DISENGAGEMENT WITH SCHOOL: CLASSROOM INVESTIGATIONS AS A POSSIBLE SOLUTION

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Abstract

We live in a highly complex society that presents its citizens with many challenges and problems. In order to respond it, by making informed decisions, citizens have to appropriate certain key competencies, for instance, reasoning, communication, life long learning, among others. So education has never been seen such a central issue to promote individual growth as nowadays, and also a central issue to enact societal and economical growth. Despite education playing a central role in the international agenda, the failure of the school systems to teach all the students has never been so visible. Nowadays, one of the greatest challenges is to provide an answer to those students who have dropped out of school, or to those who have disengaged from it. Several actions have been developed, some of which concern pedagogic actions. Activities based on investigations in science classes are seen nowadays as a way to enact key competencies, but also to involve students with their own learning. But, what make these activities so successful in getting to all students and, even more, to those who have disengaged from the school system? In this paper, we will discuss the impact of activities based on investigation in secondary students' involvement with school. Its efficacy seems to be related to identity issues. By changing classroom practices and relationships, not only among teachers and students, but also between students and school knowledge, this kind of activity allows the students to reconstruct new identities, where they can envisage new future paths.
Key words: *educational exclusion, classroom investigations, competencies, identity*.

Introduction

Dropping out rates are high in Portugal (Ministry of Education, 2006). In order to deal with it, Portuguese government has developed many actions, for instance reorganization of basic education curriculum (Law n. 6/2001, of 18th January) and the development of "second chance classes" (Law n. 453/2004, from 27th July). Both laws create a propitious context for rehearsing new, more flexible and student-centred pedagogies. Classroom investigations emerge as a useful pedagogy for promoting competencies development (Ash & Klein, 2003; Carlson, Humphrey, & Reinhardt, 2003; Hofstein, 2004; Wellington, 1998). Furthermore, research has shown that they are a powerful tool to re-conquer students who have disengaged school (Baptista, Carvalho, Freire & Freire, 2007; Carvalho, Freire, Baptista, Freire, Azevedo & Oliveira, 2008; Freire, Carvalho, Freire, Azevedo & Oliveira, 2009). In this paper, we will use classroom investigations' literature and identity framework to illuminate which characteristics of classroom investigations make it so successful among students at risk of dropping out.

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Study Contextualization

Never in history has education been so highly valued as nowadays. Indeed it is acknowledged in several international political documents as a fundamental right (European Council, 2006b, 2007; UNESCO, 2000, 2003). And as a fundamental right it should not be denied to anyone. Education is such an imperative topic, that transforming Europe in the world's most dynamic knowledge-based society is a central issue in EU's Lisbon Agenda (European Parliament, 2000). And that implies developing educational systems increasingly efficient.

Our society is complex and dynamic and in order to participate in it citizens have to appropriate certain competencies. This is quite evident in the case of science education. Science is part of the cultural and social heritage of Europe (Osborn & Dillon, 2008) and nowadays occupies a central place in our society. Not only is science a means to interpret and make sense of the physical world, but nowadays it is also an extremely important tool to understand social and ethical issues that emerge from science and technological developments (CE, 2002; NRC, 1996; Osborn & Dillon, 2008). So it is not enough to know a lot of scientific facts, or isolated scientific concepts that one cannot use or does not know how to use. Any citizen should appropriate a series of competencies that can support him/her in decision making concerning social and ethical issues related to science and technological development and in solving daily problems (European Council, 2006a; Galvão, Reis, Freire, & Oliveira, 2006; NRC, 2000; UNESCO, 2003). Substantive, procedural and epistemological knowledge, reasoning and communication competencies, social and scientific attitudes, and life long learning are some of such competencies (Galvão et al., 2006; Ministry of Education, 2000).

However, the data reveal a not so favourable situation concerning education. Indeed, as education becomes more central in the several political systems, failure of the educational system in getting to all the students is becoming more visible (European Council, 2006b, 2007; Smith, 2006; UNESCO, 2000, 2003). Not only is the number of students who drop out of school large, but also the number of those students who do not appropriate a series of essential competencies is increasing. Considering science education, there is an overall disengagement with sciences (European Commission, 2004) and a low level of scientific literacy (Autio, Kaivola & Lavonen, 2007; European Commission, 2004; Miller, 1997; UNESCO-ICSU, 1999).

Portugal is no exception. Data show a high rate of dropping out and a high number of students who does not succeed with school (Ministry of Education, 2006). Regarding the sciences, although results from international exams have been improving, those results are still below European averages (OCDE, 2002, 2003, 2006). In order to deal with this unfavourable situation, Portuguese governments have been developing several actions aimed at making schools more flexible with regards to their organization, teaching-learning strategies, and management of resources and curriculum. One of those actions consisted in the reorganization of basic education curriculum (Law n. 6/2001, of 18th January).

The national curriculum proposes a set of learning experiences that should be provided to all students and it is organized around a set of transversal and specific competencies related to subject areas, which are supposed to be appropriated during basic education (Abrantes, 2001; Law n. 6/2001, of 18th January). Indeed, it explicitly expresses that students' intellectual development should be based on problematic situations, that promote thinking and reasoning development. Ministry of Education (2000) states that curricular programs should centre on the essential. More than memorizing great amounts of information that is nowadays widely available, it is much more important to know how to look for pertinent information, how to systematize it and to evaluate its pertinence for the problem at hand and to explore its potentialities. Those competencies are considered nowadays essential and those competencies should be valued and developed. (p. 20)

Science curriculum of basic education was organized around competencies and learning experiences in agreement with the new governmental orientations (Galvão & Freire, 2004; Galvão et al., 2006; Law n. 6/2001, of 18th January). It emphasizes a constructivist approach to teaching and learning and values the endorsement of critical thinking strategies, the creation of inquiry

learning environments, and the promotion of self regulated learning based on problem solving and decision-making. As a result, the new science curriculum for basic education facilitates experiences with new pedagogies (Galvão, Neves, Freire, Lopes, Santos, Vilela, Oliveira & Pereira, 2002). Indeed, it acknowledges that for developing competencies such as substantive, procedural and epistemological knowledge, reasoning and communication competencies, scientific and social attitudes, teaching has to provide students with a series of different learning experiences (Galvão & Freire, 2004; NRC, 1996). Classroom investigation is one such teaching strategy.

Classroom investigations enact scientific thinking and science understanding (Ash & Klein, 2000; Carlson et al., 2003; Hofstein, 2004; Wellington, 1998). Furthermore, investigations are a powerful tool for re-conquering students who had disengaged from school already, by creating new contexts of participation, and by facilitating identity reconstruction and new ways to relate to school and to school knowledge (Baptista et al., 2007; Carvalho et al., 2008; Freire et al., 2009). But which characteristics of investigations facilitate changes in the way students perceive themselves as students, perceive school and school knowledge and relate to it? These were the guiding questions in this paper. In order to answer them, a number of previous studies using classroom investigations with "second chance" classes, composed of students at risk of dropping out, will be presented and discussed. "Second chance" classes are one of many government-developed initiatives for dealing with school abandonment. They provide education and training focussed on a specific profession and are designed to facilitate entry into an active life (Law nº. 453/2004, from 27th July). The special curriculum is based on practical activities and a philosophy of learning by doing.

Classroom Investigations

Portuguese curriculum for science teaching in basic schools has a constructivist focus, promotes Science-Technology-Society-Environment perspective and encourages the development of subject knowledge, reasoning, and communication competences as well as scientific and social attitudes (Galvão & Freire, 2004; Galvão et al., 2002; Galvão et al., 2006). Besides, it emphasizes that science should be taught through inquiry. Scientific inquiry involves complex reasoning as well as development of exploration processes (Ask & Klein, 2000) and many authors (Novak & Krajick, 2006; NRC, 1996; Woolnough, 1998) support its use in classroom as a way to increase students' engagement with their own learning and as a way to create successful learning situations. This conception is based on the idea of learning as an active process that implies changing the teacher's role from expositor to facilitator (NRC, 2000). Indeed, the teacher must engage students with new classroom activities that promote learning with conceptual understanding (Hewson & Hewson, 1989).

Investigations are one such classroom activity, one that is nowadays greatly recommended for classroom use (Leite, 2001; NRC, 1996; Woolnough, 1998). Classroom investigations are multifaceted activities that entail several actions: Making observations, questioning, searching for information on books, on Internet or on other sources, planning the investigation, revising previous knowledge, analysing and interpreting data by using different tools, answering initial question and communicating results (NRC, 2000). They start with problem identification, by using logical and critical thinking, and they involve consideration of alternative ways to find a solution. Problems are related to concrete situations experienced by students and can be explored by ways of open or closed questions, for which students do not know the answer (Woolnough, 1998).

According to Ash and Klein (2000), classroom investigations involve processes of exploration that arises from students' curiosity, interest and perseverance for understanding and solving a problem. With this approach students become a central pivot in the process of teaching-learning: Students' knowledge about the circumventing world is a starting point to develop classroom investigations and students' ideas, interests, questions and suggestions are essential to develop activities (Almeida, 2002; Ash & Klein, 2000; Carlson et al., 2003; Miguéns, 1999). Students learn by questioning, making predictions, developing hypothesis and creating models

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and theories and teacher has to help them connect their own ideas with scientific, founded ideas and to reflect on their learning (Almeida, 2002; Carlson et al., 2003; Miguéns, 1999).

These actions not only promote understanding but also the development of several competencies (Carlson et al., 2003; Madruga, 2002). According to Hofstein (2004) and Wellington (1998), classroom investigation can also enact social and communication attitudes, as they are based on the idea of knowledge as social and cultural construction (Vygostky, 1978). Indeed, investigations involve considerable periods of collaborative work; for instance when students negotiate plans, useful knowledge and information, material and resources selection, as well as when they make registrations of results, discuss it and take conclusions and finally when they mutually support themselves in order to complete assignments on time. All these potentialities of classroom investigation make it a central tool to be used in the new context of science education.

Identity Issues

According to a social-cultural perspective, learning emerges in social and cultural contexts, which are constantly changing and which affect and are affected by interactions, perceptions and practices (Palinscar, 1998; Perret-Clermont, 2004; Rogoff & Lave, 1984). Within this framework, we reconceptualized school (and classroom) as a community of practice. By doing so we are assuming that students in their school careers not only appropriate academic knowledge, but also develop new ways of acting and behaving, of perceiving (themselves and others), of relating to others and to knowledge. This will be determinant in the way they construct meaning about themselves as students and about their school experience (Gutierrez, Rymes, & Larson, 1995; Hand, 2006; Lave & Wenger, 1991; Nasir, 2002; Solomon, 2007; Wenger, 1998).

According to this perspective, learning consists of becoming a type of person within the school context (Gee, 2001), where several others relate to each other and share common practices. Modes of participation affect the way individuals interpret their experience and as such it affects identity construction (Wenger, 1998). Furthermore, social positions are also significant in identity construction (Gee, 2001; Hand, 2006; Holland, Lachiotte, Skinner & Cain, 1998; Wenger, 1998).

According to Wenger (1998), a practice is a way of talking by which individuals build meaning concerning their own experience. For instance, why am I doing this? What is my purpose? What is its usefulness for my life? So practice not only consists of developing a series of actions and interactions and an activity, but it also involves negotiating meanings about those actions and interactions and about the activity itself. Negotiation of meaning involves processes of participation and reification.

For being able to negotiate meaning, individuals have to become involved with activity and with others, since by that process of participation, individuals appropriate competencies, tools, and knowledge used to interpret experience and to build meaning about it. Through processes of reification, individuals are projected with (and project in others) a series of images, ideas, meanings that have a reality of their own (Wenger, 1998). So through reification, individuals are placed (and place others) in a position within a certain social and cultural space. Each position is projected with power, status, rights and legitimacy to develop certain expectations and behaviours (Archer, Hollingworth & Halsall 2007; Holland et al., 1998). As a result, by being reified in a certain position, individuals develop a perspective about their experience, about others and about their relationship with others that affect meaning construction. Furthermore, by facilitating access to certain tools (rules, norms, values, knowledge, material and symbolic resources), a position affects individuals' actions, relationships with others and interpretations of experience (e.g. modes of participation).

Individuals do not construct meaning in an empty social space. According to Wenger (1998), practice exists because there is a group of individuals who are involved with a process of meaning production and negotiation. This is a community of practice, according to Wenger's definition (1998). Becoming a member of a certain community implies becoming emerged in a certain figured world (Holland et al., 1998) that is composed of characters, who occupy certain

positions and who interact and relate to each other according to shared meanings. Figured worlds, in this sense, are important resources for individuals to interpret their actions, their relationships and their practice and also to guide their participation within that specific social context.

By negotiating meanings, individuals are also negotiating an identity. Who is he/she in that particular social context? What is expected from him/ her? What can he/she expect from others? Individuals negotiate their identity not only through processes of participation and reification, but also through their participation trajectories (Wenger, 1998). Indeed, definitions of who they were and who they expect to be also affect their experiences and meanings, and as such definitions constitute one essential element of their identity.

Classroom Investigations and Identity Reconstruction

As already stated, classrooms investigations have emerged as a possible solution for dealing with students who disengaged from school. Indeed, research has shown how they play an important role in changing students perceptions about themselves, about school knowledge and school (Baptista et al., 2007; Carvalho et al., 2008; Freire et al., 2009). But, what makes classroom investigations so special?

Classroom investigations are practical activities in science classes and students are its starting point. Indeed, classroom investigations are based on students' questioning about circumventing the world: There is one troubling question that interests them and makes them curious and students have to make a plan and execute it in order to answer their previous question. So students play a central role in this process: They question, they search for information and select what is relevant, they plan ways to solve their problem and implement their plan, and they interpret results and communicate them to others. So, not only are they pivot elements in the process of teaching and learning, but their knowledge is considered central and valid. Everything turns around students' actions and knowledge, as expressed in the following dialogue.

> Interviewer – How did you learn?
> S_{28} – How? Well… we planned and then implemented the experiment.
> S_{26} – When teacher approached us, we would present our doubts and difficulties.
> (…)
> S_{27} – We developed group work. First we thought and then we would discuss...
> S_{25} – I talked with my peers. We checked each one ideas and that allowed us to go further away. We all worked! (Taken from Baptista et al., 2007. Authors' translation)

This kind of activity, as can be observed in the previous dialogue, changes the teacher-student relationship and the role played by each of them. Students become pivot, and teacher becomes a facilitator of the learning process, as he/ she is supposed to support and guide students through the process of planning and implementing the investigation. So this kind of activity creates new contexts of participation (Cornellius, 2004; Perret-Clermont, 2004) and new social and cultural contexts in school and classroom.

According to more traditional social and cultural contexts, students have to listen to the teacher and to reproduce facts that he/ she presents. Traditional school is founded upon the figure of teacher as the expert and on the figure of students-who-know-nothing. So the expert (teacher) has to provide students with unique and superior knowledge and students have to assimilate it and to substitute their previous biased and incorrect knowledge (Gutierrez et al., 1995). Furthermore, teacher defines appropriate ways to relate to others and to behaviour. For instance, students are supposed to listen quietly and to accept what the teacher says. Within this context, students have reduced possibilities of producing and negotiating meaning about what is valid knowledge and about what is meant to be a student and a teacher (Gutierrez et al., 1995).

This issue is particularly salient in students who are at risk of dropping out, whose school histories are characterized by constant failure and disengagement with school. In the course of

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their school history, these students had been reified in an unfavourable position - they are the unsuccessful and disturbing students, who have no capacities or competencies (Carvalho et al., 2008; Freire et al., 2009). This position is projected with low status that influence how individuals sees themselves and others, and legitimizes certain expectations and behaviours, originating modes of non participation (Freire et al., 2009). For instance, placing students in this position (unsuccessful and disturbing students) legitimizes reducing teacher-student interaction as a way to control behaviour and legitimizes interpreting students' doubts not as real difficulties, but as disinterest and disturbing behaviour (Freire et al., 2009). By reducing interaction with these students, their possibilities of participating become also reduced. As a result, reified positions (and images associated to it) get imposed on these students and become constitutive elements of their identities (Freire et al., 2009). Indeed, they come to perceive themselves as the unsuccessful students, with no capacities and with no possibilities of succeeding at school (Baptista et al., 2007; Carvalho et al., 2008; Freire et al., 2009), as can be observed in the following dialogue.

> Interviewer: What do other students think about you?
> S12: They neither like us nor dislike us.
> S10: That is what you think? I think that they think that we are stupid.
> S7: You do not agree?! But we have failed quite a few times! During meetings they must say: those students they do not learn and they exert bad influence over the others! (…) (Taken from Carvalho et al., 2008)

However, from the moment that they become pivot element in teaching and learning process, the participation context changes. Now students can participate in producing and negotiating meanings. Indeed, by developing classroom investigations, students (and teacher) negotiate what is relevant knowledge, what is worth being investigated, how to investigate and with what resources. They even negotiate appropriate means of relating and of behaving (Galvão et al., in press). Another important point is that, as they control the process of teaching-learning, they control their own learning and are able to live experiences of success. Students explain this point.

> Interviewer – What were your difficulties?
> S_{20} – In the beginning, I didn't understand anything about planning.
> S_{21} – Conclusions… and having to write…
> S_{23} – Sometimes, even implementing the experiment.
> S_{20} – But, that happened during the first classes!
> Interviewer – Why do you say that it was during the first classes? What happened?
> S_{20} – Well, as we developed more classroom investigations, we started understanding how it works. We called the teacher one or twice because we had doubts, but during the last classes we called her fewer times. (Taken from Baptista et al., 2007. Author's translation)

By being able to complete assigned activities with success, these students start thinking that they can learn and succeed, which is, considering these particular students, a totally different experience from the one they had during their previous school history. In addition, the successful experience facilitates the challenging of positions that had been previously imposed (Baptista et al., 2007; Galvão et al., in press). They are no longer the unsuccessful students, but the students who are able to learn.

Those two issues – participation and the challenging of reifications, are essential, particularly in students whose school history is characterized by disbelief in their own potentialities, and by devalued identities, as already mentioned. Successful experiences associated with participation make it possible to renegotiate positions – from a position of incompetence to a position of competence (Freire et. al, 2009). So, both processes facilitate not only changing their current school experience and associated meaning, but also modifying their perceptions of what they were

(past) as well as their images projected in the future (who they can become). Students' identity was rebuilt, and with it, students' interpretations of their current experience, and expectations concerning the future. One teacher described her experience with classroom investigations and its impact on students like this:

> It was a movie about the research developed at CERN, about physics and people who work at CERN. They kept on asking: 'And what about us? Will we be able to work there one day?' 'I like this a lot'. So, the activity ended up motivating the "environment and radioactivity" school project, in which they weren't supposed to participate. But they ended up being involved with it, as a result of this activity. So they loved this activity. They even liked the part related to biology and cancer treatment. They asked a lot of questions related to their lives. They liked it a lot, a lot. (Taken from Galvão et al., in press)

By changing classroom social and cultural context, classroom investigations facilitate students' negotiation of meanings and their identity reconstruction. Their position within classroom social and cultural context change and as such meanings attached to activities, to actions and to relationships also suffer modifications. Many students start envisaging new careers for their future, new images of themselves in the future and dropping out becomes only one among other possibilities, and for some of them a possibility less valued than others.

Final Considerations

We live in a highly complex society that presents its citizens with many challenges and problems. So, in order to be able to participate in it, citizens have to appropriate certain key competencies, for instance, reasoning, communication, life long learning, among others. But this is also a highly competing and selective society and citizens are constantly put to the test. Only the best performers will succeed.

Competencies are nowadays seen as a goal to pursuit, but the educational system takes time to change and student assessment is still often based on isolated, meaningless facts. This contradiction is reflected in students' attitudes in relation to innovative practices. Those students for whom pursuing further studies is a life goal are the ones who oppose innovative practices most strongly. Indeed, they do not believe that what they learn from these practices will be of any use for obtaining good marks (Galvão, Reis & Freire, 2008).

There is no doubt that students who participate within classroom investigations develop important competencies – critical thinking, communication, argumentation, just to mention a few. But will these competencies be contemplated in traditional assessment methods? And according to a different perspective, will these competencies be of any worth for answering traditional tests and national examinations? Will students taught by innovative practices outperform other students in national exams? Will their performance improve? Although education should not be reduced to this dimension, this is an important point to take into consideration: Is it worth developing several key competencies, but at the same time not succeed in traditional methods of assessment?

The students whose situation was discussed within this paper were potential drop-out students, for whom school was not an option for their future. But classroom investigations changed their current experience at school and their own projects for the future. Some of these students started envisaging new future careers and proceeding further studies was one of those possibilities. But, how will they perform on national examinations? Will their performance be better than if they had been provided with traditional teaching strategies? We might argue that if they had remained with traditional teaching strategies, they would have dropped out of school. But, the truth is that classroom investigations changed their identities as students – they perceive themselves now as competent students who can succeed. Will students taught by way of classroom investigations be prepared to answer national examinations and other traditional assessment methods and to the competencies evaluated there? This is an issue that deserves future study.

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