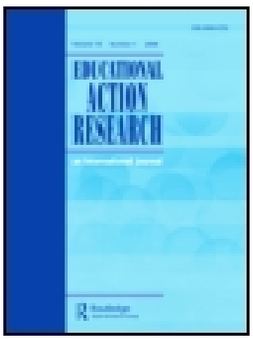

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Changes in school through a long-term project of action research. Building bridges between school practice and Roma communities

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ABSTRACT

This study was carried out within the framework of a long-term action-research project in schools in Barcelona, Spain, in which a large concentration of pupils come from diverse ethnic backgrounds and are at risk of social exclusion. Specifically, the introduction of the *Fifth Dimension* (5D) model into these schools is analysed here. 5D is an action-research programme partnership between universities and schools that has been developed by an international network of researchers and is based on a collaborative learning model, supported by information and communication technologies and by the university students themselves. This study focuses on the changes produced in school practices and in the role of teachers. Over a 4-year period, qualitative data were elicited from four primary school using linguistic methods, field notes, interviews and focus group with educators involved in the process. Cultural Historical Activity Theory was used as a framework for analysis of the coded data. The findings highlight the key elements for the change: consistency in the mediating devices (proposed tools and activities), reorientation of classroom interactions into forms of collaboration, the changing roles of the teachers to include design, observation and help, and the development of inter-institutional partnerships based on permanent negotiation.

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Collaborative learning; service-learning; cultural historical activity theory; social exclusion

Introduction

Shere Rom is a long-term action-research project, initiated in 1998 and motivated by high levels of failure and dropout of students belonging to Roma communities in the Barcelona area. The project, developed over the last 18 years both outside and inside school, is a community of practice inspired by the theoretical framework of Cultural Psychology (Cole 1996; Rogoff 2003), which assumes that the construction of knowledge is a social process, based on the participation and collaboration between agents with different knowledge and experience. Their encounter, under certain circumstances, occurs in the zone of proximal development, in which the apprentice, by means of the expert's guidance, progressively acquires the autonomy needed to carry out new tasks (Vygotsky 1978).

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The main feature of the Cultural Psychology approach in education is the emergence of meaning in the relationships between school practices and social environments, that is, how educational practices make sense alongside community practices (Gutierrez and Rogoff 2003; Hedegaard et al. 2012). This topic is especially relevant in social environments where there are strong discontinuities between the family culture and its practices and the school culture and its practices. Therefore, the research line developed over the last four decades by Michael Cole and the Laboratory of Comparative Human Cognition (LCHC), carried out in Africa in the 1970s, (IAP. Laboratory of Comparative Human Cognition 1982) and in minority environments in the United States in the 1980s (Vásquez, Pease-Alvarez, and Shannon 1994; Cole 1996), focusing on the context dependence of meaningful learning, shows that participants consistently learn better through practices that form a part of activities that focus on goals that can be identified by the members of their community. Schooling therefore becomes ineffective when it is transferred without any substantial modifications to cultural and social environments that are different to those in which it was created. Consequently, it cannot be a meaningful activity for a significant proportion of this population.

Seeking alternatives, the LCHC has been developing the *Fifth Dimension (5D)* programme: a set of activity systems based on collaborative learning mediated by ICT tools (Information and Communication Technologies), with the participation of university students using a service-learning programme, and organised around forms of cooperation between universities and community institutions (Cole 2009; Cole, Packer, and Kobelt 2014; Macias Gómez-Estern, Martinez-Lozano, and Vasquez 2014). Such systems are intended to be sensitive to local cultures, since they are based on practices that are meaningful for the participants and orientated towards explicit goals. This research-action programme has been developed by means of an international network (Cole 2006; Nilson and Nocon 2005), whose node in Barcelona is the Shere Rom Project, an activity aimed at building bridges between school practice and Roma communities by means of community institutions (Padrós et al. 2014a).

The 5D model was originally developed in informal environments and it has been described in various reports (Blanton, Greene, and Cole 1999; Brown and Cole 2002; Cole 2005; Gallego 2001; Underwood, Pranzetti, Toloza, 2014; Vasquez 2007). 5D is an activity system that develops a new and flexible institutional frame, looking for links with community culture, free of school constraints. This low level of institutionalization allows it to be adapted to fit very different contexts (civic centres, cultural associations, boys and girls clubs and libraries).

Over the past decade, 5D has also been employed as a reference in the development of collaborative work experiences in schools in some European countries (Nilson and Nocon 2005). It is assumed that this transition to formal education has been possible due to the plasticity of the model; i.e. its flexibility, possibilities of mutating, developing and adapting to the context, in such a way that it can be incorporated into each school in a different way after objectives and tasks have been negotiated. The aim of this study was to obtain evidence on whether this is indeed the case.

Why return to school?

In Spain, the Roma social group shows the highest rates of failure at school. There are important discontinuities between school and families in terms of goals, values and

practices, and many Roma families distrust this institution (Lalueza 2012; Lalueza and Crespo 2009; Lalueza et al. 2016). The 5D model, oriented towards avoiding the constraints and systems of authority that characterise most traditional schooling, was therefore identified by us as an opportunity to build an educational space collaboratively with a Roma community and, in 1998, our research team designed, under the supervision of the LCHC, a 5D activity system called 'la Casa de Shere Rom' within the premises of a local Roma association. The power relationships, the division of work, rules and roles within this community were fundamentally different to those in school practice, yet they provided literacy skills that are usually acquired only in school.

The 5D international experience (Cole 2006), and the local Shere Rom Project (Padrós et al. 2014b) show that this model promotes motivated participation and meaningful literacy. Therefore, why return to school? This institution is the meeting place for children and adolescents from different social and cultural groups, and is usually the only one. It is potentially a powerful tool for social inclusion, despite the fact that its institutional practices usually redirect it in just the opposite direction to inclusion. Since schooling is compulsory, minority children spend a considerable number of hours every week in a, for them, non-sense activity. So, after 5 years developing educational practices in 'la Casa de Shere Rom', a new challenge emerges: to introduce those practices in a school, with the goal of provoking changes in this institution considering that in essence the classroom can be regarded as an activity system in which teachers and pupils (subjects) use semiotic and material tools to learn (Fraser 2010), so what happens if we change the rules?

The framework of the study: an action-research project

The study we are presenting here falls within the framework of the Shere Rom action-research project, and the development of several communities of practices based on the 5D model in formal and informal environments. All sites are in areas with a population that is at risk of social exclusion, and pupils who belong to minority groups such as Roma and members of migrant families from North Africa, Pakistan and Latin America.

Following a previous stage developing the model in after-school programmes, over the past 7 years Shere Rom has been developed in seven primary and three secondary state schools all located in the metropolitan area of Barcelona.

Each of the projects starts when the research team presents the schema of the project to the staff of the school. This proposal consists of two models of activity: the *Labyrinth* model, for second to fourth grade children at primary school, and the *Troubadours* model, for fifth grade children upwards.

The *Labyrinth* model reproduces the original model of the 5D developed in California and consisting of playing a series of computer games that involve literacy and other school skills, mediated by a set of devices: a maze, a set of task cards, a wizard, explicit rules discussed by all members of the group and a virtual environment based on the Moodle platform.

The programme is usually carried out in the school's computer room during regular school hours. Each university student works collaboratively with two children, sharing a computer, for a semester or a whole course, with the aim of completing the maze. The student writes field notes after every session and notes down the progress of the

children in a passport. At primary school, from fifth grade upwards, the *Troubadours* model maintains some devices such as the *Moodle* platform, the wizard and a set of rules. However, here participants are involved in a more open activity, collaborating in groups of three, four or five children and one university student, to develop *digital storytelling*. The process essentially consists of choosing a theme for the story, developing a storyboard, recording the scenes, then editing and presenting that story.

Every 'site coordinator' is also a member of the research team. They are postgraduate students involved in the research project, with earlier experience participating as Service-Learning student in other 5D sites. Their role is to connect school management team and teachers involved in the project with the research team in order to design the 5D activity in every grade at school, with the collaboration of teachers and under supervision of research team; to guide undergraduate students in the interactions with children; to collect field notes informing about activity; to collaborate with the evaluation of the activity development.

Every year, the school and the research team work together to evaluate the experience and agree on maintaining, changing or terminating the activity. In addition, each year a workshop is organised with the teachers of all the schools, as well as a meeting with the older children in the university to show their digital stories, and to get a taste of university life (an unknown experience in their environment).

Method of analysis

The main aim of our study is *to assess how participants adapt to the introduction of a 5D activity (initially designed as an out-of-school system activity) at school. Participants include not only teachers and pupils, but also university students and researchers*. This study thus aims to analyse the process of change in participants when involved in a new activity at school, based on their own record of experience, for several years after the intervention begins. For analysis, we used a linguistic method as this allows us to raise broad issues that cover a wide range of aspects – current, past or future – about the individuals or about significant elements that concern them.

Our study is performed within the framework of the whole action-research project in which researchers and teachers collaborate in designing activities, with the aim of improving their educational practices according to a methodology oriented towards *the analysis of needs, design, development and evaluation of the process*.

The analysis presented in this paper concerns four of these centres (we have selected for this study only elementary schools were the project was running more of 2 years): school A, where four grade groups of children participated each year for 4 years; school B, three groups each year for 4 years; school C, three groups each year for 2 years; school D, one group each year for 2 years. Throughout the course, a weekly session was held for each group, jointly organised by the site coordinator (the assigned university researcher) and a school teacher. The study is grounded in the narratives produced by all of these (site coordinators and teachers) involved from the beginning in each school project.

Field notes kept by each site coordinator, based on their experiences, were periodically shared with the rest of the research team and formed the basis of interviews with each site coordinator (four – one for each school) plus a focus group (four focus groups) of teachers involved in the project at each school. Guidelines for interviews and focus

groups were not designed to establish a strict order, but rather as a checklist to check that all aspects were addressed. The interviews were organised in the form of a long conversation, in such a way that the discourse of the interviewed person would adopt a narrative form, closer to the format of a life story. This format was chosen in order to obtain a narrative of the historical development of the activity.

Based on the contents of these first interviews, a set of questions aimed at guiding the focus group for each school involved in the project was drawn up. Each group was made up of between three and five people (the whole team of teachers involved in the project in every school), and the duration was between 90 and 120 min. This discussion format was adopted to promote the confrontation of points of view and the contrast of experiences, encouraging the use of spontaneous justifications.

Although the primary data we use in our study comes from the personal records and thoughts of study participants, the site coordinators (giving voice to the university perspective) and the teachers (giving voice to the school perspective), the huge volume of information obtained from the transcripts made it necessary to segment and group them into codes, after the triangulation performed by the researchers responsible for this study. The attached table shows the codes used and the topics that arose from the texts. Thus, while a linear reading of transcripts from each interview and focus group permitted analysis of the development processes of the activity at each site, the ATLAS.ti 7.0 tool (Muñoz 2004) facilitated treatment of the quotes grouped by categories, to identify which processes were present at all sites Table 1.

It is important to clarify that this study is not performed on an 'external object', as it is carried out by the research team members who have, for 4 years, participated in the course of the project, in the decision-making required by the intervention, and in negotiations with the various actors. Thus, interpretation of the results is made from a

Table 1. Categories that emerged from ATLAS.ti analysis.

CATEGORY FAMILY	CODE
Contextual Factors (CF)	CF academic CF social CF family CF cultural
Contradictions (CO)	CO discipline CO power relations CO diversity attention CO directive leadership style CO resistance CO expectations
Children's Changes (CC)	CC competence CC ICT CC social CC motivation
Teacher's Changes (TC)	TC teacher TC coordinator
School's Changes (SC)	SC role SC organization SC negotiation SC change orientation SC progressive expansion
5D Model (MO)	MO ICT MO student

certain position that is defined by the involvement of the researchers in the project development and results.

Results

Analysis of interview transcriptions provided us with two kinds of descriptions and explanations. Firstly, they gave information about the school situation at the beginning of the project. All schools were found to be in a critical situation as a result of their drift towards a cultural ghetto, resistance to change and contradictions observed since the project was started. Secondly, the transcripts gave information about the process of change in teachers and pupils.

Initial restrictions and resistance to change

A first unit of analysis refers to contextual factors, which give information about the teachers' perception of their students' academic, sociocultural and family profiles. This perception is corroborated by the project coordinators (quotes related to those categories were provided by both groups). The teachers describe their relationship with the families as distant and sometimes conflictive, and cultural diversity is not perceived as beneficial in any sense. Teachers reveal that children show serious learning difficulties in the major academic areas and there are varied forms of absenteeism, low motivation and a high failure rate at school, observations that were supported by interviewees with low trans-generational academic expectations.

> These are boys and girls who live in families that are highly unstructured, with both financial and cultural problems, and their ambitions do not go further than being what their parents are or emulating the ambitions of others in their surroundings. They do not aspire to a job or studies, they do not aspire to self-improvement, and from that point on they are highly unmotivated students. They have no interest in learning and they show no interest in school, and this makes our job difficult [teacher at School C].

A second unit of analysis focuses on contradictions that emerge between the school's educational model and the 5D collaborative learning model. It contains the *discipline* codes, *power relationships, directive leadership* towards the style, *model of attention to diversity, expectations* and *resistance* enforcement of the project, which altogether provide a view of the difficulties in implementing the activity and the opportunities for change.

In this scenario, an instructional top-down model based on transmission prevails, with a dynamic of assistance, compensation and control, supported by a very hierarchical structure of relationships, rigid roles, and homogenisation, all of which represent the opposite of an inclusive strategy.

> I believe that the first thing the Principal said in the first year we arrived was very clear: 'when the children come to the school, they are not Gypsies, or Payos, or Moroccan, or anything; we are all the same. Thus, the phrase I am a Gypsy, or I am a payo is not valid here, as we are all the same' [coordinator School B].

> I believe it is more a project designed to ensure compulsory education for all, but without guaranteeing its quality, that is, an excessive preoccupation with attendance, order, keeping things as they should be within a school [coordinator School B].

The fear of loss of control and authority translates into disorderly group work, and this is addressed with control, promoting an instructional model that is very different to that of the collaborative work which the project intends to introduce. To start with, the activity generated by it is perceived as being a threat to discipline, thereby increasing insecurity amongst the teachers. In three out of four of the schools studied, we found resistance to changing roles in favour of a more egalitarian relationship with students.

> For teachers who have not been involved in the project, the view they have is that we make noise and that the students are not under control, and are running around in the corridors… Order is important, and this was something that we also had difficulties with. [coordinator School B].

Changes in those involved and in the institutions

In all the interviews and focus groups, references were made to a distinct process of change in both children and teachers. These changes cannot be understood if they are introduced and analysed in an isolated way, as they are created within the interaction of several elements which shape the situation or scenario in which these changes develop. The three elements that can together be interpreted as catalysts of the changes. They are: the use of ICTs, the influence of the students and the change in teacher and student roles.

The use of ICTs is reflected in the children's development of the skills needed to use them and in a positive change in their self-perception as competent students and in their self-esteem (reflected in the relationship between the quotes relevant to the categories CC ICT – CC motivation). However, an improvement in these skills is also perceived in the teachers themselves, who begin to incorporate them into their teaching performance (MO ICT – TC teacher). Lastly, the use of these tools has brought about a number of organisational changes in the school (MO ICT – SC organisation), stemming from the use of ICTs.

The university students are presented as a powerful artefact. They provide a very different kind of interaction with children than teachers. Children are engaged in more affective relationships with a figure that is not perceived as an evaluator, but rather as an older and experienced peer who invites them to explore new activities. However, the perturbation caused by this new figure also affects the teachers, who need to redefine the network of relationships from a binary (teachers – pupils) to a triadic (teachers – university students – pupils) schema.

The use of ICTs, together with the introduction of a new figure to the students, has caused both teachers and students to develop new roles. Thus, the new mediating devices have modified teaching practices to a point where people have transformed their participation in the system of activity. We shall analyse this in detail.

Changes in the pupils

The teachers provide a large number of quotes referring to changes in the pupils. They describe how the rapid acquisition of skills in the use of ICTs instils greater confidence in the pupils in their abilities, which in turn makes them more motivated to use them.

> The level of communication has increased their self-esteem. They've started talking with knowledge now, which must give them satisfaction as far as ICTs are concerned [teacher School A].

The teachers perceive that the use of ICTs have allowed boys and girls to play a more active role. In some cases, they encourage the use of technological tools to develop tasks beyond the participation in the project sessions.

> Even with the P.E. teacher they do hip-hop and they tape it. This attitude is spreading new technologies into other areas… Some kids go into their class and it is as if they were in Shere Rom. We start talking and the kids talk as if they were adults… Now we are doing a task searching for different types of lyrics. The opportunity to communicate what they are doing is now available to them [teacher School A].

In addition, both teachers and coordinators agree that the active and expert role that boys and girls experience during the activity leads, in turn, to changes in the social sphere. The children slowly acquire more confidence and control over the activity, becoming the protagonist of their own learning process. The activity in itself is shown as an appropriate place for interaction, but its sense and quality is found to be mediated by the changes in the roles being built, in a context of horizontal social relationships in which communication, cooperation and even affection play an important part. All of this is happening in an improved social climate.

> Another thing they have made me discover is the cooperation between them. During class, when one of the pupils understands something better he is capable of explaining it to the others better than I could teach it. The explanations they give each other are very funny, I have fun with them. They understand much better than I if I try to make myself understood. They do better at everything that involves collaboration… they show more respect towards each other and also know their peers better because sometimes the arguments between them occur out of ignorance. Now they work more with each other, they understand themselves better, and that is why they respect each other a little more [teacher School C].

The improvement in the quality of the interactions, and the increase in the children's skills and motivation to learn about ICTs contrasts with the image of the children obtained in the quotes categorised as contextual factors (restrictions), related to their academic and social capacities, which were defined as deficient.

Changes in the teachers

The category which refers to the changes in the teachers corresponds mainly to quotes from the site coordinators (interviews and field notes), as the teachers basically focus on the changes in pupils more than on themselves.

Changes in the teachers are related to changes in the pupils involved in the activity, energised by the new role they are all experiencing. In the first phase, the teacher occupies a peripheral position within the activity, observing the system of interaction between university students, site coordinators, children and ICT tools during practice. With time, the teacher adopts a more active role, moving progressively from the peripheral position to a more central participation. However, compared to the ordinary classroom, the teacher's functions have changed. In the activity, the teacher represents the role of organiser, guide or counsellor in the teaching-learning process, meaning she

or he goes from playing a role of *transmitter of knowledge* to one of *promoter of exploration*.

> It helps us too, to teach our students, to learn in a different way, to motivate them, to look after the diversity we have in the classrooms. It allows us to do our job in a more personalised way, so that every child keeps up to his/her level, to his/her rhythm, mmm… it motivates them more, makes them think more because if they don't click on what they have to click on they are forced to think in order to continue. It may make manipulation easier. In most of the cases when information is visual it reaches them faster. This makes progress better [teacher School B].

Just as with their students, teachers' perceptions of being better trained in using technologies, plus their direct participation in the activity and the change in role experienced, facilitates teacher motivation and involvement in the project. This means that they become autonomous in their revision of and reflection on their own educational practices and transfer certain aspects to the classroom.

> One of the new teachers this year, says that she isn't clear about her role within the activity, nor any specific role, and therefore feels she has not contributed anything. Another teacher expresses a similar feeling, that she also felt lost within the activity to begin with, but little by little she better understood her guiding role to be more an organizer of the class. [coordinator, school C]

Changes in the schools

At the time the interviews were conducted, the schools were in different stages of the process of appropriating the activity. The teachers who had recently been incorporated into the project's activities began to understand what the activity entailed, beyond the mere operational aspects (SC roles). Those teachers who had been there for longer, and who had more experience in the project, together with the coordinator researcher, were involved in a process of permanent negotiation (SC negotiation-TC teacher-TC coordinator), with the aim of developing new ways of coordinating and organising the activity in order to build new roles.

> The project has given us new ways of working within the school, which is why, I believe, we signed up. The aim is to search for a very different methodology to that which we are used to, which will help us … not us but our students … to learn things in another way and to be more motivated … Things that have changed for the better, mainly the methodology. We work in areas of the curriculum such as language as well as media, mathematics, or maybe art or computers … we work differently to the way we used to work in the classroom [teacher School B].

Upon analysing the quotes, we found a close link between organisational changes (SC organization) and the changes in the roles of the participants (SC roles). The negotiation processes not only involve the need for greater coordination, but we also find that the implementation of the project has promoted a learning process in the field of ICTs (TC teacher – MO ICT), and also in that of new methods and strategies of teaching in the framework of cooperative work.

> We are teachers and are used to sharing learning, to working with a certain methodology, to working in a very different way to the way we usually do. It is something that comes from

> the outside, that we have to work on, that we have to assimilate, and I believe that without the help of this team it would have been impossible [teacher School C].

Changes in everyday practice of the teachers in classroom are much slower than changes observed in the 5D Activity, but long-term observation in school provides clear evidence:

(1) 5D activity initially justified and limited as practices in digital literacy, evolve to support learning in general literacy and language.
(2) Teachers collaborate in work teams to design tasks of diverse curricular areas connecting 5D activity and regular classes.
(3) Collaborative learning and peer monitoring, introduced in the school through 5D is transferred to the rest of the class time.

They are not abrupt changes, but rather a progressive transformation in class management in relation to the new role acquired by teachers. So, 5D activity seems to contribute to teachers considering that they themselves are not the main source of information, and that the interactions of the children with their schoolfellows and with university students was more effective for working in the proximal development zone. Thus, observing and listening to their pupils is now more relevant than older methods, because designing activities based on interactions is now a priority for information 'transfer'.

So, new requirements for coordination of teachers are introduced into schools, together with new routines focused on observation and design at a new pace that reflects the diversity of children (a factor that is neglected with the transmission model). However, all these changes are only indicators of a new potential for transformation. Only a complete transformation of the school as a system would be sustainable in the long term.

Discussion

By introducing the 5D at school, an extremely optimistic forecast would predict a radical transformation of the institution. This seems unlikely to occur, at least for the present. The Shere Rom project involves just 2 h per week of activity for each group, spread throughout the year. The impact on the other 28 h per week of school for each child would still be indirect and long term, to the extent that the appropriation of the model by teachers participating in those 2 h would involve a change in practices for the rest of the time.

At the other extreme, the most pessimistic forecast would involve a failure of the attempt to change the school practices, since the rules of the institution and its institutionalised practices would lead to an assimilation of the 5D, transforming it into merely an incorporation of new tools that are used according to the old rules, without changes in the purpose of the activity, and even less so in people who participate in it.

Instead, the experience we analyse here is more modest than the first forecast, but more hopeful than the second. After the 5D model has been developed over 4 years in schools, educational practice has been transformed. The 5D model experience changes

when incorporated into the institutional framework of the school, but the school practice also changes when the 5D is introduced, acting as a systemic disturbance. Although the above results have been obtained from studying processes that are common to the four schools, it should be explicitly noted that each school has adhered to their own process of continual negotiation and mutual learning within research teams, school management and the teachers involved. Just as the 5D experiences outside of school are different depending on the context in which they are developed, there are also differences between the 5D activities implemented within the schools. Even so, we have found some common traits in the processes studied.

In our study, the starting point shows that pupils' participation usually remains on the periphery, demonstrating resistance to the practice of learning, and resulting in an average level of skills that is below their real skills and the level of their school year (in keeping with the findings about Roma community of Crespo et al. 2012; about other ethnic groups, Langhout 2005). We have also seen that this peripheral participation is related to the fact that the school goals are not shared by pupils' families. In contrast, both teachers and site coordinators report greater pupil involvement in 5D project tasks and highlight the key elements responsible for this change: (1) the introduction of new ways of using ICTs, (2) a new distribution of tasks as a result of the relationship with university students, and (3) the new perception of these tasks. The use of ICTs provides an unusual (for these children) experience of successful skills, encouraging experienced children to be considered as agents. The main contribution of the university students lies in the style of interaction they develop with the children, validating them as legitimate partners, and easing the transition from spectators to active participants. As a result of this dialogue-based interaction, the tasks are not perceived as an exhaustive exercise, but as a practice that is orientated towards shared goals. The activity becomes meaningful through the experience of using tools, the configuration of new practices and awareness of goals (finality). Changes in the children can therefore be understood in the transition from a peripheral to a central participation (Wenger 1998).

We can consider that this activity, in which practices and goals, common language and meaningfulness are shared between researchers, teachers, university students and school children, constitutes an *idioculture*, 'a system of knowledge, beliefs, behaviours and customs shared by members of an interacting group to which members can refer and employ as the basis of further interaction' (Fine, cited by Cole 1996). The reported reduction in absenteeism and the increase in motivation to master the devices is an indicator of the transition to a central participation that is manifested in the changes in the social relationships between children, and between them and their teachers, as much as in the appearance of new ways of relating to the students. This new context of activity is closer to practices of daily life, which often involve collaboration, permanent negotiation, shared goals, and role definition.

Teacher professional development is understood as a process where dimensions such as action and reflection, autonomy and net-working are combined (Zehetmeier et al. 2015). All these dimensions are reflected in the changes provoked in the teachers' role, so they follow a characteristic path in the participation: from central to peripheral, and from there to central again. In the regular classroom the teacher plays a central role as a source of transmission of information and as a controller of behaviour. However, the introduction of a system of collaborative activities is, at first, a relegation of this role, as

the activity is focused on the interaction between school children and university students, as well as on the use of mediating devices such as ICT, the *wizard*, or the *task guides*. Yet with time, the appropriation of the activity by the teachers leads to a progressive shift from the peripheral position to a central one by development of a new role which is totally different to the one played in an ordinary classroom. The time has now come to take the initiative to encourage participation in the design of activities, prepare the devices, give feedback to the students, introduce the activity and its devices to the children, provide personalised help, revitalise the group and mediate through the figure of the wizard when dealing with situations of conflict and confusion and collaboratively collecting data and evidence about our changing practices. Lastly, in response to the need to look for solutions to deal with the contradictions generated whilst performing the role, the teachers create new action protocols to guide the activity, through dynamic conversation (Bleach 2016) which are more relevant to the model of collaborative learning. So, introducing collaborative activities is not enough to explain the changes. We must consider the role of collaboration between researchers and teachers in decision-making, in joint recruitment of participants, as well as in the level of commitment to change.

These changes are better understood by referring to the Activity Theory (Leontiev 1978; Wertsch 1985; Cole 1996; Engeström 2001). Each activity involves a particular kind of relationship between a subject and object via the mediating tools, within a community ruled by norms and organised according to the kind of labour division. Here the mediating tools have been changed by introducing a particular use of ICTs, and this has been achieved by work division, redefining the roles; the composition of the community has been changed, with the input of students and the coordinator; the rules have changed, re-establishing what is allowed and what is not; the objectives have been redefined to make them more accessible to the students. All of these changes generate strong resistance in the school, known for being a system which tends to maintain its homeostasis. However, the development of contradictions between a usual practice and an innovative practice becomes the driving force for change, leading to the transformation of the subjects, for both children and teachers, by reflecting on the existing and the new, confronting the old role and the one they are building. We then have a new interaction between participants, tools and structures in a social environment (Lasky 2005).

However, the changes in the classroom cannot be accounted for by lineal causality in a closed system. On the contrary, these changes happen at the junction of two activity systems: the school, which provides a historical background and some practical knowledge on educational performance, and the research team, which provides a collaborative model that also has a historical development outside of the school (the 5D international network). The new activity in the school is a new object (Engeström 2001); its development cannot be explained without examining the interactions of both systems. Thus new teaching developments towards collaborative learning in the school must be understood in turn as a collaborative process of permanent negotiation with the university team. The site coordinator is part of the research team, functioning as an advisor and guiding the teachers on how to introduce the activities. This explicit voice of the 5D model, together with the modelling of the activity, enhances the possibilities of collaboration and inter-institutional exchange, at the same time as it

makes the existing contradictions flourish between the school's educational practice based on a model of knowledge transmission and the new proposal based on a participative model (Rogoff 2011).

Conclusions

This study reflects on the progress of 4 years of action research. Over this time we have seen a change in the activity – it has become a 'third object', distinct from the model (5D) proposed by university researchers, but also different from daily practices carried out by teachers at schools. A definition for this new activity comes from the collaborative learning of all participants, over the years, in which varied opinions, aims and motivations come together to construct a collective narrative for change.

Our main interest here has been to study the changes arising from the introduction of 5D in schools, changes that cannot be explained with a linear casuistry model. On the contrary, introduction of a 5D activity in schools would seem to be more like a systemic disturbance, in that the result may be explained in terms of adaptations by the participants in their search for a new equilibrium after the disturbance. The key elements of this process of systemic change, compatible with those described by other authors, such as Bevins and Price (2014), are: (1) assignation of new mediator devices; (2) reorienting classroom interactions, basing them on collaboration; (3) adjusting teachers' roles to include design, observation and assistance; and (4) developing collaborations between institutes based on continued and permanent negotiations.

But convergence of the processes studied at our four school sites does not follow a general model for the introduction of a 5D activity into schools. First of all, all four schools are socioculturally similar in terms of student origins and teacher experience. Second, the same research team has been responsible for all processes, analysing testimonials and insights, negotiating with schools and teachers, and promoting collaborative reflection on the part of all site coordinators. And despite all of this, although we have focused here on analysis of the prevailing aspects of the four schools, there have been considerable differences in the processes experienced at each school. Therefore, a first limitation of the scope of this study is a recognition of its eminently local character. For this reason, we must give explicit warning about any generalization of results with respect to attempts to introduce the 5D model into schools.

Other limitations of this study include potential research possibilities that have not been addressed here. First, the focus of our study on innovative intervention in the classroom, with teachers as participants, needs to be complemented with a broader focus on the historical processes occurring in the institution, that is, the dynamics of change that affects the school as a whole and the management of school processes (Frantzeskaki, Loorbach, and Meadowcroft 2012). Changing practices and participant changes may provoke institutional changes and both types of changes (personal and institutional) are complementary and necessary. If there is personal change, but there is no institutional change, if no team takes charge of the project and this project does not become the aim for the centre as a whole, sustainability is compromised, as the different kinds of dynamics that it promotes generate strong resistance. The new practice, in order to be sustainable, needs to be institutionalised. The sustainability of our action

research project, in the long term, should allow us to carry out a longitudinal study that addresses these issues.

Second, action-research involves transformations in the different participants, and the sustainability of the project will also depend on activities being meaningful for participants. In as much as the main goal of the project is precisely that students have a more meaningful school experience (Padrós, Sánchez-Busqués, Lalueza, Crespo and Lamas, 2014b) , we must also be aware of its meaning for teachers. Teacher identity may be compromised when faced with an innovative project, in as far as it depends on the sense they themselves make of the project, as well as their own personal goals, and supposes support for teachers in the often exasperating process of dealing with contradictions (Lamas and Lalueza 2016).

Not to be forgotten are other study participants, university students. In our analysis they have been addressed as 'instruments' of change, but we do not consider them as participants that learn and change. In other words, we see them as 'catalysts' of change, from the teachers' and university researchers' perspective, but without heeding their own views. Measurement of the processes of authentic learning and identity change in students that participate in service-learning programmes, addressed in studies such as that by Macias Gómez-Estern, Martinez-Lozano, and Vasquez (2014), is a starting point for the next steps in our analysis.

Lastly, other key actors are the university researchers. Analysis of the inferences of researchers is a classic discussion in action research (Dick 2004). The need to conceptualise researchers as participants whose functions include being an agent for change, a knowledge broker, a thoughtful and reflective scientist and a process facilitator (Wittmayer and Schapke 2014), has been widely discussed. Thus, still pending, is an analysis of those processes that have been meaningful to researchers, a necessary part of explaining the sustainability of the whole action research project.

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