA experiment only partially confirm our empirical hypothesis that there is a relationship between the degree of TC and the use of external resources. They also partially confirm our operational hypotheses on differences between levels of TCA in relation to the distribution of time spent on searches, the variety of resources consulted and the variety of searches performed. Our operational hypothesis corresponding to the total time spent on searches indicator has not been confirmed, and we were unable to verify our operational hypothesis related to the number of searches indicator.

With regard to the **time spent on searches and its distribution between stages**, we have made the following findings:

1. Most time spent on searches in the development stage. Development is the stage in which every group devotes the most time to searches. In general, revision is the stage in which the second greatest amount of time is spent on searches, with orientation, when very little time is spent on searches, in last position. The behaviour of the first-year students is notable for involving no searches whatsoever in the orientation stage, as is that of the second-year students for involving the highest and lowest percentages of searches performed in the orientation and revision stages respectively.

2. Type of evolution. The total time spent on searches is homogeneous throughout TCA and does not evolve. The time spent on searches in the orientation and revision stages fluctuates, undergoing mixed evolution. Falling evolution takes place in the case of development, however, reflecting a gradual reduction in the proportion of time devoted to searches in the stage in question. We observed a general trend of increasing balance in the distribution of searches between the three stages as TCA advances.

3. Relationship with acceptability. From a statistical perspective, we found no correlation between acceptability and the total time spent on searches in any of the groups. This points to there being a great deal of variation in acceptability and the time spent on searches within each group. The students are heterogeneous and spend more or less time on searches depending on their individual needs.

From a descriptive perspective, a comparison of the groups' mean acceptability values shows that acceptability increases as TCA advances despite the time spent on searches being the same at every level of the process. This could indicate that the subjects use electronic reference resources more effectively as they acquire TC,

although the improvement in efficacy might be due to other factors, such as an increase in cognitive resources and psycho-physiological components (memory, self-confidence, capacity for critical thinking, etc.).

4. Lack of progression. The total time spent on searches is very similar at the beginning and upon completion of training. There does appear to be a degree of progression in the efficacy of the use of external support, although, as mentioned above, this could be due to other factors.

5. Distance from the professional translators. We found there to be no difference between the graduates and the professional translators as regards the total time they spend on searches. The translators, however, distribute that time more evenly between the three stages and spend much longer performing searches in the orientation stage than the graduates. It seems that the professionals are more aware of the importance of performing searches at the beginning of the translation process to ensure that the subsequent stages run more smoothly.

6. Influence of training. The differences between the first and second years can be attributed to students' training. The second-year students are the group that spends the most time on searches in the orientation stage (during which, contrastingly, the first-year students perform no searches whatsoever) and the least in the revision stage. The first-year students lack experience in translation and are as yet unaware of the potential of the different types of instrumental resources. Having taken a semester-long translation subject, the second-year students seem to be more conscious of the problems translation entails, familiar with more electronic sources of documentation, and more aware of the importance of the orientation stage. They consequently make greater use of such sources of documentation during the orientation and development stages, although,

having still to fully grasp the importance of the quality of their work, they spend little time on the revision stage.

The graduates appear to perform searches more effectively, which could also be interpreted as a result of their training.

Lastly, training may also be a factor in the general trend we observed of the time spent on searches being distributed more evenly between the three stages as TC is acquired, gradually getting closer to the values of the professional translators. Little by little, the students shake off the notion that searches are limited to the development stage and become more aware of the importance of working through the three stages of the translation process properly.

In relation to the **use of external resources and the searches performed**, analysis of our results has shown the following:

1. Predominance of mixed evolution. The variety of resources used undergoes mixed evolution, as does the use of each combination of types of searches except the multiple combination, for which falling evolution takes place. The variety of types of searches performed undergoes rising evolution, however. There are thus fluctuations in the variety of resources used and the use of combinations of searches as the subjects acquire TC and assimilate internal and external resources, while the variety of types of searches performed increases, probably due to greater familiarity with external resources and confidence in using them.

2. Relationship with acceptability. From a statistical perspective, we found there to be no correlation with acceptability. There is no correlation in any of the groups in the case of the number of searches, and only a moderate positive correlation in two groups where both the variety of resources and variety of searches are concerned. This points to there being a great deal of variation among the students in each group in terms

of their use of instrumental resources and the acceptability they achieve. This finding could mean that the use of instrumental resources depends to a large extent on each student's specific needs, and the results are sometimes good and sometimes poor.

From a descriptive perspective, a comparison of our results for the indicators referred to in the previous paragraph with each group's mean acceptability value suggests that external resources are used more effectively as TCA advances. The variety of resources used fluctuates (undergoing mixed evolution) as TC is acquired, with the second and third-year students and the graduates having similar values (the highest), but acceptability increases, which could be taken to mean that resources are used more effectively at the end of training. The number of searches performed is similar at every level of TCA, but, given that acceptability gradually increases, the relationship between the two could be considered to involve greater efficacy at the end of training in this case too. Where the types of searches performed are concerned, both acceptability and the variety of searches increase (albeit very little in the latter case) as TCA takes place. In any case, as stated previously, there are other factors that may influence the quality of the end product of the translation process.

3. Lack of progression. Little progression occurs in the case of the variety of resources used, and none at all in that of the types of searches performed. Furthermore, each group performs a similar number of searches. It should be borne in mind, nonetheless, that the range of searches performed is at its least varied at the beginning of training and at its most varied (albeit with a value similar to that of the second-year students) upon completion of training. Our results for translation acceptability, which increases as TCA advances, could indicate an increase in the efficacy of the use of external support, although other factors may be involved.

4. Distance from the professional translators. The professionals perform many more searches than the graduates, although there is no difference between the two groups in terms of the variety of the types of searches they carry out. All the graduates performed searches, whereas some of the translators did not.

5. Influence of training. The fluctuation that occurs throughout the TCA process in the variety of resources used and in the combinations of types of searches performed, and the increase in the variety of searches performed, could both be deemed a consequence of the students' training, during which their internal and external resources increase and are restructured.

Training could also be regarded as a factor in the apparent general rise in the efficacy of the use of instrumental resources.

It is worth highlighting that the multiple combination is used most frequently in the first year, which is when acceptability is at its lowest. Performing a wide variety of types of searches therefore does not appear to have a positive effect on translation quality at the stage in question. It should also be noted that as of the second year, all the groups use the triple+ combination more than the double combination (with large differences between the two categories) and translation acceptability gradually increases. The corresponding relationship thus seems to involve greater efficacy, which is possibly a result of the training received.

In our TCA study, despite there being an increase in the efficacy of the use of instrumental resources among the groups from a descriptive perspective, we found no correlation between acceptability and the variable's indicators within any of the groups. On the basis of this lack of correlation, we believe that the use of instrumental resources depends on each student's specific needs. The correlation coefficients we obtained show

that translation solution quality does not correlate with spending more or less time on searches, using a more or less varied range of resources, or performing more or fewer searches. This could imply that each student's use of instrumental resources is conditioned by what they as an individual need to acceptably solve a translation problem caused by a lack of internal resources (linguistic and extralinguistic knowledge, knowledge of translation and cognitive strategies). Some students come up with acceptable solutions using only a small variety of resources, performing few searches and devoting little time to searching, while others need to use many types of resources, perform many searches and spend a lot of time searching. This may indicate that instrumental resources are used as a complement to internal support, in a way that is linked to personal needs and difficulties, making it impossible to reach a conclusion as to whether using such resources to a higher or lower degree leads to better results.

We would like to end by stressing that our analysis is based on documentation strategies used when consulting electronic resources and focuses on non-specialised translation. Additionally, it does not extend to the use of translation technologies, which is also an aspect of the instrumental sub-competence and should be analysed in other studies.

8. Defining features of translation competence acquisition

This article contains the conclusions of PACTE's experimental study of translation competence acquisition (TCA), which involved 129 first to fourth-year students and recent graduates (four months before the experiment) from the Universitat Autònoma de Barcelona's Translation and Interpreting degree programme. The experiment was carried out in November 2011. In our research we analysed various indicators, distributed among six study variables (knowledge of translation; translation project; identification and solution of translation problems; decision-making; efficacy of the translation process; and use of instrumental resources), and their relationship with translation acceptability. The results we obtained clearly show that TCA is a non-linear process, corroborating

PACTE's TCA model. In the article we present the characteristics of TCA we have identified, relate them to our hypotheses, compare the recent graduates' results with those of professional translators, and infer implications for translator training. Lastly, we make some methodological remarks and suggest future lines of research on TCA, highlighting the importance of advancing towards establishing competence levels in TCA.

Keywords: translation competence acquisition; types of evolution; translator training; comparison with professionals

8.1. Introduction

Our research was based on our conception of translation competence acquisition (TCA) as a spiral, a non-linear process in which novice knowledge (pre-translation competence) evolves into translation competence (TC), involving the development of sub-competences and learning strategies (see Figure 1.2). The objective of our study was to observe how the process in question takes place, focusing on the acquisition of the competences that, according to PACTE's model (see section 1.2.1), are specific to TC (the knowledge of translation, instrumental and strategic competences), although we also obtained data on the acquisition of the bilingual and extralinguistic competences. As mentioned in section 1.3, we did not study psycho-physiological components or the acquisition of learning strategies.

To observe the process of the acquisition of the aforementioned sub-competences of TC, we established six study variables (see Table 1.1):

- Knowledge of translation, related to the knowledge of translation sub-competence (see article 3).
- Translation project, related to the strategic sub-competence (see article 3).
- Identification and solution of translation problems, related to the strategic and knowledge of translation sub-competences (see article 4).

- Decision-making, related to the strategic and instrumental sub-competences (see article 5).
- Efficacy of the translation process, related to the strategic sub-competence (see article 6).
- Use of instrumental resources, related to the instrumental sub-competence (see article 7).

We analysed 20 indicators distributed among the six variables, plus two further indicators, namely the dynamic translation index (see article 3) and translation acceptability (see article 2), a cross-cutting indicator whose results we brought together with those of most of the other indicators.

The data we obtained enabled us to identify four types of *evolution* in TCA (see section 1.4.4), specifically non-evolution, rising evolution, falling evolution and mixed evolution (a combination of rising and falling evolution). The existence of these four types of evolution, which vary from indicator to indicator, and the fact that many of the indicators undergo mixed evolution demonstrate that TCA is a non-linear process, confirming our initial conception of it.

8.2. Characteristics of translation competence acquisition

The results our variables and indicators yielded enabled us to identify certain characteristics of TCA.

8.2.1. Increase in acceptability as TC is acquired. Intentionality-related translation problems are the most complex.

In general, translation acceptability (see article 2) undergoes rising evolution, with progression taking place between the first year and the graduates. The problems that

appear to be most complex in TCA are those that involve intentionality, as it is with such problems that acceptability levels are lowest at both the beginning and upon completion of training and furthest from the level of the professional translators. Additionally, the only translation problem for which acceptability undergoes mixed (rather than rising) evolution involves intentionality, and the factor of acceptability for which progression is lowest is meaning, which is related to understanding the intentions of the source text.

8.2.2. Progression from a more static to a more dynamic concept of and approach to translation.

Our results for the indicators of the knowledge of translation and translation project variables (see article 3), which correspond to declarative and procedural knowledge respectively, show that TCA involves progression from a more *static* (linguistic and literal) to a more *dynamic* (textual, interpretative, communicative and functionalist) concept of and approach to translation. The consistency of both declarative and, in particular, procedural knowledge of translation is very high. Dynamism is greater in the case of procedural knowledge than in that of declarative knowledge.

8.2.3. Fluctuation in the acquisition of procedural knowledge for solving translation problems. Concern for target text linguistic quality. Influence of subjectivity.

The identification and solution of translation problems variable (see article 4) also provided data on the acquisition of procedural and declarative knowledge of translation. Of the variable's four procedural indicators, which are related to the strategic sub-competence, three (perception of difficulty coefficient, identification of prototypical translation problems, and problem-solving procedures) undergo mixed evolution,

showing that their acquisition process is non-linear.

With regard to declarative knowledge about solving translation problems (knowledge of translation sub-competence), we found linguistic reformulation difficulties to be the type of difficulty the students most often identify as problematic, indicating that they are aware that translation requires proficiency in the target language and lack confidence in their ability to produce a linguistically correct target text. Pragmatic difficulties are the type of difficulty deemed least problematic, although the source text's absence of cultural problems requiring adaptation to target readers may have contributed to that view.

We found that subjectivity influences all the variable's indicators, as the way students identify problems, describe their characteristics, use procedures to solve them and evaluate solutions depends on their knowledge, abilities and shortcomings. Subjectivity conditions both their declarative knowledge (*implicit theories*) and their procedural knowledge related to solving translation problems.

8.2.4. Fluctuation in the acquisition of problem-solving strategies. Very little use of internal support and automatised processes.

To observe decisions made in solving translation problems (see article 5), we drew on the results of our TC experiment (PACTE 2017i) to establish four categories of sequences of actions, namely internal support, predominantly internal support, predominantly external support and simple external support, which encompass different types of strategies. We also made a distinction between automatised and non-automatised processes in decision-making. The data we obtained show that both the use of each sequence and the acceptability achieved with each sequence undergo mixed evolution. This suggests that the procedures the subjects use to solve translation problems are restructured as the internal (cognitive) and external resources they can call

upon increase in quality, quantity and variety.

Throughout TCA, according to our results, predominantly internal support is the sequence used most frequently, internal support is that used least frequently, and very little use is made of automatised internal support. The sequences that give the highest acceptability values are predominantly external support, predominantly internal support and simple external support. We have thus deduced that the students do little in terms of mobilising their cognitive resources, i.e. linguistic knowledge, all kinds of extralinguistic (cultural, thematic and world) knowledge, knowledge of translation, and cognitive strategies (contextualising words, identifying key elements of a text which provide information, drawing inferences, drawing analogies, formulating hypotheses about meaning, comparing different solutions, etc.), to solve translation problems.

8.2.5. Predominance of the development stage as regards use of time.

Fluctuations in the total time taken and its distribution between stages. Very small increase in translation process efficacy.

The efficacy of the translation process variable (see article 6) yielded data on the time spent on the translation task and its distribution between stages, and we brought the data in question together with the results we obtained for translation acceptability. We found development to be the stage on which the most time is spent at every level of TCA, and that both the total time taken to translate and the time spent on each stage undergo mixed evolution, with the greatest number of fluctuations throughout the process occurring in the orientation stage. There are also fluctuations in terms of the correlation between time and acceptability (involving alternating positive and negative correlations). Our comparison of the subjects' mean acceptability values and times suggests that translation process efficacy increases only slightly over the course of TCA, as acceptability improves but the speed with which acceptable solutions are found

does not.

8.2.6. Predominance of the development stage as regards time spent on searches. Very little time devoted to searching in the orientation stage. More balanced distribution of time spent on searches and more effective use of instrumental resources as TCA advances. Fluctuations in the variety of resources used. Increase in the variety of searches performed.

In our analysis of the use of instrumental resources variable (see article 7), we collected data on the acquisition of documentation strategies used with electronic resources.

Throughout TCA, according to our results, development is the stage in which the most time is spent on searches and very little time is devoted to searching in the orientation stage.

While we saw no evolution in the total time spent on searches, we detected fluctuations in the orientation and revision stages and a decrease in the development stage. The time spent searching is distributed more evenly between the three stages as TC is acquired.

The evolution of the variety of resources used is mixed, reflecting restructuring as TCA takes place. The variety of searches performed undergoes rising evolution, pointing to a gradual increase in familiarity with and confidence in using external resources.

From a descriptive perspective, comparing our results for the variety of resources, number of searches and variety of searches indicators (the variable's non-time-related indicators) with the results we obtained for acceptability reveals an apparent increase in the efficacy of the use of external resources as TCA advances. We found no statistical correlations between the indicators in question and acceptability, however. This suggests that the use of instrumental resources depends on each subject's

individual needs, as determined by their linguistic and extralinguistic knowledge, mastery of cognitive strategies, knowledge of translation, etc.

8.2.7. Predominance of mixed evolution: the non-linear nature of TCA.

Table 8.1 shows the type of evolution we identified for each indicator (with the corresponding variable in square brackets). As stated in the relevant articles, there are three indicators for which, for methodological reasons, we were unable to calculate evolution.

Table 8.1. Types of evolution identified

Type of evolution	Indicators
Non-evolution	17. Total time spent on searches [use of instrumental resources]
Rising evolution	1. Dynamic index of knowledge of translation [knowledge of translation] 6. Dynamic translation index [knowledge of translation + translation project] 8. Identification of prototypical translation problems (no clear pattern according to RP type) [identification and solution of translation problems] 10. Satisfaction coefficient [identification and solution of translation problems] 21. Variety of searches [use of instrumental resources] 22. Acceptability (overall and by factor; predominant by RP)
Falling evolution	18. Time spent on searches at each stage (development) [use of instrumental resources]
Mixed evolution	2. Coherence coefficient of knowledge of translation [knowledge of translation] 3. Dynamic index of the overall translation project [translation project] 4. Dynamic index of the translation project for translation problems [translation project] 5. Coherence coefficient of the translation project [translation project] 7. Perception of difficulty coefficient [identification and solution of translation problems] 9. Problem-solving procedures (in every case: automatic solution, internal support and external support) [identification and solution of translation problems] 13. Sequences of actions (in every case: internal support, predominantly internal support, predominantly external support and simple external support) [decision-making] + when analysed in conjunction with acceptability 14. Type of internal support (in both cases: automatised and non-automatised internal support) [decision-making] 15. Total time taken [efficacy of the translation process] 16. Time taken at each stage (in every case: orientation, development and revision) [efficacy of the translation process] 18. Time spent on searches at each stage (orientation and revision) [use of instrumental resources] 19. Variety of resources [use of instrumental resources]

Not calculated	11. Characterisation of the text's main types of difficulties [identification and solution of translation problems]
	12. Characterisation of prototypical translation problems [identification and solution of translation problems]
	20. Number of searches [use of instrumental resources]

There is only one case of non-evolution, that of the total time spent on searches, which remains the same throughout TCA; and just one case of falling evolution, that of the time spent on searches in the development stage.

The cases of rising evolution correspond to increases in acceptability, the dynamism of the subjects' concept of translation and the dynamic translation index, the number of translation problems identified, the variety of searches performed and satisfaction with proposed solutions. Such evolution applies not only to overall acceptability but also to acceptability by factor in every case (meaning, function and language), and is predominant where acceptability by RP is concerned. While the indicator related to a *dynamic* concept of translation undergoes rising evolution, the evolution of the dynamism of the subjects' approach to translation is mixed. The number of translation problems identified rises as TCA advances, although there is no clear pattern of evolution according to RP type. The variety of searches performed to solve such problems grows, as does satisfaction with proposed solutions, pointing to an increase in confidence in them.

Most of the indicators undergo mixed evolution. Of those that do, all but the coherence coefficient of knowledge of translation correspond to procedural knowledge. Furthermore, they are all related to the strategic sub-competence apart from the time spent on searches at each stage and the variety of resources used, which are both related to the instrumental sub-competence but still refer to the use of strategies, albeit external support strategies. It thus appears that the acquisition of procedural knowledge and the use of strategies are non-linear and are restructured as TCA advances.

8.2.8. Progression varies from indicator to indicator. Lack of progression in the case of procedural indicators.

Table 8.2 shows the progression we identified between the pre-TC stage (first-year students beginning their training, who have yet to take any translation subjects) and the completion of training (recent graduates). As stated in the relevant articles, there are eight indicators for which, for methodological reasons, we were unable to calculate progression.

Table 8.2. Types of progression identified

Type of progression	Indicators
Major progression	1. Dynamic index of knowledge of translation [knowledge of translation] 2. Coherence coefficient of knowledge of translation [knowledge of translation] 3. Dynamic index of the overall translation project [translation project] 6. Dynamic translation index [knowledge of translation + translation project]
Progression	4. Dynamic index of the translation project for translation problems [translation project] 22. Acceptability (overall and by RP; predominant by factor: language and function)
Little progression	15. Total time taken [efficacy of the translation process] 19. Variety of resources [use of instrumental resources] 22. Acceptability by factor: meaning
No progression	5. Coherence coefficient of the translation project [translation project] 7. Perception of difficulty coefficient [identification and solution of translation problems] 8. Identification of prototypical translation problems (predominant) [identification and solution of translation problems] 10. Satisfaction coefficient [identification and solution of translation problems] 17. Total time spent on searches [use of instrumental resources] 21. Variety of searches [use of instrumental resources]
Not calculated	9. Problem-solving procedures [identification and solution of translation problems] 11. Characterisation of the text's main types of difficulties [identification and solution of translation problems] 12. Characterisation of prototypical translation problems [identification and solution of translation problems] 13. Sequences of actions [decision-making] 14. Type of internal support [decision-making] 16. Time taken at each stage [efficacy of the translation process] 18. Time spent on searches at each stage [use of instrumental resources] 20. Number of searches [use of instrumental resources]

According to our results, four of the six indicators related to a dynamic concept of and approach to translation account for all the cases of major progression between the first year and the graduates. Additionally, progression occurs where a fifth of the six is concerned, with only one (coherence coefficient of the translation project) lacking any progression at all. This confirms the importance of acquiring such a concept of and approach to translation in TCA.

There is progression in both overall acceptability and acceptability by RP, as well as with two of the three factors of acceptability, the exception being meaning, where little progression takes place.

Little progression occurs in terms of the total time taken (with the graduates needing slightly longer than the first-year students) and the variety of external resources used to perform the translation task.

It is worth highlighting that the six indicators for which no progression takes place refer to procedural knowledge and are related to the strategic and instrumental sub-competences, suggesting that procedural knowledge is harder to assimilate. They are also related to the subjects' individual characteristics, their knowledge, abilities and shortcomings, and their psycho-physiological components, which affect their consistency, the number of problems they identify, the number of searches they need to perform and their level of satisfaction with their proposed solutions.

8.2.9. Very few relationships between acceptability and the other indicators.

Table 8.3 shows the results we obtained by using correlations or regressions to analyse the subjects' acceptability values in conjunction with their values for the other indicators. As stated in the relevant articles, there are 10 indicators whose relationship with acceptability we did not analyse for methodological reasons. In the case of the knowledge of translation and translation project variables, we brought the subjects'

dynamic translation index (the mean of the two variables' dynamic index results) values together with their acceptability values.

Table 8.3. Statistical correlation and regression results

Correlations/ regressions	Indicators	Results
Correlations	6. Dynamic translation index [knowledge of translation + translation project]	6. Positive correlation in first year
	15. Total time taken [efficacy of the translation process]	15. Positive correlation in first year, negative correlation in second year, positive correlation in fourth year, negative correlation among graduates
	17. Total time spent on searches [use of instrumental resources]	17. No correlation
	19. Variety of resources [use of instrumental resources]	19. Positive correlation in first and fourth years
	20. Number of searches [use of instrumental resources]	20. No correlation
	21. Variety of searches [use of instrumental resources]	21. Positive correlation in first and third years
Regressions	7. Perception of difficulty coefficient [identification and solution of translation problems]	No relationship in any case
	8. Identification of prototypical translation problems [identification and solution of translation problems]	
	9. Problem-solving procedures [identification and solution of translation problems]	
	10. Satisfaction coefficient [identification and solution of translation problems]	
	11. Characterisation of the text's main types of difficulties [identification and solution of translation problems]	
Not calculated	1. Dynamic index of knowledge of translation [knowledge of translation]	
	2. Coherence coefficient of knowledge of translation [knowledge of translation]	
	3. Dynamic index of the overall translation project [translation project]	
	4. Dynamic index of the translation project for translation problems [translation project]	
	5. Coherence coefficient of the translation project [translation project]	
	12. Characterisation of prototypical translation problems [identification and solution of translation problems]	

- 13. Sequences of actions [decision-making]
- 14. Type of internal support [decision-making]
- 16. Time taken at each stage [efficacy of the translation process]
- 18. Time spent on searches at each stage [use of instrumental resources]

We only found correlations for four indicators, namely the dynamic translation index, total time taken, variety of resources and variety of searches. Notably, in each of the four cases there is a correlation in the first year and that correlation is *positive*, meaning that greater acceptability is associated with: a more dynamic concept of and approach to translation; taking more time to perform the translation task; using a wider variety of resources; and performing a wider variety of searches. Given the first-year students' lack of cognitive resources (linguistic knowledge, knowledge of translation, assimilated strategies, etc.), it may be the factors in question that contribute most to solving translation problems adequately at this stage of training.

The alternating occurrence of positive and negative correlations in the total time taken indicator (efficacy of the translation process variable) is also noteworthy. This could be related to the cases of mixed evolution we observed in the acquisition of translation process efficacy.

Table 8.4 shows the results we obtained through descriptive analysis, i.e. by comparing the rising evolution of acceptability and the type of evolution we identified for each of the other indicators. A non-parallel relationship may be due to the relevant indicator undergoing a different type of evolution (mixed or falling evolution) or lacking differences between groups.

Table 8.4. Relationship between acceptability and the other indicators from a descriptive perspective

Relationship from a descriptive perspective	Indicators
---	------------

Parallelism	6. Dynamic translation index - rising evolution [knowledge of translation + translation project]
No parallelism due to different type of evolution	7. Perception of difficulty coefficient - mixed evolution [identification and solution of translation problems] 9. Problem-solving procedures - mixed evolution [identification and solution of translation problems] 13. Sequences of actions - mixed evolution in all categories (internal support, predominantly internal support, predominantly external support and simple external support) [decision-making] 15. Total time taken - mixed evolution [efficacy of the translation process] 19. Variety of resources - mixed evolution [use of instrumental resources]
No parallelism due to lack of notable differences between groups	8. Identification of prototypical translation problems [identification and solution of translation problems] 10. Satisfaction coefficient [identification and solution of translation problems] 17. Total time spent on searches [use of instrumental resources] 20. Number of searches [use of instrumental resources] 21. Variety of searches [use of instrumental resources]
Not described	1. Dynamic index of knowledge of translation [knowledge of translation] 2. Coherence coefficient of knowledge of translation [knowledge of translation] 3. Dynamic index of the overall translation project [translation project] 4. Dynamic index of the translation project for translation problems [translation project] 5. Coherence coefficient of the translation project [translation project] 11. Characterisation of the text's main types of difficulties [identification and solution of translation problems] 12. Characterisation of prototypical translation problems [identification and solution of translation problems] 14. Type of internal support [decision-making] 16. Time taken at each stage [efficacy of the translation process] 18. Time spent on searches at each stage [use of instrumental resources]

The only case of parallelism is between acceptability and the dynamic translation index.

Our results corroborate the paucity of relationships we detected using correlations. The lack of relationships may be attributable to each individual using the sub-competences of TC differently and compensating between them according to their needs to obtain acceptable solutions when translating, taking varying paths and using the strategic sub-competence differently.

8.3. Confirmation of hypotheses

The results we obtained confirm our theoretical and empirical hypotheses and most of

our operational hypotheses (see appendix 1).

8.3.1. Confirmation of theoretical hypotheses

Our results confirm our theoretical hypotheses, which reflect our TCA model.

Firstly, we obtained confirmation that *TCA is a dynamic, non-linear, spiral process* (hypothesis 1). We saw that TCA involves combinations of different kinds of evolution, with mixed evolution predominant, highlighting its non-linear nature.

We also verified that *TCA involves an evolution from novice knowledge to TC* (hypothesis 2), given that internal and external resources are combined and adjusted to produce better acceptability results as TC is acquired, with the greatest change generally taking place at the beginning of the process (between the first and second years).

Based on our results, there are non-parallel changes in declarative and procedural knowledge as TC is acquired. This is related to hypotheses 3 (*TCA is a process in which the sub-competences of TC are developed and restructured*) and 4 (*in TCA, not all sub-competences develop in parallel, i.e. at the same time and at the same rate*). Where the assimilation of a dynamic concept of and approach to translation is concerned, we saw that declarative knowledge about translation (knowledge of translation sub-competence) undergoes rising evolution while procedural knowledge (related to the strategic sub-competence) undergoes mixed evolution. The lack of linearity we observed in the evolution of the use of sequences of actions in our analysis of the decision-making variable, and the tendency to make greater use of internal or external resources depending on the level of TCA involved, could also be linked to the non-parallel process of acquiring competences (the linguistic and extralinguistic, instrumental, and knowledge of translation competences) as TCA takes place. In general, the predominance of mixed evolution could be related to the unequal (non-parallel) process of acquiring the different competences that are part of TC (the

bilingual, extralinguistic, knowledge of translation, instrumental and strategic sub-competences) as TC itself is acquired.

It should be stressed that the indicators we analysed are mainly sources of information on the three sub-competences that, in PACTE's model, are specific to TC, i.e. the knowledge of translation, instrumental and strategic sub-competences. Our results unequivocally confirm that *in TCA, the development of the strategic, instrumental, and knowledge of translation sub-competences is particularly important* (hypothesis 5).

According to PACTE's model, the strategic sub-competence monitors the translation process, activates the other sub-competences to solve translation problems, makes up for shortcomings in the other sub-competences and is used to appraise provisional solutions. The importance of its acquisition is further underlined by the compensation and adjustments that take place in TCA between the use of internal support procedures and external support to solve translation problems (hypothesis 6: *TCA is a process in which the development of procedural knowledge – and, consequently, of the strategic sub-competence – is essential*).

8.3.2. Confirmation of empirical and operational hypotheses

Our TCA study's results reconfirm our empirical hypotheses, which our TC experiment had already confirmed (see PACTE 2017c). Our results firstly confirm hypothesis 1, according to which the degree of TC influences not only the product (acceptability) of the translation process but also the way the process itself is undertaken (concept of and approach to translation, identification of translation problems, application of strategies, etc.). They also confirm that the degree of TC can be defined on the basis of translation acceptability (hypothesis 2), given that we found acceptability to increase as TCA advances, and that TC is acquired through experience of translating (hypothesis 3).

Additionally, as explained in the conclusions of our articles on the different variables, we identified a relationship between the degree of TC and the way each variable works, confirming all our other empirical hypotheses, albeit only partially in the case of the one linked to the use of instrumental resources variable, according to which there is a relationship between the degree of TC and the use of external resources.

As can also be seen in the conclusions of our analyses of the different variables, our results confirm all but three of our operational hypotheses. Where the efficacy of the translation process variable is concerned, the hypothesis that differences can be observed between levels of TCA in relation to the time taken and the acceptability of results has not been confirmed. In the case of the use of instrumental resources variable, the hypothesis that differences can be observed between levels of TCA in relation to the time spent on searches has not been confirmed, and we were unable to verify the hypothesis regarding such differences in relation to the number of searches performed.

8.4. Comparison between the graduates and the professional translators

Table 8.5 shows how the graduates' values (upon completion of their training) compare to those of the professional translators from our TC experiment. As stated in the relevant articles, there are four indicators for which, for different kinds of methodological reasons, we were unable to calculate the degree of similarity involved. Additionally, we did not compare the two groups' values in the case of acceptability by factor.

Table 8.5. Comparison between the graduates and the professional translators

Result of comparison	Indicators
Graduates' values higher than translators' values	<ol style="list-style-type: none"> 1. Dynamic index of knowledge of translation [knowledge of translation] 2. Coherence coefficient of knowledge of translation [knowledge of translation] 3. Dynamic index of the overall translation project [translation project]

	4. Dynamic index of the translation project for translation problems [translation project] 6. Dynamic translation index [knowledge of translation + translation project] 7. Perception of difficulty coefficient [identification and solution of translation problems] 8. Identification of prototypical translation problems [identification and solution of translation problems] 13. Sequences of actions (predominantly external support and simple external support) [decision-making] + when analysed in conjunction with acceptability 15. Total time taken [efficacy of the translation process] 16. Time taken at each stage (development) [efficacy of the translation process] 18. Time spent on searches at each stage (development) [use of instrumental resources]
Graduates' values similar to translators' values	5. Coherence coefficient of the translation project [translation project] 17. Total time spent on searches [use of instrumental resources] 21. Variety of searches [use of instrumental resources] 22. Acceptability (overall; predominant by RP)
Graduates' values lower than translators' values	10. Satisfaction coefficient [identification and solution of translation problems] 13. Sequences of actions (internal support and predominantly internal support) [decision-making] + when analysed in conjunction with acceptability 14. Type of internal support (automatised internal support) [decision-making] + when analysed in conjunction with acceptability 16. Time taken at each stage (orientation and revision) [efficacy of the translation process] 18. Time spent on searches at each stage (orientation and revision) [use of instrumental resources] 20. Number of searches [use of instrumental resources]
Not calculated	9. Problem-solving procedures [identification and solution of translation problems] 11. Characterisation of the text's main types of difficulties [identification and solution of translation problems] 12. Characterisation of prototypical translation problems [identification and solution of translation problems] 19. Variety of resources [use of instrumental resources] 22. Acceptability by factor (meaning, language and function)

Upon completion of their training, the students outscore the translators in every indicator related to a dynamic concept of and approach to translation except the coherence coefficient of the translation project, for which the two groups have similar values. The graduates' greater dynamism may be due to their generation's training emphasising a communicative concept of translation, in line with current approaches in Translation Studies.

Another point worth mentioning is that the graduates' acceptability level is similar to that of the translators, except with problems that include aspects of intentionality, for which it is lower.

In our analysis of the identification and solution of translation problems variable, we found differences between the graduates and the translators for each indicator on the basis of which it was possible to compare them (perception of difficulty coefficient, identification of prototypical translation problems, and satisfaction coefficient), all of which are related to the strategic sub-competence. The graduates perceive more difficulty in translating the text and identify more translation problems than the translators. Additionally, it seems that the difference between the two groups is largest with intentionality-related problems, which the translators find less difficult to solve than the graduates. The graduates' level of satisfaction is far below that of the translators (despite the two groups having similar acceptability values), which suggests they still lack confidence in the solutions they choose.

Our results for the decision-making variable reveal differences in the two groups' use of sequences of actions and internal support. Compared with the translators, the graduates use internal support much less and with poorer acceptability results; and the simple external support and predominantly external support sequences more and with better acceptability results. The graduates thus make far less use of cognitive resources when translating than the professionals, who, probably due to their experience of translating, have consolidated knowledge of translation and cognitive strategies for solving translation problems, and thus have less need to resort to external support and are better able to make decisions using more internal support (predominantly internal support, predominantly external support, and internal support).

The graduates make much less use of automatised internal support (and automatised processes in general) than the translators, and obtain poorer results with non-automatised internal support than the professionals. They thus seemingly have less of the cognitive baggage that makes it possible to solve translation problems automatically and improve translation quality by mobilising knowledge and reflecting than the translators.

Based on the results of our analysis of the efficacy of the translation process variable, it is clear that the graduates' translation process is less efficient than that of the translators, as the two groups' acceptability values are similar but the graduates take longer to translate than the professionals. In terms of stages, the graduates spend more time on development than the translators, probably because they need longer to solve the text's translation problems. They devote less time than the translators to orientation and revision (the latter being the stage for which the two groups' values differ most). The graduates thus appear to attribute less importance to preparing to translate (orientation) and checking the quality of their end product (revision).

Where the use of instrumental resources variable is concerned, we detected no differences between the graduates and the translators in terms of the total time spent performing searches, but found that the translators distribute their searches among the three stages of the translation process (orientation, development and revision) more evenly and perform many more searches in the orientation stage than the graduates. It seems that the graduates are less aware of the importance of performing searches at the beginning of the translation process to ensure that the subsequent stages run smoothly. Additionally, the professionals perform a far greater number of searches than the graduates, although there is no difference between the two groups as regards the variety of their searches.

In any case, it should be borne in mind that it will take the graduates several years of professional practice to reach a level of TC similar to that of the translators from our TC experiment, who had an average of 7.51 years of professional experience (Kuznik 2017b, 105). When we collected our TCA experiment's data, the graduates had completed their training just four months earlier and had therefore not had time to build up any professional translation experience.

It should also be taken into consideration that we collected our TC experiment's data between October 2005 and March 2006, and our TCA experiment's data in November 2011. In the interval between the two experiments, ICTs, translation technologies and documentation resources improved greatly and took on a more important role in translator training. This may have contributed to the differences we observed between the graduates and the translators, particularly as regards their use of external support.

8.5. Implications for translator training

We did not set out to investigate the influence of the pedagogical input received by the students, which would have required a control group with different training for comparison purposes. Nonetheless, when analysing our results for the different variables (see the corresponding articles), we found most of the indicators to be influenced by the students' training and were able to identify certain flaws in it.

8.5.1. Influence of training

The influence of training is particularly identifiable in the changes that take place in most of the indicators' results between the first year (at the beginning of training, when the students have yet to take any translation subjects) and the second (when the students have taken a semester-long translation subject). The cases we detected of rising

evolution and progression between the first year and the graduates (especially where acceptability and a dynamic concept of and approach to translation are concerned) could also be a reflection of the training received. Repeated restructuring in the acquisition of knowledge and, in particular, of abilities (related to procedural knowledge), as evinced by the cases of mixed evolution we observed, can also be attributed to the students' training.

The variable we found to be least influenced by training is identification and solution of translation problems. This may be because its indicators are highly marked by subjectivity, as they are related to each individual's level of linguistic and extralinguistic knowledge and psycho-physiological components (capacity for critical thinking, self-confidence, etc.).

8.5.2. Implications for translator training

A number of implications for translator training can be inferred from our study's results.

1. Greater emphasis should be placed on intentionality-related translation problems and developing the strategic sub-competence. According to our results, the students' acceptability levels upon completion of training are similar to those of the professional translators, except with intentionality-related translation problems. As indicated previously, such problems are very complicated. Solving them requires a combination of different abilities and types of knowledge, as well as the application of the strategic sub-competence, which monitors the translation process. It thus seems that training should place greater emphasis on identifying and solving intentionality-related problems and, consequently, on developing the strategic sub-competence.

2. More attention should be paid to the development of *generic competences*. We found identification and solution of translation problems to be the variable whose indicators are least influenced by training. Its indicators are highly marked by

subjectivity due to them being related to each subject's individual characteristics (knowledge, abilities and shortcomings) and *psycho-physiological components* (capacity for critical thinking, for self-criticism, for logical thinking, etc.). Translator training should therefore pay greater attention to the development of psycho-physiological components, which are linked to the *generic competences* advocated by competence-based training, identifying those that future translators need most and giving them greater prominence in curriculums.

3. L1 writing skills should be developed further. Based on our results for the identification and solution of translation problems variable, linguistic reformulation continues to cause difficulties upon completion of training. This suggests that L1 writing skills ought to be developed further.

4. More should be done to stimulate the use of internal support. While the use of the different sequences of actions is more balanced upon completion of training, our results for the decision-making variable clearly show that the students use internal support and automatised processes to solve translation problems less than the professional translators. Additionally, the students make greater use of external support, something we associate with advances in ICTs applied to translation, translation technologies and documentation resources over the last decade.

Without losing sight of the increased role of ICTs and translation technologies in the translation process nowadays, we believe translator training should stimulate greater use of internal support, i.e. making decisions without resorting to external support as often when translating. That entails teaching translation in such a way as to enable students to develop more world knowledge, more cognitive strategies for solving translation problems and a more critical way of thinking. They would thus be more

autonomous and capable of thinking for themselves, evaluating the resources they use for documentation purposes, and appraising their own translation solutions.

5. Automatisation in solving translation problems appropriately should be promoted. Our results for the decision-making variable's type of internal support indicator and the identification and solution of translation problems variable's problem-solving procedures indicator reveal a lack of automatisation in solving translation problems appropriately. Training should take this into account, as a high level of automatisation in problem-solving is a sign of expertise in any discipline. This is one of a number of arguments for targeting greater development of students' linguistic and extralinguistic knowledge and for encouraging them to solve translation problems without using external support. Establishing time limits to induce them to translate quickly could also help stimulate automatisation.

6. The time pressure professional practice involves should be emphasised more. The level of progression in translation process efficacy is low, and a value closer to that of the professional translators would be desirable upon completion of training. We found that training contributes to increased acceptability but not to greater speed in coming up with acceptable solutions. This suggests that training should place greater emphasis on the conditions stemming from time pressure in professional practice, to expressly coach students to be more 'efficient' in their translation process. Graduates need more experience of translating (to be able to find appropriate solutions to translation problems faster), and this should be taken into account in the progression involved in training.

7. More effective use of instrumental resources should be promoted. Despite the graduates apparently performing searches more effectively than the other students and the general tendency we observed of searches being more evenly distributed among the

three stages of the translation process as TCA advances, we believe, as indicated previously, that it is important to stimulate the use of internal support to encourage more effective use of instrumental resources. This includes learning to make decisions on the basis of more than just external support and to evaluate documentation resources. It is also important that translator training foster effective use of instrumental resources by teaching students to prioritise and order searches and to evaluate resource quality and potential.

8. *Deliberate practice* of translation should be increased. The aspects mentioned in the previous points entail promoting more regular, well structured practice of performing specific translation tasks with a view to boosting automatisisation in processes, making solving translation problems easier, reducing the cognitive effort required to solve them and improving efficacy in the use of instrumental resources.

Our experiment's results show that while the students assimilate the basic strategies that make it possible to translate adequately in their degree-level training, they need more experience of translating to attain the level of the professional translators in terms of speed, automatisisation, use of cognitive resources, etc. It is worth reiterating that their degree programme does not focus on areas of specialised translation (legal translation, technical translation, scientific translation, literary translation, audiovisual translation, etc.).

9. Clear competence level criteria should be established. Our research has shown that TC requires an acquisition process, and the process involved consists of different stages. Describing each stage's characteristics to make it possible to determine levels of TCA is something we have yet to accomplish.

Unlike other disciplines (e.g. language teaching), translation lacks standardised levels. Following on from our research on TCA, PACTE is currently looking into

establishing performance levels in translation, involving describing each level's defining characteristics. In the 'Establishing Competence Levels in the Acquisition of Translation Competence in Written Translation' project (NACT, based on its initials in Spanish), we have produced a first level descriptor proposal as a first step in developing a common European framework of reference for translation's academic and professional arenas, comparable to the Common European Framework of Reference for Languages. The document we have produced puts forward a scale comprising three levels (plus sub-levels) of translation (see PACTE 2018, in press b).

8.6. Methodological contributions and limitations of PACTE's study

Our study of TC clearly demonstrated the validity of the variables and indicators we used, as well as of different aspects of its design (PACTE 2017c, 296-301), specifically the appropriateness of using acceptability as a cross-cutting indicator, and the suitability of our knowledge of translation questionnaire and the texts and RPs we selected. Our study of TCA has shown that the instruments in question are also suitable for collecting data on TCA, as is our translation problems questionnaire, which we adapted for the experiment. Researchers could use the aforementioned instruments to collect data on TCA in other contexts, replicating our study.

The parameters we considered for measurement purposes (differences between groups, types of evolution, progression between the first year and the graduates, degree of similarity to the professional translators) could also serve as a guide for future research on TCA. Of particular note in that regard are the four types of evolution we identified (non-evolution, rising evolution, falling evolution and mixed evolution), which enabled us to measure the TCA process.

As stated previously (see section 1.5), our study has three essential limitations, which future research should rectify:

- It was carried out in a single context of degree-level training.
- It was not a genuine longitudinal study.
- Several years went by between us collecting data on the group of professional translators (TC experiment) and on the students (TCA experiment).

8.7. Future lines of research

Given the limitations of our study, the experiment ought to be replicated in another educational context, involving a real longitudinal study (controlling all extraneous variables) in which data on professional translators and students are collected at the same time.

Our research did not extend to analysis of the psycho-physiological components or the learning strategies involved in TCA, which other studies should look into.

Lastly, as our research focused on degree-level training and non-specialised translation, other studies should be conducted to find out how TC is acquired at postgraduate levels, how translators become specialised (in legal translation, technical translation, scientific translation, literary translation, audiovisual translation, etc.) and how they develop expertise.

All such studies would enhance knowledge of the TCA process and contribute to defining competence levels in translation.

Translation competence acquisition. Design and results of the PACTE group's experimental research

References

- Alves, F. 1995. *Zwischen Schweigen und Sprechen: Wie bildet sich eine transkulturelle Brücke?*. Hamburg: Dr. Kovac.
- Alves, F. 1996a. "Veio-me um 'click' na cabeça: the theoretical foundations and the design of a psycholinguistically oriented, empirical investigation on German-Portuguese translation processes." *Meta* 41 (1): 33–44.

- Alves, F. 1997. "A formação de tradutores a partir de uma abordagem cognitiva: reflexões de um projeto de ensino." *TradTerm* 4 (2): 19–40.
- Alves, F. 2005a. "Ritmo cognitivo, meta-reflexão e experiência: parâmetros de análise processual no desempenho de tradutores novatos e experientes." In *Competência em tradução. Cognição e discurso*, edited by A. Pagano, C. Magalhães and F. Alves, 90–122. Belo Horizonte: Editora UFMG.
- Alves, F. 2005b. "Esforço cognitivo e efeito contextual em tradução: relevância no desempenho de tradutores novatos e expertos." *Linguagem em (Dis)curso* 5: 11–31.
- Alves, F. and J. L. Gonçalves. 2003. "A relevance theory approach to the investigation of inferential processes in translation." In *Triangulating translation*, edited by F. Alves, 11–34. Amsterdam: John Benjamins.
- Alves, F. and C. Magalhães. 2004. "Using small corpora to tap and map the process-product interface in translation." *TradTerm* 10: 179–211.
- Alves, F. and J. L. Gonçalves. 2007. "Modelling translator's competence: relevance and expertise under scrutiny." In *Translation Studies: Doubts and Directions*, edited by Y. Gambier, M. Shlesinger, and R. Stolze, 41–55. Amsterdam: John Benjamins.
- Anderson, J.R. 1983. *The Architecture of Cognition*. Cambridge: Harvard University Press.
- Angelone, E. 2014. "A Corpus-Based Comparison of Self-Reflection Modalities in Process-Oriented Translator Training." In *Handbook of Research on Teaching Methods in Language Translation and Interpretation*, edited by Y. Cui, and W. Zhao, 346–361. Hershey: IGI Global.
- Bayer-Hohenwarter, G. 2011. "Die Entwicklung translatorischer Kreativität." PhD diss., Universität Graz.
- Bell, R. T. 1991. *Translation and Translating*. London: Longman.
- Cao, D. 1996. "Towards a model of translation proficiency." *Target* 8 (2): 325–340.
- Cohen, J. 1988. *Statistical power analysis for the behavioral sciences*. 2nd ed. Hillsdale: Lawrence Erlbaum Associates.
- Chesterman, A. 1997. *Memes of Translation*. Amsterdam: John Benjamins.
- Dancette, J. 1994. "Comprehension in the Translation Process: an analysis of Think-Aloud Protocols." In *Teaching Translation and Interpreting 2*, edited by C. Dollerup, and A. Lindegaard. Amsterdam: John Benjamins.
- Dancette, J. 1995. *Parcours de traduction: Étude expérimentale du processus de compréhension*. Lille: Presses Universitaires de Lille.
- Dancette, J. 1997. "Mapping Meaning and Comprehension in Translation: Theoretical and Experimental Issues." In *Cognitive Processes in Translation and Interpreting*, edited by J. Danks, G. M. Shreve, S. B. Fountain, and M. K. McBeath et al, 77–103. Thousand Oaks: Sage.
- De Rooze, Bart. 2003. "La traducción, contra reloj. Consecuencias de la presión por falta de tiempo en el proceso de traducción." PhD diss., Universidad de Granada.
- Dreyfus, H. L., and S. E. Dreyfus. 1986. *Mind Over Machine*. Oxford: Blackwell.
- Ehrensberger-Dow, M. 2013. *Capturing Translation Processes Final Report*. Zurich: School of Applied Linguistics. IUED Institute of Translation and Interpreting.
- Ehrensberger-Dow, M., and G. Massey. 2013. "Indicators of Translation Competence: Translators' Self-Concepts and the Translation of Titles." *Journal of Writing Research* 5 (1): 103–131.
- Englund Dimitrova, B., and K. Jonasson. 2002. "Translation Ability and Translational Competence: Expert Versus Novice use of Dictionaries." In *Translation as Intercultural Communication*, edited by B. Svane, 51–72. Uppsala: Uppsala University.

- Ericsson, K. A. and R. J. Crutcher. 1990. "The nature of exceptional performance." In *Lifespan Development and Behavior*, edited by P. B. Baltes, D. L. Featherman, and R. M. Lerner, 188–218. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Ferguson, Ch. J. 2009. "An effect size primer: a guide for clinicians and researchers." *Professional Psychology: Research and Practice* 40 (5): 532–338.
- Gómez Hurtado, M. 2006. "Traducir: ¿capacidad innata o destreza adquirible?" PhD diss., Universidad de Granada.
- González Davies, M. 2004. "Undergraduate and postgraduate translation degrees: Aims and expectations." In *Translation as an Undergraduate Degree*, edited by K. Malmjkaer, 67–81. Amsterdam: John Benjamins.
- Göpferich, S. 2008. *Translationsprozessforschung: Stand- Methoden- Perspektiven*. Tübingen: Narr.
- Göpferich, S. 2009. "Towards a model of translation competence and its acquisition: The longitudinal study TransComp." In *Behind the Mind: Methods, Models and Results in Translation Process Research*, edited by S. Göpferich, A. Lykke Jakobsen, and I. M. Mees, 12–38. Copenhagen: Samfundslitteratur.
- Göpferich, S. 2012. "Tracing strategic behavior in translation processes: Translation novices, 4th-semester students and professional translators compared." In *Global Trends in Translator and Interpreter Training: Mediation and Culture*, edited by M. Borodo, and S. Hubscher-Davidson. London: Continuum.
- Gregorio Cano, A. 2014. "Estudio empírico-descriptivo del desarrollo de la competencia estratégica en la formación de traductores." PhD diss., Universidad de Granada.
- Harris, B. 1973. "La traductologie, la traduction naturelle, la traduction automatique et la sémantique." *Cahiers de Linguistique* 10: 11–34.
- Harris, B. 1977. "The importance of natural translation." *Working Papers on Bilingualism* 12: 96–114.
- Harris, Brian. 1980. "How a three-year-old translates." In *Patterns of bilingualism*, edited by E. A. Afrendas, 370–393. Singapore: National University of Singapore Press.
- Harris, B., and Sherwood, B. 1978. "Translating as an innate skill." In *Language, Interpretation and Communication*, edited by D. Gerver and H. W. Sinaiko, 155–170. Oxford: Plenum Press.
- Hatim, B. and Mason, I. 1997. *The Translator as Communicator*. London: Routledge.
- Hurtado Albir, A. 1996a. "La enseñanza de la traducción directa 'general'. Objetivos de aprendizaje y metodología." In *La enseñanza de la traducción*, edited by A. Hurtado Albir, 31–55. Castellón: Universitat Jaume I.
- Hurtado Albir, A. 1996b. "La cuestión del método traductor. Método, estrategia y técnica de traducción." *Sendebare* 7: 39–57.
- Hurtado Albir, A., ed. 2017a. *Researching Translation Competence by PACTE Group*. Amsterdam: John Benjamins.
- Hurtado Albir, A. 2017b. "Translation and Translation Competence." In *Researching Translation Competence by PACTE Group*, edited by A. Hurtado Albir, 3–33. Amsterdam: John Benjamins.
- Jääskeläinen, R. 1990. "Features of Successful Translation Processes: A Think-Aloud Protocol Study." PhD diss., University of Joensuu.
- Jääskeläinen, R., and S. Tirkkonen-Condit (1991). "Automatised Processes in Professional vs. Non-professional Translation: a think-aloud protocol study." In *Empirical Research in Translation and Intercultural Studies*, edited by S. Tirkkonen-Condit. Tübingen: Gunter Narr.

- Jakobsen, A.L. 2002. "Translation drafting by professional translators and by translation students." In *Empirical Translation Studies: process and product*, edited by G. Hansen, 191–204. Copenhagen: Samfundslitteratur.
- Jakobsen, A. L. 2003. "Effects of Think Aloud on Translation Speed, Revision and Segmentation." In *Triangulating Translation*, edited by F. Alves, 69–95. Amsterdam: John Benjamins.
- Jakobsen, A. L., and K. T. H. Jensen 2008. "Eye Movement Behaviour Across Four Different Types of Reading Task." In *Looking at Eyes: Eye-Tracking Studies of Reading and Translation Processing*, edited by S. Göpferich, A. L. Jakobsen, and I. M. Mees, 103–124. Copenhagen: Samfundslitteratur.
- Janisch, E. 2009. "Pausen im Translationsprozess: Befunde aus einer Longitudinalstudie." PhD diss., Universität Graz.
- Katan, D. 2008. "University training, competencies and the death of the translator. Problems in professionalizing translation and in the translation profession." In *Tradurre: Formazione e Professione*, edited by M. Musacchio, and G. Henrot, 113–140. Padova: CLEUP.
- Kelly, D. 2002. "Un modelo de competencia traductora: bases para el diseño curricular." *Puentes* 1: 9–20.
- Kelly, D. 2005. *A Handbook for Translator Trainers*. Manchester: St Jerome.
- Kelly, D. 2007. "Translator competence contextualized. Translator training in the framework of higher education reform: In search of alignment in curricular design." In *Across Boundaries: International Perspectives on Translation Studies*, edited by D. Kenny, and K. Ryou, 128–142. Cambridge: Cambridge Scholars.
- Kiraly, D. 1995. *Pathways to Translation. Pedagogy and Process*. Kent, OH: The Kent State University Press.
- Kiraly, D. 2013. "Towards a View of Translator Competence as an Emergent Phenomenon: Thinking outside the Box(es) in Translator Education." In *New Prospects and Perspectives for Educating Language Mediators*, edited by D. Kiraly, S. Hansen-Schirra, and K. Maksymski, 197–224. Tübingen: Gunter Narr.
- Kiraly, D. 2015: "Occasioning translator competence: Moving beyond social constructivism toward a postmodern alternative to instructionism." *Translation and Interpreting Studies* 10 (1): 8–32.
- Kussmaul, P. 1991. "Creativity in the Translation Process: Empirical Approaches." In *Translation Studies. The State of the Art*, edited by K. van Leuven-Zwart, and T. Naaijken, 91–101. Amsterdam: Rodopi.
- Künzli, A. 2001. "Experts Versus Novices: L'utilisation de sources d'information pendant le processus de traduction." *Meta* 46 (3): 507–523.
- Künzli, A. 2004. "Risk Taking: Trainee Translators Vs. Professional Translators. A Case Study." *The Journal of Specialised Translation* 2: 34–49.
- Kuznik, A. 2017a. "Use of Instrumental Resources." In *Researching Translation Competence by PACTE Group*, edited by A. Hurtado Albir, 219–241. Amsterdam: John Benjamins.
- Kuznik, A. 2017b. "Characteristics of the sample." In *Researching Translation Competence by PACTE Group*, edited by A. Hurtado Albir, 97–105. Amsterdam: John Benjamins.
- Kuznik, A. and Olalla-Soler, Ch. 2018. "Results of PACTE Group's Experimental Research on Translation Competence Acquisition. The Acquisition of the Instrumental Sub-Competence." *Across Languages and Cultures*, 19 (1): 19–51

- Lachat Leal, C. 2003. "Estrategias y problemas de traducción." PhD diss., Universidad de Granada.
- Lajoie, S. 2003. "Transitions and trajectories for studies of expertise." *Educational Researcher* 32 (8): 21–25.
- Massana Roselló, G. 2016. *La adquisición de la competencia traductora portugués-español: un estudio en torno a los falsos amigos*. PhD diss., Universitat Autònoma de Barcelona.
- Massey, G., and M. Ehrensberger-Dow. 2011. "Investigating Information Literacy: A Growing Priority in Translation Studies." *Across Languages and Cultures* 12 (2): 193–211.
- Matrat, C. M. 1992. "Investigating the Translation Process: Thinking-aloud versus Joint Activity." PhD diss., University of Delaware.
- Mees, I.M., B. Dragsted, I. G. Hansen, and A. L. Jakobsen. 2013. "Sound effects in translation." *Target* 25 (1): 140–154.
- Mellinger, Ch. D; Hanson, Th. A. (2017). *Quantitative research methods in Translation and Interpreting Studies*. New York: Routledge.
- Muñoz Martín, R., and T. Conde Ruano. 2007. *Effects of Serial Translation Evaluation. Leipziger Studien Zur Angewandten Linguistik Und Translatologie*. Frankfurt: Peter Lang.
- Neubert, A. 1994. "Competence in translation: a complex skill, how to study and how to teach it." In *Translation Studies. An Interdiscipline*, edited by M. Snell-Hornby, F. Pöchhacker, and K. Kaindl, 411–420. Amsterdam: John Benjamins.
- Neubert, A. 2000. "Competence in language, in languages, and in translation." In *Developing Translation Competence*, edited by C. Schäffner, and B. Adabs, 3–18. Amsterdam: John Benjamins.
- Neunzig, W., and Kuznik, A. 2007. "Probleme der übersetzungswissenschaftlichen Forschung: zur Entwicklung eines Einstellungsfragebogens." In *Translationsqualität*, edited by P. A. Scvhmitt, and H. E. Jüngst, 445–456. Frankfurt: Peter Lang Verlag.
- Nida, E.A. 1964. *Toward a Science of Translating, with Special Reference to Principles and Procedures Involved in Bible Translating*. Leiden: E.J. Brill.
- Nord, C. 1988/1991. *Textanalyse und Übersetzen*, Heidelberg: J. Groos Verlag (*Text analysis in Translation*. Amsterdam: Rodopi, 1991).
- Nord, C. 1992. "Text analysis in translator training." In *Teaching Translation and Interpreting 1*, edited by C. Dollerup and A. Lindegaard, 39–48. Amsterdam: John Benjamins.
- Olalla-Soler, C. 2017. "La competencia cultural del traductor y su adquisición. Un estudio experimental en la traducción alemán-español." PhD diss., Universitat Autònoma de Barcelona
- Orozco, M. 2000. "Instrumentos de medida de la adquisición de la competencia traductora: Construcción y validación." PhD diss., Universitat Autònoma de Barcelona
- Orozco, M., and A. Hurtado Albir. 2002. "Defining and measuring translation competence acquisition." *Meta* 47 (3): 375–402.
- PACTE. 2000 "Acquiring translation competence: Hypotheses and methodological problems in a research project." In *Investigating Translation*, edited by A. Beeby, D. Ensinger, and M. Presas, 99–106. Amsterdam: John Benjamins.
- PACTE. 2002a. "Una investigación empírico-experimental sobre la adquisición de la competencia traductora." In *La traducción científico-técnica y la terminología en la sociedad de la información*, edited by A. Alcina Caudet, and S. Gamero Pérez, 125–138. Castellón de la Plana: Publicacions de la Universitat Jaume I.
- PACTE. 2002b. "Exploratory tests in a study of translation competence." *Conference Interpretation and Translation* 4 (2): 41–69.

- PACTE. 2003. "Building a translation competence model." In *Triangulating Translation*, edited by F. Alves, 43–66. Amsterdam: John Benjamins.
- PACTE. 2005a. "Primeros resultados de un experimento sobre la Competencia Traductora." In *II AIETI. Actas del II Congreso Internacional de la Asociación Ibérica de Estudios de Traducción e Interpretación*, edited by M. L. Romana García, 573–587. Madrid: AIETI. URL: http://www.aieti.eu/pubs/actas/II/AIETI_2_PACTE_Resultados.pdf
- PACTE. 2005b. "Investigating translation competence: Conceptual and methodological issues." *Meta* 50 (2): 609–619.
- PACTE. 2008. "First results of a translation competence experiment: Knowledge of translation and Efficacy of the translation process." In *Translator and Interpreter Training*, edited by J. Kearns, 104–126. London: Continuum.
- PACTE. 2009. "Results of the validation of the PACTE Translation Competence model: Acceptability and Decision-making." *Across Language and Cultures* 10 (2): 207–230.
- PACTE. 2011a. "Results of the validation of the PACTE translation competence model: Translation Project and Dynamic Translation Index." In *Cognitive Explorations of Translation*, edited by S. O'Brien, 30–53. London: Continuum.
- PACTE. 2011b. "Results of the Validation of the PACTE translation competence model: Translation problems and translation competence." In *Methods and Strategies of Process Research*, edited by C. Alvstad, A. Hild, and E. Tiselius, 317–343. Amsterdam: John Benjamins.
- PACTE. 2014. "First Results of PACTE Group's Experimental Research on Translation Competence Acquisition: The Acquisition of Declarative Knowledge of Translation." *MonTI* special issue 1, 85–115.
- PACTE. 2015. "Results of PACTE's Experimental Research on the Acquisition of Translation Competence: the Acquisition of Declarative and Procedural Knowledge in Translation. The Dynamic Translation Index." *Translation Spaces* 4 (1): 29–53.
- PACTE. 2017a. "PACTE Translation Competence model." In *Researching Translation Competence by PACTE Group*, edited by A. Hurtado Albir, 35–41. Amsterdam: John Benjamins.
- PACTE. 2017b. "Data collection and analysis." In *Researching Translation Competence by PACTE Group*, edited by A. Hurtado Albir, 107–116. Amsterdam: John Benjamins.
- PACTE. 2017c. "Conclusions." In *Researching Translation Competence by PACTE Group*, edited by A. Hurtado Albir, 281–302. Amsterdam: John Benjamins.
- PACTE. 2017d. "Identification and Solution of Translation Problems." In *Researching Translation Competence by PACTE Group*, edited by A. Hurtado Albir, 171–189. Amsterdam: John Benjamins.
- PACTE. 2017e. "Acceptability." In *Researching Translation Competence by PACTE Group*, edited by A. Hurtado Albir, 119–130. Amsterdam: John Benjamins.
- PACTE. 2017f. "Knowledge of Translation." In *Researching Translation Competence by PACTE Group*, edited by A. Hurtado Albir, 131–152. Amsterdam: John Benjamins.
- PACTE. 2017g. "Translation Project." In *Researching Translation Competence by PACTE Group*, edited by A. Hurtado Albir, 153–164. Amsterdam: John Benjamins.
- PACTE. 2017h. "Dynamic Translation Index." In *Researching Translation Competence by PACTE Group*, edited by A. Hurtado Albir, 165–170. Amsterdam: John Benjamins.
- PACTE. 2017i. "Decision-Making." In *Researching Translation Competence by PACTE Group*, edited by A. Hurtado Albir, 191–210. Amsterdam: John Benjamins.

- PACTE. 2017j. "Efficacy of the Translation process." In *Researching Translation Competence by PACTE Group*, edited by A. Hurtado Albir, 211–218. Amsterdam: John Benjamins.
- PACTE. 2017k. "Developing the research design." In *Researching Translation Competence by PACTE Group*, edited by A. Hurtado Albir, 63–79. Amsterdam: John Benjamins.
- PACTE. 2018. "Competence Levels in Translation: Working Towards a European Framework." *The Interpreter and Translator Trainer* 12 (2): 111–131.
- PACTE. In press a. "Evolution of the Efficacy of the Translation Process in Translation Competence Acquisition. Results of the PACTE Group's Experimental Research."
- PACTE. In press b. "Establecimiento de niveles de competencias en traducción. Primeros resultados del proyecto NACT." *Onomazein* 43.
- Pardo, A., and R. San Martín. (2010). *Análisis de datos en ciencias sociales y de la salud II*. Madrid: Síntesis.
- Pozo, J.I. and Postigo, Y. 1993. "Las estrategias de aprendizaje como contenido del currículo." In *Estrategias de aprendizaje*, edited by C. Monereo Font, 47–64. Barcelona: Domènech.
- Prassl, F. 2010a. "Translators' Decision-Making Processes in Research and Knowledge Integration." In *New Approaches in Translation Process Research*, edited by S. Göpferich, F. Alves, and I. M. Mees, 57–81. Copenhagen: Samfundslitteratur.
- Prassl, F. 2010b. "Übersetzerisches Rechercheverhalten von Profis und Novizen auf dem Prüfstand." *Trans-kom* 4 (1): 23–48.
- Presas, M. 2000. "Bilingual Competence and Translation Competence." In *Developing Translation Competence*, edited by Ch. Schäffner, and B. Adabs, 19–31. Amsterdam: John Benjamins.
- Presas, M., and C. Martín de León. 2014. "The role of implicit theories in the non-expert translation process." *MonTI special issue 1*: 273–302.
- Quinci, C. 2014. "Translators in the making: an empirical longitudinal study on translation competence and its development." PhD diss., Università degli studi di Trieste.
- Reiss, K., and Vermeer, J. 1984. *Grundlegung einer Allgemeinen Translationstheorie*. Tübingen: Niemeyer.
- Risku, H. 1998. *Translatorische Kompetenz. Kognitive Grundlagen des Übersetzens als Expertentätigkeit*. Tübingen: Stauffenburg.
- Rothe-Neves, R. 2003. "The Influence of Working Memory Features on some Formal Aspects of Translation Performance." In *Triangulating Translation*, edited by F. Alves, 97–119. Amsterdam: John Benjamins.
- Séguinot, C. 1991. "A Study of Student Translation Strategies." In *Empirical Research in Translation and Intercultural Studies*, edited by S. Tirkkonen-Condit. Tübingen: Gunter Narr.
- Seleskovitch, D. 1968. *L'interprète dans les conférences internationales. Problèmes de langage et de communication*. Paris: Minard.
- Seleskovitch, D., and M. Lederer. 1984. *Interpréter pour traduire*. Paris: Didier Érudition.
- Shreve, G. M. 1997. "Cognition and the evolution of translation competence." In *Cognitive processes in translation and interpreting*, edited by J. H. Danks, G. M. Shreve, S. B. Fountain, and M. K. McBeath, 120–136. Thousand Oaks: Sage.
- Shreve, G.M. 2006. "The deliberate practice: translation and expertise." *Journal of Translation Studies* 9 (1): 27–42.

- Shreve, G., G. Angelone, and I. Lacruz. 2014. "Efficacy of screen recording in the other-revision of Translations: episodic memory and event models." *MonTI* special issue 1: 225-245.
- Tirkkonen-Condit, S. 1988. "Tekstin Tulkinta Käännöprosessin Osana." In *Kielen Käyttämisen ja ymmärtämisen ongelmia*, edited by L. Laurinen, and A. Kauppinen, 145–155. Helsinki: AfinLA.
- Toury, G. 1980. *In Search of a Theory of Translation*. Tel Aviv: Tel Aviv University.
- Toury, G. 1986b. "Natural Translation and the Making of a Native Translator." *Textcontext* 1: 11–29.
- Toury, G. 1995. *Descriptive Translation Studies and Beyond*. Amsterdam: John Benjamins.
- Wilss, W. 1976. "Perspectives and limitations of a didactic framework for the teaching of translation." In *Translation Applications and Research*, edited by R. W. Brislin, 117-137. New York: Gardner.
- Yarosh, M. 2012. "Translator Intercultural Competence: The Concept and Means to Measure the Competence Development." PhD diss., University of Deusto.

Translation competence acquisition. Design and results of the PACTE group's experimental research

APPENDICES

- Appendix 1: Hypotheses
- Appendix 2: Texts used and rich points
- Appendix 3: Knowledge of translation questionnaire
- Appendix 4: Translation problems questionnaire
- Appendix 5: Statistical test results
- Appendix 6: Glossary

APPENDIX 1. HYPOTHESES

THEORETICAL HYPOTHESES

1. TCA is, like all learning processes, a dynamic, non-linear, spiral process.
2. TCA involves an evolution from novice knowledge (pre-TC) to TC.
3. TCA is a process in which the sub-competences of TC are developed and restructured.
4. In TCA, not all sub-competences develop in parallel, i.e. at the same time and at the same rate.
5. In TCA, the development of the strategic, instrumental, and knowledge of translation sub-competences is particularly important.
6. TCA is a process in which the development of procedural knowledge – and, consequently, of the strategic sub-competence – is essential.

EMPIRICAL HYPOTHESES

1. The degree of TC influences the translation process and product.
2. The degree of TC can be defined by the acceptability of the results.
3. TC is acquired through experience of translating.
4. There is a relationship between the degree of TC and knowledge of translation.
5. There is a relationship between the degree of TC and the existence of a translation project.
6. There is a relationship between the degree of TC and the identification of translation problems.
7. There is a relationship between the degree of TC and the solution of translation problems.
8. There is a relationship between the degree of TC and making certain decisions specific to the translation process to solve translation problems
9. There is a relationship between the degree of TC and the efficacy of the translation process.
10. There is a relationship between the degree of TC and the use of external resources

OPERATIONAL HYPOTHESES

Acceptability

- Translation acceptability increases as TC is acquired.

Knowledge of translation

1. Differences can be observed between levels of TCA in relation to the concept of translation.
2. Differences can be observed between levels of TCA in relation to the coherence of the concept of translation.

Translation project

1. Differences can be observed between levels of TCA in relation to the type of translation project chosen for the whole text and for the units that make up the text.
2. Differences can be observed between levels of TCA in relation to the coherence of the translation project for the whole text and for the units that make up the text.

Identification and solution of translation problems

1. Differences can be observed between levels of TCA in relation to the perception of the difficulty of translating a text.
2. Differences can be observed between levels of TCA in relation to the number of problems identified.
3. Differences can be observed between levels of TCA in relation to the types of problems identified.
4. Differences can be observed between levels of TCA in relation to the types of procedures used.
5. Differences can be observed between levels of TCA in relation to the degree of satisfaction with the results obtained.
6. Differences can be observed between levels of TCA in relation to the characterisation of the main types of difficulties a text's translation involves.
7. Differences can be observed between levels of TCA in relation to the characterisation of the nature of the problems identified.

Decision-making

1. Differences can be observed between levels of TCA in relation to the use of certain sequences of actions to solve a translation problem.
2. Differences can be observed between levels of TCA in relation to the use of automatised and non-automatised cognitive processes.

Efficacy of the translation process

1. Differences can be observed between levels of TCA in relation to the time taken.
2. Differences can be observed between levels of TCA in relation to the distribution between stages of the time taken.
3. Differences can be observed between levels of TCA in relation to the time taken and the acceptability of results.

Use of instrumental resources

1. Differences can be observed between levels of TCA in relation to the time spent on searches.
2. Differences can be observed between levels of TCA in relation to the distribution between stages of the time spent on searches.
3. Differences can be observed between levels of TCA in relation to the variety of resources consulted.
4. Differences can be observed between levels of TCA in relation to the number of searches performed.
5. Differences can be observed between levels of TCA in relation to the variety of searches performed.

APPENDIX 2. TEXTS USED AND RICH POINTS

1. TEXTS USED

BRIEF: The newspaper *El País* has just received this report and wants to have it translated into Spanish for immediate publication online.

EMAIL VIRUS STRIKES IN NEW FORM

Computer users were warned last night to be on the lookout for an email virus that can steal confidential information and allow hackers to take control of infected machines. The virus, a new variant of the BugBear email worm that infected tens of thousands of computers around the world last October, began to spread rapidly from Australia to Europe and the USA at around 8am yesterday. According to MessageLabs, a Cheltenham-based virus filtering firm which reported about 30,000 infected messages in 115 countries, the propagation rate of BugBear.B almost doubled every hour throughout the morning. There was also a huge surge as US users came online. Like its predecessor, the variant spreads by sending itself as an attachment to every address in an infected machine's email address book. To disguise where it came from, it uses different subject headings. As well as searching for anti-virus software and disabling it, BugBear.B installs a keylogger to record what the user types, which may allow hackers to record confidential information such as credit card details and passwords. It also installs a "Trojan horse" program which could allow a hacker to take remote control of infected machines. Experts analysing the virus code have found that it contains the domain name of about 20 banks and financial institutions. One of the possibilities being investigated is that BugBear.B is able to check whether an infected machine is inside one of these domains and, if it is, launch a dial-up connection that could allow a hacker into the bank's computer system.

The Guardian, 6-6-2003

BRIEF: The newspaper *El País* has just received this report and wants to have it translated into Spanish for immediate publication online.

BUGBEAR.B, LE VIRUS INFORMATIQUE QUI LIT PAR-DESSUS L'ÉPAULE DE SES VICTIMES

Le ver dérobe des informations confidentielles

ALERTE rouge sur le front des virus informatiques. Le ver Bugbear.B, une « résurgence » de Bugbear qui avait frappé en septembre 2002, se répand comme une traînée de poudre depuis le 4 juin. Le surlendemain, l'un des leaders de l'édition de logiciels antivirus, Symantec, annonçait la réévaluation du risque de 3 à 4 sur une échelle qui compte 5 niveaux. En moins de quarante-huit heures, l'entreprise a reçu plus de 1 000 soumissions, des communications du virus à ses experts par ses clients. Le 6 juin, l'entreprise MessageLabs, spécialiste du filtrage des messages électroniques, révélait avoir bloqué 150.000 copies du ver.

Bugbear.B est de la famille des rétrovirus. Le rétrovirus fonctionne en deux temps. Il se présente comme une enveloppe chargée de masquer la charge utile qui peut être un ancien virus ayant fait ses épreuves. Encore inconnu des logiciels antivirus lorsqu'il apparaît pour la première fois, le rétrovirus profite de cet incognito pour désactiver la protection virale ainsi que le pare-feu du réseau local avant de libérer le véritable virus nuisible qui, sans ce sabotage préalable, aurait été instantanément repéré et détruit. Ce principe permet de recycler à l'infini des codes malicieux. Il suffit, pour cela, de changer leur apparence, ce qui représente sans doute moins de travail que de créer de toutes pièces un virus inédit.

Le Monde, 13-6-2003

BRIEF: The newspaper *El País* has just received this report and wants to have it translated into Spanish for immediate publication online.

Wurm in der Leitung Computervirus mit neuen Tricks

Ein Computervirus mit dem Namen Mydoom.B verbreitet sich zurzeit mit hoher Geschwindigkeit im Internet. Der digitale Parasit reist mit den E-Mails durch das Datennetz. Aktiviert wird er, wenn Internetnutzer versuchen, den als harmlose Datei getarnten Schädling zu öffnen. Anders als viele bekannte E-Mail-Würmer, die sich als Pornobildchen tarnen, versteckt sich Mydoom hinter technischen Begriffen wie „Mail Delivery System“ oder „Error“. Er versucht Rechner im lokalen Netzwerk, die schon von seiner Vorgängervariante infiziert wurden, zu infizieren, indem er das schon installierte Backdoor benutzt. Nach Angaben führender Hersteller von Antiviren-Software ist er darauf programmiert, vom 1. Februar an die Webseite des Softwareherstellers SCO zu attackieren. Aktiviert wird der Schädling beim Start des Betriebssystems Windows. Er kopiert sich auch unter verschiedenen Dateinamen in das Download-Verzeichnis der Dateien-Tauschbörse Kazaa. Weiteren Angaben zufolge soll er auch ein Programmteil enthalten, das Tastatureingaben von PC-Nutzern nach Kreditkartennummern und Ähnlichem überwacht. Das Bundesamt für Sicherheit in der Informationstechnik hat eine detaillierte Beschreibung im Internet veröffentlicht: www.bsi.de.

Frankfurter Allgemeine Zeitung, 14-6-2003

2. RICH POINTS IN TEXTS

1 Email virus strikes in new form

Computer users were warned last night to be on the lookout for an email virus that can steal confidential information and allow hackers to take control of infected machines. The virus, a new variant of the BugBear email worm that infected tens of thousands of computers around the world last October, began to spread rapidly from Australia to Europe and the USA at around 8am yesterday. According to MessageLabs, a 5Cheltenham-based virus filtering firm which reported about 30,000 infected messages in 115 countries, the 3propagation rate of BugBear.B almost 3doubled every hour throughout the morning. There was also a huge 3surge as US users came online. Like its predecessor, the variant spreads by sending itself as an attachment to every address in an infected machine's email address book. To disguise where it came from, it uses different subject headings. As well as searching for anti-virus software and disabling it, BugBear.B installs a 2keylogger to record what the user types, which may allow hackers to record confidential information such as credit card details and passwords. It also installs a 4"Trojan horse" program which could allow a hacker to take remote control of infected machines. [...]

The Guardian, 6-6-2003

1 BUGBEAR.B, LE VIRUS INFORMATIQUE QUI LIT PAR – DESSUS L'ÉPAULE DE SES VICTIMES

Le ver dérobe des informations confidentielles

ALERTE rouge sur le front des virus informatiques. 2Le ver Bugbear.B, une « 2résurgence » de Bugbear qui avait frappé en septembre 2002, se répand comme une traînée de poudre depuis le 4 juin. Le surlendemain, l'un des leaders de 3l'édition de logiciels antivirus, Symantec, annonçait la réévaluation du risque de 3 à 4 sur une échelle qui compte 5 niveaux. En moins de quarante-huit heures, l'entreprise a reçu plus de 1 000 4soumissions, des communications du virus à ses experts par ses clients. Le 6 juin, l'entreprise MessageLabs, spécialiste du filtrage des messages électroniques, révélait avoir bloqué 150 000 copies du ver.

La principale originalité qui distingue Bugbear.B de 2ses congénères réside dans son aptitude à 5enregistrer les caractères tapés sur le clavier de l'ordinateur infecté, de stocker ce butin dans un fichier et d'ouvrir une « porte » dans la machine afin de permettre aux pirates de venir récupérer le fruit de leur forfait. De quoi dérober les mots de passe et les numéros de carte bancaire utilisés par la victime. Le voleur de données peut ensuite exploiter ces informations pour accéder gratuitement à Internet ou à des services en ligne et faire des achats sur la Toile, sans bourse délier.

Le Monde, 13-6-2003

1 Wurm in der Leitung

Computervirus mit neuen Tricks

Ein **2Computervirus** mit dem Namen Mydoom.B verbreitet sich zurzeit mit hoher Geschwindigkeit im Internet. Der digitale Parasit reist mit den E-Mails durch das Datennetz. Aktiviert wird er, wenn Internetnutzer versuchen, den als harmlose Datei getarnten **2Schädling** zu öffnen. Anders als viele bekannte **2E-Mail-Würmer**, die sich als Pornobildchen tarnen, versteckt sich Mydoom hinter technischen Begriffen wie „Mail Delivery System“ oder „Error“. Er versucht Rechner im lokalen Netzwerk, die schon von seiner **2Vorgängervariante** infiziert wurden, zu infizieren, indem er das schon installierte Backdoor benutzt. Nach Angaben führender Hersteller von Antiviren-Software ist er darauf programmiert, vom 1. Februar an die Webseite des Softwareherstellers SCO zu attackieren.

Aktiviert wird der Schädling beim Start des Betriebssystems Windows. Er kopiert sich auch unter verschiedenen Dateinamen in das **3Download-Verzeichnis** der **4Dateien-Tauschbörse Kazaa**. Weiteren Angaben zufolge soll er auch ein Programmteil enthalten, das **5Tastatureingaben von PC-Nutzern nach Kreditkartennummern und Ähnlichem überwacht**. Das Bundesamt für Sicherheit in der Informationstechnik hat eine detaillierte Beschreibung im Internet veröffentlicht: www.bsi.de.

Frankfurter Allgemeine Zeitung, 14-6-2003

APPENDIX 3. KNOWLEDGE OF TRANSLATION QUESTIONNAIRE

What is your opinion about the following statements?

1. As you read the source text, you are already thinking about how you are going to translate it.
☐ I strongly disagree ☐ I disagree ☐ I agree ☐ I strongly agree
2. You always lose something in translation since words do not normally mean exactly the same in the source language as in the target language.
☐ I strongly disagree ☐ I disagree ☐ I agree ☐ I strongly agree
3. The client conditions how the translator translates a text.
☐ I strongly disagree ☐ I disagree ☐ I agree ☐ I strongly agree
4. The aim of every translation is to produce a text as close in form to the original as possible.
☐ I strongly disagree ☐ I disagree ☐ I agree ☐ I strongly agree
5. Most translation problems can be solved with the help of a good dictionary.
☐ I strongly disagree ☐ I disagree ☐ I agree ☐ I strongly agree
6. When you translate a text, the most important thing is to satisfy target reader expectations.
☐ I strongly disagree ☐ I disagree ☐ I agree ☐ I strongly agree
7. In order to understand the source text, the most important thing to do is to solve vocabulary problems.
☐ I strongly disagree ☐ I disagree ☐ I agree ☐ I strongly agree
8. If the characteristics of the source text are very different from those of the same genre in the target culture (e.g. business letters, instruction manuals, etc.) you should adapt the target text accordingly.
☐ I strongly disagree ☐ I disagree ☐ I agree ☐ I strongly agree
9. Since you cannot be expected to know every word of a language, a good bilingual dictionary is the best way to ensure a good translation.
☐ I strongly disagree ☐ I disagree ☐ I agree ☐ I strongly agree
10. A text should be translated in different ways depending on who the target reader is.
☐ I strongly disagree ☐ I disagree ☐ I agree ☐ I strongly agree
11. All translated texts should keep the same paragraphs and order of sentences in the target text as in the original text.
☐ I strongly disagree ☐ I disagree ☐ I agree ☐ I strongly agree
12. Idiomatic expressions are the biggest problem in translation.
☐ I strongly disagree ☐ I disagree ☐ I agree ☐ I strongly agree
13. The best way to translate is to concentrate on the words and syntax of the original and then reproduce them in the target language.
☐ I strongly disagree ☐ I disagree ☐ I agree ☐ I strongly agree
14. When translating a technical text, terminology is not the biggest problem.
☐ I strongly disagree ☐ I disagree ☐ I agree ☐ I strongly agree
15. With the exception of proverbs, idioms and metaphors, the best way to translate is always word for word.
☐ I strongly disagree ☐ I disagree ☐ I agree ☐ I strongly agree
16. As soon as you find a word or expression you do not know the meaning of, you should look it up in a bilingual dictionary.
☐ I strongly disagree ☐ I disagree ☐ I agree ☐ I strongly agree

17. One of the biggest problems when translating a novel is cultural references (e.g. institutions, typical dishes, etc.).

☐ I strongly disagree ☐ I disagree ☐ I agree ☐ I strongly agree

18. When you translate, you concentrate on one sentence and translate it, then the next, and so on until you have translated the whole text.

☐ I strongly disagree ☐ I disagree ☐ I agree ☐ I strongly agree

19. When you translate, you must bear in mind the text conventions of the target language.

☐ I strongly disagree ☐ I disagree ☐ I agree ☐ I strongly agree

20. It is not enough to know two languages well to be able to translate well.

☐ I strongly disagree ☐ I disagree ☐ I agree ☐ I strongly agree

21. When you translate an essay you must ensure that target readers react to the text in the same way as the source text readers.

☐ I strongly disagree ☐ I disagree ☐ I agree ☐ I strongly agree

22. When you find a cultural reference in a text (e.g. a typical dish) you should try to find a similar reference in the target culture.

☐ I strongly disagree ☐ I disagree ☐ I agree ☐ I strongly agree

23. If you begin translating a text with certain criteria (e.g. respecting the format of the original text, adapting the text to the target reader, etc.), these should be kept to throughout the translation.

☐ I strongly disagree ☐ I disagree ☐ I agree ☐ I strongly agree

24. When you translate a text, you should not be influenced by the target reader.

☐ I strongly disagree ☐ I disagree ☐ I agree ☐ I strongly agree

25. The best way to translate a text is to translate sentence by sentence.

☐ I strongly disagree ☐ I disagree ☐ I agree ☐ I strongly agree

26. The same translation problems come up in every text.

☐ I strongly disagree ☐ I disagree ☐ I agree ☐ I strongly agree

27. If you find a word in a text you do not understand, you should firstly try to work out its meaning from the context.

☐ I strongly disagree ☐ I disagree ☐ I agree ☐ I strongly agree

APPENDIX 4. TRANSLATION PROBLEMS QUESTIONNAIRE (FOR ENGLISH TEXT)

YOU MAY REFER BACK TO YOUR TRANSLATION TO ANSWER THIS QUESTIONNAIRE
TITLE OF TEXT: E-MAIL VIRUS STRIKES IN NEW FORM

PART I

1. How difficult did you find translating the text?

Choose a point on the scale below.

Very easy

Very difficult

○○

2. What general types of difficulties do you feel translating the text involved?

Choose at least one and a maximum of three.

Place your choices in order by numbering them (1 being the main type).

Number each of your choices differently.

- Cultural difficulties.
- Difficulties in terms of understanding the intended meaning (information conveyed, comprehension of main and secondary ideas, etc.).
- Lexical and morphosyntactic comprehension difficulties.
- Lexical and morphosyntactic reformulation difficulties.
- Difficulties in terms of producing a coherent, stylistically appropriate text.
- Difficulties related to the text's subject.
- Difficulties related to the text's function, the characteristics of the translation brief and the target reader.

☐ I didn't notice any difficulties.

3. What was your priority when translating the text?

- ☐ Adapting it to meet the target reader's expectations.
- ☐ Reproducing the lexis and morphosyntax of the source text.
- ☐ Reproducing the structure and formal aspects of the source text.
- ☐ Communicating the meaning of the source text.
- ☐ I didn't have a priority.

PART II

ANSWER THE QUESTIONS ABOUT THE FOLLOWING SEGMENTS OF THE TEXT

E-mail virus strikes in new form

1. Did the underlined segment of the text cause you difficulties?

- ☐ Yes ☐ No

2. What types of translation difficulties could it cause?

Choose at least one and a maximum of three.

Place your choices in order by numbering them (1 being the main type).

Number each of your choices differently.

- Cultural difficulties.
- Difficulties in terms of understanding the intended meaning (information conveyed, comprehension of main and secondary ideas, etc.).
- Lexical and morphosyntactic comprehension difficulties.
- Lexical and morphosyntactic reformulation difficulties.
- Difficulties in terms of producing a coherent, stylistically appropriate text.
- Difficulties related to the text's subject.
- Difficulties related to the text's function, the characteristics of the translation brief and the target reader.

3. What was your priority when translating it?

- ☐ Adapting it to meet the target reader's expectations.
- ☐ Reproducing the lexis and morphosyntax of the source text.
- ☐ Reproducing the structure and formal aspects of the source text.
- ☐ Communicating the meaning of the source text.
- ☐ I didn't have a priority.

4. Explain what you did to translate it.

- ☐ 1. I translated it automatically, without stopping to think about it.
- ☐ 2. I didn't consult any external sources but

I thought about what the segment might mean until I came to understand it. Specify what you thought:

I thought about various options until I settled on a way of reformulating the segment. Specify what you thought:

- ☐ 3. I consulted external sources (bilingual dictionary, internet, etc.).

5. Are you satisfied with your solution?

- ☐ Yes ☐ No ☐ Partially

[repeat for each of the other 4 rich points]

APPENDIX 5. STATISTICAL TEST RESULTS

1. Dynamic index of knowledge of translation [knowledge of translation]³⁷

Comparing groups	Kruskal-Wallis H test (4) = 22.398; $p = 0.001$; $\eta^2 = 0.17$		
1 st year vs. 2 nd year	$U = 144$	$p = 0.020$ (Bonferroni corrected)	$r = 0.52$
2 nd year vs. 3 rd year	$U = 319$	$p = 0.999$ (Bonferroni corrected)	$r = 0.09$
3 rd year vs. 4 th year	$U = 417$	$p = 0.999$ (Bonferroni corrected)	$r = 0.01$
4 th year vs. graduates	$U = 294.5$	$p = 0.999$ (Bonferroni corrected)	$r = 0.11$
Graduates vs. translators	$U = 238$	$p = 0.007$ (one-tailed)	$r = 0.38$

The relationship between this indicator and acceptability was not calculated for conceptual reasons.

2. Coherence coefficient of knowledge of translation [knowledge of translation]

Comparing groups	Kruskal-Wallis H test (4) = 15.354; $p = 0.004$; $\eta^2 = 0.12$		
1 st year vs. 2 nd year	$U = 163.5$	$p = 0.018$ (Bonferroni corrected)	$r = 0.46$
2 nd year vs. 3 rd year	$U = 337.5$	$p = 0.999$ (Bonferroni corrected)	$r = 0.04$
3 rd year vs. 4 th year	$U = 362.5$	$p = 0.999$ (Bonferroni corrected)	$r = 0.14$
4 th year vs. graduates	$U = 307$	$p = 0.999$ (Bonferroni corrected)	$r = 0.07$
Graduates vs. translators	$U = 282$	$p = 0.031$ (one-tailed)	$r = 0.27$

The relationship between this indicator and acceptability was not calculated for conceptual reasons.

3. Dynamic index of the overall translation project [translation project]

Comparing groups – Fisher's exact test	p	V
1 st year vs. 2 nd year	0.033	0.30
2 nd year vs. 3 rd year	0.999	0.01
3 rd year vs. 4 th year	0.999	0.06
4 th year vs. graduates	0.057	0.22
Graduates vs. translators - chi-squared test (2) = 3.445	0.179	0.246

The relationship between this indicator and acceptability was not calculated for conceptual reasons.

4. Dynamic index of the translation project for translation problems [translation project]

Comparing groups – chi-squared test	df	χ^2	p	V
1 st year vs. 2 nd year	2	0.313	0.855	0.08
2 nd year vs. 3 rd year	2	0.948	0.623	0.13
3 rd year vs. 4 th year	2	1.822	0.402	0.18
4 th year vs. graduates	2	0.219	0.640	0.06
Graduates vs. translators	2	4.046	0.132	0.26

The relationship between this indicator and acceptability was not calculated for conceptual reasons.

5. Coherence coefficient of the translation project [translation project]

Comparing groups – chi-squared test	df	χ^2	p	V
1 st year vs. 2 nd year	2	0.327	0.849	0.08
2 nd year vs. 3 rd year	2	0.795	0.672	0.12
3 rd year vs. 4 th year	2	1.353	0.508	0.16
4 th year vs. graduates	2	6.458	0.040	0.36
Graduates vs. translators	2	4.651	0.098	0.28

The relationship between this indicator and acceptability was not calculated for conceptual reasons.

6. Dynamic translation index [knowledge of translation + translation project]

Comparing groups	Kruskal-Wallis H test = 16.273; $p = 0.003$; $\eta^2 = 0.13$		
1 st year vs. 2 nd year	$U = 203$	$p = 0.846$ (Bonferroni corrected)	$r = 0.29$

³⁷ The variable to which each indicator belongs is shown in square brackets.

2 nd year vs. 3 rd year	$U = 287.5$	$p = 0.999$ (Bonferroni corrected)	$r = 0.15$
3 rd year vs. 4 th year	$U = 343$	$p = 0.999$ (Bonferroni corrected)	$r = 0.09$
4 th year vs. graduates	$U = 293$	$p = 0.999$ (Bonferroni corrected)	$r = 0.09$
Graduates vs. translators	$U = 192.5$	$p = 0.001$ (one-tailed)	$r = 0.52$

Relationship with acceptability	r_s	95% CI	p
1 st year	0.56	0.19; 0.79	0.060
2 nd year	-0.10	-0.48; 0.31	0.646
3 rd year	-0.25	-0.58; 0.14	0.214
4 th year	0.22	-0.17; 0.55	0.368
Graduates	0.27	-0.16; 0.61	0.219
Translators	0.13	-0.21; 0.44	0.454

7. Perception of difficulty coefficient [identification and solution of translation problems]

Comparing groups	Kruskal-Wallis H test (4) = 13.339; $p = 0.010$; $\eta^2 = 0.11$		
1 st year vs. 2 nd year	$U = 184.5$	$p = 0.116$ (Bonferroni corrected)	$r = 0.38$
2 nd year vs. 3 rd year	$U = 210$	$p = 0.094$ (Bonferroni corrected)	$r = 0.40$
3 rd year vs. 4 th year	$U = 359$	$p = 0.999$ (Bonferroni corrected)	$r = 0.12$
4 th year vs. graduates	$U = 225$	$p = 0.999$ (Bonferroni corrected)	$r = 0.29$
Graduates vs. translators	$U = 230$	$p = 0.001$ (one-tailed)	$r = 0.69$

Relationship with acceptability: we found a significant regression equation ($F(2, 124) = 12.034$, $p < 0.001$), with an r^2 of 0.163. Students' predicted acceptability is equal to $0.384 + 0.060$ (year), 95% CI [0.036; 0.085] + 0.116 (perception of difficulty coefficient), 95% CI [-0.080; 0.311]. While the year is a significant predictor of acceptability ($p < 0.001$), the perception of difficulty coefficient is not ($p = 0.244$).

8. Identification of prototypical translation problems [identification and solution of translation problems]

Comparing groups	Kruskal-Wallis H test (4) = 3.056; $p = 0.549$; $\eta^2 = 0.02$		
Graduates vs. translators	$U = 92$	$p = 0.001$ (one-tailed)	$r = 0.76$

Relationship with acceptability: we found a significant regression equation ($F(2, 125) = 11.139$, $p < 0.001$), with an r^2 of 0.138. Students' predicted acceptability is equal to $0.337 + 0.056$ (year), 95% CI [0.031; 0.081] + 0.001 (percentage of prototypical translation problems identified), 95% CI [-0.001; 0.003]. While the year is a significant predictor of acceptability ($p < 0.001$), the percentage of prototypical translation problems identified is not ($p = 0.189$).

9. Problem-solving procedures [identification and solution of translation problems]

Comparing groups – automatic solution	Kruskal-Wallis H test (4) = 4.081; $p = 0.395$; $\eta^2 = 0.03$		
Comparing groups – internal support strategies	Kruskal-Wallis H test (4) = 7.701; $p = 0.103$; $\eta^2 = 0.06$		
Comparing groups – external support strategies	Kruskal-Wallis H test (4) = 2.658; $p = 0.617$; $\eta^2 = 0.02$		

Relationship with acceptability: we performed a multiple linear regression to predict acceptability based on the students' year and their use, as a percentage, of each problem-solving procedure. We obtained the following results:

- Use of automatic solution: $F(2, 125) = 11.188$, $p < 0.001$, $r^2 = 0.138$; year = 0.056 ($p < 0.001$; 95% CI [0.031; 0.081]); use of automatic solution = -0.001 ($p = 0.179$; 95% CI [-0.003; 0.001]).
- Use of internal support strategies: $F(2, 125) = 11.034$, $p < 0.001$; $r^2 = 0.138$; year = 0.054 ($p < 0.001$; 95% CI [0.029; 0.079]); use of internal support strategies = 0.001 ($p = 0.214$; 95% CI [-0.001; 0.003]).
- Use of external support strategies: $F(2, 125) = 10.133$, $p < 0.001$; $r^2 = 0.126$; year = 0.057 ($p < 0.001$; 95% CI [0.032; 0.082]); use of external support strategies = 0.000001 ($p = 0.915$; 95% CI [-0.001; 0.001]).

10. Satisfaction coefficient [identification and solution of translation problems]

Comparing groups	Kruskal-Wallis H test (4) = 2.144; $p = 0.709$; $\eta^2 = 0.02$		
------------------	--	--	--

Graduates vs. translators	$U = 312.5$	$p = 0.001$ (one-tailed)	$r = 0.59$
---------------------------	-------------	--------------------------	------------

Relationship with acceptability: we found a significant regression equation ($F(2, 125) = 10.443, p < 0.001$), with an r^2 of 0.143. Students' predicted acceptability is equal to $0.412 + 0.056$ (year), 95% CI [0.031; 0.081] + 0.048 (satisfaction coefficient), 95% CI [-0.080; 0.176]. While the year is a significant predictor of acceptability ($p < 0.001$), the satisfaction coefficient is not ($p = 0.462$).

11. Characterisation of the text's main types of difficulties [identification and solution of translation problems]

No statistical tests were performed for methodological reasons.

Relationship with acceptability: we performed a multiple linear regression to predict acceptability based on the students' year and their characterisation of the text's translation difficulties. We found that the students' year has an effect on acceptability but their characterisation of the text's translation difficulties does not:

- Cultural difficulties: $F(2, 125) = 10.339, p < 0.001, r^2 = 0.128$; year = 0.057 ($p < 0.001$; 95% CI [0.32; 0.82]); cultural difficulties = 0.026 ($p = 0.547$; 95% CI [-0.059; 0.112]).
- Intentionality difficulties: $F(2, 125) = 11.876, p < 0.001, r^2 = 0.146$; year = 0.056 ($p < 0.001$; 95% CI [0.31; 0.80]); intentionality difficulties = 0.070 ($p = 0.085$; 95% CI [-0.010; 0.149]).
- Linguistic comprehension difficulties: $F(2, 125) = 10.259, p < 0.001, r^2 = 0.127$; year = 0.058 ($p < 0.001$; 95% CI [0.32; 0.83]); linguistic comprehension difficulties = -0.017 ($p = 0.634$; 95% CI [-0.089; 0.055]).
- Linguistic reformulation difficulties: $F(2, 125) = 10.853, p < 0.001, r^2 = 0.134$; year = 0.057 ($p < 0.001$; 95% CI [0.32; 0.82]); linguistic reformulation difficulties = -0.047 ($p = 0.265$; 95% CI [-0.129; 0.036]).
- Textual difficulties: $F(2, 125) = 10.130, p < 0.001, r^2 = 0.126$; year = 0.057 ($p < 0.001$; 95% CI [0.32; 0.82]); textual difficulties = -0.003 ($p = 0.936$; 95% CI [-0.071; 0.066]).
- Thematic difficulties: $F(2, 125) = 10.542, p < 0.001, r^2 = 0.131$; year = 0.056 ($p < 0.001$; 95% CI [0.30; 0.81]); thematic difficulties = -0.029 ($p = 0.399$; 95% CI [-0.098; 0.039]).
- Pragmatic difficulties: $F(2, 125) = 10.139, p < 0.001, r^2 = 0.126$; year = 0.057 ($p < 0.001$; 95% CI [0.32; 0.82]); pragmatic difficulties = -0.006 ($p = 0.884$; 95% CI [-0.087; 0.075]).

12. Characterisation of prototypical translation problems [identification and solution of translation problems]

No statistical tests were performed for methodological reasons.

The relationship between this indicator and acceptability was not calculated for conceptual reasons.

13. Sequences of actions [decision-making]

Comparing groups – chi-squared test of independence			
Internal support	df	χ^2	p
1 st year vs. 2 nd year	1	0.806	0.369
2 nd year vs. 3 rd year	1	0.040	0.841
3 rd year vs. 4 th year	1	5.158	0.023
4 th year vs. graduates	1	6.081	0.014
Graduates vs. translators	1	35.630	0.001
Comparing groups – chi-squared test of independence			
Predominantly internal support	df	χ^2	p
1 st year vs. 2 nd year	1	6.145	0.013
2 nd year vs. 3 rd year	1	3.835	0.050
3 rd year vs. 4 th year	1	0.563	0.453
4 th year vs. graduates	1	0.333	0.564
Graduates vs. translators	1	12.794	0.001
Comparing groups – chi-squared test of independence			
Predominantly external support	df	χ^2	p
1 st year vs. 2 nd year	1	0.783	0.376
2 nd year vs. 3 rd year	1	4.188	0.041
3 rd year vs. 4 th year	1	0.178	0.673

4 th year vs. graduates	1	4.813	0.028
Graduates vs. translators	1	0.074	0.785

Comparing groups – chi-squared test of independence

Simple external support	<i>df</i>	χ^2	<i>p</i>
1 st year vs. 2 nd year	1	4.829	0.028
2 nd year vs. 3 rd year	1	11.000	0.001
3 rd year vs. 4 th year	1	0.600	0.439
4 th year vs. graduates	1	2.814	0.093
Graduates vs. translators	1	6.287	0.003

Relationship with acceptability

Chi-squared test – internal support	<i>df</i>	χ^2	<i>p</i>	<i>V</i>
1 st year vs. 2 nd year	2	2.024	0.363	0.26
2 nd year vs. 3 rd year	2	3.251	0.197	0.36
3 rd year vs. 4 th year	2	1.186	0.553	0.18
4 th year vs. graduates	2	0.703	0.704	0.14
Graduates vs. translators	2	1.141	0.565	0.16

Relationship with acceptability

Chi-squared test – predominantly internal support	<i>df</i>	χ^2	<i>p</i>	<i>V</i>
1 st year vs. 2 nd year	2	1.348	0.510	0.11
2 nd year vs. 3 rd year	2	1.227	0.41	0.10
3 rd year vs. 4 th year	2	1.782	0.410	0.14
4 th year vs. graduates	2	2.321	0.313	0.18
Graduates vs. translators	2	3.394	0.183	0.18

Relationship with acceptability

Chi-squared test – predominantly external support	<i>df</i>	χ^2	<i>p</i>	<i>V</i>
1 st year vs. 2 nd year	2	1.881	0.390	0.20
2 nd year vs. 3 rd year	2	2.709	0.258	0.20
3 rd year vs. 4 th year	2	3.982	0.137	0.21
4 th year vs. graduates	2	2.503	0.286	0.18
Graduates vs. translators	2	0.605	0.739	0.11

Relationship with acceptability

Chi-squared test – simple external support	<i>df</i>	χ^2	<i>p</i>	<i>V</i>
1 st year vs. 2 nd year	2	9.059	0.011	0.51
2 nd year vs. 3 rd year	2	0.586	0.746	0.12
3 rd year vs. 4 th year	2	2.809	0.246	0.22
4 th year vs. graduates	2	6.948	0.031	0.40
Graduates vs. translators	2	7.667	0.022	0.54

14. Type of internal support [decision-making]

No statistical tests were performed due to the low number of observations registered in the automatised internal support category.

15. Total time taken [efficacy of the translation process]

Comparing groups	Kruskal-Wallis <i>H</i> test (4) = 31.778; <i>p</i> = 0.001; η^2 = 0.27		
1 st year vs. 2 nd year	<i>U</i> = 120.5	<i>p</i> = 0.001 (Bonferroni corrected)	<i>r</i> = 0.54
2 nd year vs. 3 rd year	<i>U</i> = 159	<i>p</i> = 0.088 (Bonferroni corrected)	<i>r</i> = 0.51
3 rd year vs. 4 th year	<i>U</i> = 209	<i>p</i> = 0.105 (Bonferroni corrected)	<i>r</i> = 0.45
4 th year vs. graduates	<i>U</i> = 102.5	<i>p</i> = 0.015 (Bonferroni corrected)	<i>r</i> = 0.60
Graduates vs. translators	<i>U</i> = 153.5	<i>p</i> = 0.001 (one-tailed)	<i>r</i> = 0.51

Relationship with acceptability	r_s	95% CI	p
1 st year	0.41	-0.01; 0.71	0.057
2 nd year	-0.39	-0.69; -0.01	0.050
3 rd year	-0.07	-0.44; 0.32	0.728
4 th year	0.40	0.03; 0.67	0.036
Graduates	-0.54	-0.80; -0.09	0.022
Translators	-0.28	-0.56; 0.06	0.109

16. Time taken at each stage [efficacy of the translation process]

No statistical tests were performed for this indicator.

17. Total time spent on searches [use of instrumental resources]

Comparing groups	Kruskal-Wallis H test (4) = 7.930; p = 0.094; η^2 = 0.07		
Graduates vs. translators	U = 256.5	p = 0.135 (one-tailed)	r = 0.19

Relationship with acceptability	r_s	95% CI	p
1 st year	-0.13	-0.53; 0.32	0.579
2 nd year	-0.04	-0.44; 0.37	0.855
3 rd year	-0.01	-0.38; 0.38	0.988
4 th year	0.27	-0.11; 0.59	0.161
Graduates	0.07	-0.41; 0.52	0.785
Translators	-0.04	-0.37; 0.30	0.816

18. Time spent on searches at each stage [use of instrumental resources]

Comparing groups - orientation	Kruskal-Wallis H test (4) = 18.386; p = 0.001; η^2 = 0.16		
1 st year vs. 2 nd year	U = 157.5	p = 0.001 (Bonferroni corrected)	r = 0.38
2 nd year vs. 3 rd year	U = 233	p = 0.037 (Bonferroni corrected)	r = 0.28
3 rd year vs. 4 th year	U = 364	p = 0.999 (Bonferroni corrected)	r = 0.04
4 th year vs. graduates	U = 248	p = 0.999 (Bonferroni corrected)	r = 0.02
Graduates vs. translators	U = 250	p = 0.037 (one-tailed)	r = 0.21

Comparing groups - development	Kruskal-Wallis H test (4) = 13.128; p = 0.011; η^2 = 0.11		
1 st year vs. 2 nd year	U = 198.5	p = 0.999 (Bonferroni corrected)	r = 0.21
2 nd year vs. 3 rd year	U = 169	p = 0.037 (Bonferroni corrected)	r = 0.48
3 rd year vs. 4 th year	U = 354	p = 0.999 (Bonferroni corrected)	r = 0.06
4 th year vs. graduates	U = 189.5	p = 0.999 (Bonferroni corrected)	r = 0.25
Graduates vs. translators	U = 139	p = 0.001 (one-tailed)	r = 0.56

Comparing groups - revision	Kruskal-Wallis H test (4) = 17.181; p = 0.002; η^2 = 0.15		
1 st year vs. 2 nd year	U = 173	p = 0.682 (Bonferroni corrected)	r = 0.31
2 nd year vs. 3 rd year	U = 119	p = 0.002 (Bonferroni corrected)	r = 0.63
3 rd year vs. 4 th year	U = 316	p = 0.999 (Bonferroni corrected)	r = 0.16
4 th year vs. graduates	U = 215	p = 0.999 (Bonferroni corrected)	r = 0.15
Graduates vs. translators	U = 274	p = 0.214 (one-tailed)	r = 0.13

The relationship between this indicator and acceptability was not calculated.

19. Variety of resources [use of instrumental resources]

Comparing groups	Kruskal-Wallis H test (4) = 11.962; p = 0.018; η^2 = 0.10		
1 st year vs. 2 nd year	U = 120	p = 0.005 (Bonferroni corrected)	r = 0.52
2 nd year vs. 3 rd year	U = 286	p = 0.999 (Bonferroni corrected)	r = 0.12
3 rd year vs. 4 th year	U = 313.5	p = 0.999 (Bonferroni corrected)	r = 0.17
4 th year vs. graduates	U = 171	p = 0.632 (Bonferroni corrected)	r = 0.32

Relationship with acceptability	r_s	95% CI	p
1 st year	0.55	0.15; 0.79	0.011

2 nd year	-0.07	-0.46; 0.34	0.749
3 rd year	0.29	-0.10; 0.60	0.146
4 th year	0.36	-0.02; 0.65	0.061
Graduates	-0.08	-0.43; 0.30	0.755

20. Number of searches [use of instrumental resources]

Comparing groups	Kruskal-Wallis H test (4) = 10.981; $p = 0.07$; $\eta^2 = 0.09$		
Graduates vs. translators	$U = 257.5$	$p = 0.139$ (one-tailed)	$r = 0.18$
Relationship with acceptability	r_s	95% CI	p
1 st year	0.04	-0.40; 0.46	0.865
2 nd year	0.10	-0.31; 0.49	0.633
3 rd year	0.03	-0.35; 0.41	0.871
4 th year	0.27	-0.12; 0.58	0.170
Graduates	-0.01	-0.48; 0.46	0.955
Translators	0.17	-0.18; 0.47	0.340

21. Variety of searches [use of instrumental resources]

Comparing groups	Kruskal-Wallis H test (4) = 8.151; $p = 0.086$; $\eta^2 = 0.07$		
Graduates vs. translators	$U = 288.5$	$p = 0.305$ (one-tailed)	$r = 0.08$
Relationship with acceptability	r_s	95% CI	p
1 st year	0.49	0.08; 0.76	0.023
2 nd year	0.09	-0.32; 0.48	0.663
3 rd year	0.39	0.01; 0.67	0.047
4 th year	0.23	-0.16; 0.55	0.241
Graduates	-0.20	-0.61; 0.29	0.418
Translators	0.37	0.04; 0.62	0.030

22.1. Acceptability by group

Comparing groups	Kruskal-Wallis H test (4) = 17.792; $p = 0.001$; $\eta^2 = 0.14$		
1 st year vs. 2 nd year	$U = 185.0$	$p = 0.033$ (Bonferroni corrected)	$r = 0.36$
2 nd year vs. 3 rd year	$U = 322.0$	$p = 0.999$ (Bonferroni corrected)	$r = 0.08$
3 rd year vs. 4 th year	$U = 390.0$	$p = 0.999$ (Bonferroni corrected)	$r = 0.11$
4 th year vs. graduates	$U = 281.5$	$p = 0.999$ (Bonferroni corrected)	$r = 0.05$
Graduates vs. translators	$U = 249.5$	$p = 0.171$ (one-tailed)	$r = 0.16$

22.2. Acceptability by rich point

Comparing groups – chi-squared test				
RP1	df	χ^2	p	V
1 st year vs. 2 nd year	2	10.385	0.006	0.46
2 nd year vs. 3 rd year	2	0.486	0.784	0.10
3 rd year vs. 4 th year	2	5.552	0.062	0.31
4 th year vs. graduates	2	1.420	0.492	0.16
Graduates vs. translators	2	3.207	0.201	0.24

Comparing groups – chi-squared test				
RP2	df	χ^2	p	V
1 st year vs. 2 nd year	2	1.928	0.381	0.20
2 nd year vs. 3 rd year	2	0.781	0.677	0.12
3 rd year vs. 4 th year	2	0.038	0.981	0.03
4 th year vs. graduates	2	0.057	0.972	0.03
Graduates vs. translators	2	0.579	0.749	0.10

Comparing groups – chi-squared test				
RP3	df	χ^2	p	V
1 st year vs. 2 nd year	2	0.815	0.665	0.13

2 nd year vs. 3 rd year	2	0.829	0.661	0.12
3 rd year vs. 4 th year	2	1.964	0.375	0.18
4 th year vs. graduates	2	2.805	0.246	0.23
Graduates vs. translators	2	0.238	0.888	0.06

Comparing groups – chi-squared test				
RP4	<i>df</i>	χ^2	<i>p</i>	<i>V</i>
1 st year vs. 2 nd year	2	2.343	0.310	0.22
2 nd year vs. 3 rd year	2	2.816	0.245	0.23
3 rd year vs. 4 th year	2	2.342	0.310	0.20
4 th year vs. graduates	2	0.353	0.838	0.08
Graduates vs. translators	2	0.787	0.675	0.12

Comparing groups – chi-squared test				
RP5	<i>df</i>	χ^2	<i>p</i>	<i>V</i>
1 st year vs. 2 nd year	2	0.291	0.865	0.08
2 nd year vs. 3 rd year	2	0.721	0.697	0.12
3 rd year vs. 4 th year	2	12.186	0.002	0.46
4 th year vs. graduates	2	1.965	0.374	0.19
Graduates vs. translators	2	0.253	0.881	0.67

22.3. Acceptability by factor

Comparing groups - meaning	Kruskal-Wallis <i>H</i> test (4) = 5.303; <i>p</i> = 0.258; η^2 = 0.04		
----------------------------	---	--	--

Comparing groups - function	Kruskal-Wallis <i>H</i> test (4) = 25.356; <i>p</i> = 0.001; η^2 = 0.20		
1 st year vs. 2 nd year	<i>U</i> = 203.5	<i>p</i> = 0.915 (Bonferroni corrected)	<i>r</i> = 0.29
2 nd year vs. 3 rd year	<i>U</i> = 328.5	<i>p</i> = 0.999 (Bonferroni corrected)	<i>r</i> = 0.06
3 rd year vs. 4 th year	<i>U</i> = 285.5	<i>p</i> = 0.029 (Bonferroni corrected)	<i>r</i> = 0.33
4 th year vs. graduates	<i>U</i> = 342.5	<i>p</i> = 0.999 (Bonferroni corrected)	<i>r</i> = 0.03

Comparing groups - language	Kruskal-Wallis <i>H</i> test (4) = 19.966; <i>p</i> = 0.001; η^2 = 0.16		
1 st year vs. 2 nd year	<i>U</i> = 182.5	<i>p</i> = 0.036 (Bonferroni corrected)	<i>r</i> = 0.37
2 nd year vs. 3 rd year	<i>U</i> = 320.5	<i>p</i> = 0.999 (Bonferroni corrected)	<i>r</i> = 0.08
3 rd year vs. 4 th year	<i>U</i> = 286	<i>p</i> = 0.043 (Bonferroni corrected)	<i>r</i> = 0.32
4 th year vs. graduates	<i>U</i> =	<i>p</i> = 0.999 (Bonferroni corrected)	<i>r</i> = 0.12

APPENDIX 6. GLOSSARY³⁸

Acceptability: Refers to translation product quality. Used in PACTE's research on *translation competence* and *translation competence acquisition* as a cross-cutting indicator to establish the relationship between the results obtained for different indicators of variables under study and the quality of subjects' translations. Defined in terms of whether or not the solution to a translation problem effectively: (1) communicates the meaning of the source text; (2) fulfils the function of the translation (within the context of the translation brief, the readers' expectations, and genre conventions in the target culture); and (3) makes use of appropriate language. Solutions may be acceptable, semi-acceptable or non-acceptable.

Bilingual sub-competence: A sub-competence of PACTE's *translation competence* model. Defined as predominantly procedural knowledge required to be able to communicate between two languages. It comprises pragmatic, sociolinguistic, textual, grammatical and lexical knowledge.

Decision-making: A variable in PACTE's research on *translation competence* and *translation competence acquisition*, related to the *strategic* and *instrumental sub-competences*. Defined as decisions made during the translation process which involve the use of automatised and non-automatised cognitive resources (internal support) and of different sources of documentation (external support) to solve translation problems.

Efficacy of the translation process: A variable in PACTE's research on *translation competence* and *translation competence acquisition*, related to the *strategic sub-competence*. Defined as the relationship between the time taken to complete a translation task, its distribution between stages, and the *acceptability* of solutions.

Extralinguistic sub-competence: A sub-competence of PACTE's *translation competence* model. Defined as predominantly declarative knowledge, both implicit and explicit, about the world in general, and field-specific. It comprises bicultural, world, and subject knowledge.

Falling evolution: A type of evolution in *translation competence acquisition*, according to PACTE. Defined as a fall in values between the start and completion of training, with each value between consecutive groups being lower than or equal to the previous one.

Identification and solution of translation problems: A variable in PACTE's research on *translation competence* and *translation competence acquisition*, related to the *strategic* and *knowledge of translation sub-competences*. Defined as the subject's identification, characterisation and solution of difficulties when carrying out a translation task.

Instrumental sub-competence: A sub-competence of PACTE's *translation competence* model. Defined as predominantly procedural knowledge related to the use of documentation resources and information and communication technologies applied to translation and translation technologies: dictionaries of all kinds, encyclopaedias, grammars, style books, parallel texts, electronic corpora, search engines, assisted translation software, machine translation software, terminology database management software, post-editing software, etc.

Knowledge of translation sub-competence: A sub-competence of PACTE's *translation competence* model. Defined as predominantly declarative knowledge, both implicit and explicit, about translation and aspects of the profession. It comprises knowledge about how translation functions (translation units, processes required, methods and procedures used, types of problems, etc.); and knowledge about professional translation practice (the labour market, types of translation briefs, target audiences, etc.).

Knowledge of translation: A variable in PACTE's research on *translation competence* and *translation competence acquisition*, related to the *knowledge of translation sub-competence*. Defined as the subject's implicit knowledge about the principles of translation.

Mixed evolution: A type of evolution in *translation competence acquisition*, according to PACTE. Defined as a combination of rising and falling evolution between the start and completion of training.

Non-evolution: A type of evolution in *translation competence acquisition*, according to PACTE. Defined as no difference in the values between consecutive groups between the start and completion of training.

³⁸. The terms in italics in the definitions are themselves defined in the glossary.

Psycho-physiological components: Part of PACTE's *translation competence* model. Defined as different types of cognitive and attitudinal components and psycho-motor mechanisms. They include: cognitive components such as memory, perception, attention and emotion; attitudinal aspects such as intellectual curiosity, perseverance, rigour, critical spirit, knowledge about and confidence in one's own abilities, the ability to measure one's own abilities, motivation, etc.; and abilities such as creativity, logical reasoning, analysis and synthesis, etc.

Rising evolution: A type of evolution in *translation competence acquisition*, according to PACTE. Defined as a rise in values between the start and completion of training, with each value between consecutive groups being higher than or equal to the previous one.

Strategic sub-competence: A sub-competence of PACTE's *translation competence* model. Defined as the procedural knowledge required to ensure the efficacy of the translation process and to solve problems arising. Strategic competence is an essential component of *translation competence* as it controls the translation process by activating and creating links between all other sub-competences as they are required. It is used to: plan the process and carry out the translation project (choosing the most appropriate method); identify translation problems and apply procedures to resolve them; evaluate the process and the partial and final results obtained in relation to the end purpose; and activate the different sub-competences and compensate for any shortcomings in them.

Translation competence acquisition: Defined in PACTE's translation competence acquisition model as a spiral, a non-linear process in which novice knowledge (pre-TC) evolves into TC, involving the development of sub-competences and learning strategies.

Translation competence: Defined in PACTE's translation competence model as the underlying system of knowledge, abilities and attitudes required to be able to translate. Translation competence involves declarative and predominantly procedural knowledge. It comprises five sub-competences (*bilingual*, *extralinguistic*, *knowledge of translation*, *instrumental* and *strategic*) and activates a series of *psycho-physiological components*.

Translation project: A variable in PACTE's research on *translation competence* and *translation competence acquisition*, related to the *strategic sub-competence*. Defined as the subject's approach (dynamic or static) to the translation of a text and of the units it comprises within a specific context.

Use of instrumental resources: A variable in PACTE's research on *translation competence* and *translation competence acquisition*, related to the *instrumental sub-competence*. Defined as documentation strategies used when consulting resources in electronic format (websites, dictionaries and encyclopaedias on CD-ROM, etc.).