

Planting the seeds of Action Research for the revitalization and professionalism of Mathematics teachers

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Abstract

Teachers with many years of experience often do not have the same enthusiasm as at the beginning of their career. My aims in this research were to study what influence Action Research has on Mathematics teachers' revitalization and professionalism, and to study which strategies might bring teachers to be involved in the processes of Action Research. For this last purpose I developed a Booklet through which teachers can be introduced to such a strategy. I worked with two Sicilian high school teachers in an intervention that took place in classes at 2nd and a 3rd grade (15 to 17 yrs.). I involved them individually in the processes of Action Research through two projects based on this strategy, using qualitative methodologies to collect my data. My role in this research was, to a certain extent, quite unusual since besides being a researcher, I was also supporter, advisor, and developer of the teaching and learning material. From the findings we can see that teachers involved in the processes of Action Research can indeed be revitalized, and several aspects of their professionalism can be influenced.

INTRODUCTION

Teaching, as other professions, is a job that within the years of practice could become routine, so it happens that teachers after many years of experience do not have the same enthusiasm as they did at the beginning of their career. Consequently, students, who are quite aware when a teacher is full of energy to teach or not, could be affected in their motivation and attitude towards school.

This research concerns the influence on teachers' professionalism and revitalization through the involvement of teachers in projects based on Action Research.

The reason why I chose Action Research as a method to revitalize teachers' energy in their professional practice is because it can be developed and conducted by teachers to solve their own problems in teaching (Carr & Kemmis, 1986; Kember & Gow, 1992; Gratton, 2004; Ferrance, 2000; Cohen & Manion, 1980 and 1984; Calhoun, 2002). Moreover they can continue doing small projects throughout their career, without the external help of a researcher. In this research I was interested in understanding how solving problems in teaching using Action Research as a method of (self-)discovery influences the teacher's energy to teach and the teacher's professionalism.

The Italian Scenario

The working conditions of the secondary school teachers in Italy are not such that can motivate teachers to change. In the Italian system teachers have a contract for life in teaching. This is on the one hand a very positive point in our society because it gives certainty to our teachers, but on the other hand, teachers often lose the enthusiasm and energy to teach during their career.

Wear and tear of experience is not the only factor for demotivation (Box 1). As a matter of fact, there are several aspects of the Italian educational system that might lead to teachers' demotivation. Throughout a teacher's career, the Ministry of Education and the schools promote in-service trainings (out of the regular teaching time), but it is up to each teacher to decide whether s/he attends them or not, because they are not compulsory. Participation in such training gives no extra promotion, because financial promotions are attained only by accumulation of years of experience.

Box 1 - Factors for teachers' demotivation

- 1) Contract for life
- 2) Lack of financially-based promotion (other than for years of teaching)
- 3) No evaluation for teachers
- 4) Frequent large and small scale education reforms
- 5) Introduction of the *educational debt*
- 6) Change in teaching hours
- 7) Change in social development

The fact that these in-service trainings are not compulsory means that the Ministry of Education does not have the right to assess or check teachers' in-service updating. Consequently, teachers do not feel the need to attend extra courses to increase their professionalism. Moreover, in the last few years teachers have experienced a succession of several large and small scale reforms. Reform represents a potential cause of stress by itself, and consequently demotivation. Unfortunately some reforms have caused changes in the educational system that might lead to further demotivation, for example, the introduction of the *educational debt*¹ and the change of teaching hours². Last, but not least, there is an obvious change in society that results in continuous behavioral changes of youngsters (Posh, 1996, pp. 63-64). Those changes sometimes happen so fast that teachers do not have time to get accustomed to them and find possible solutions. It can be said that there is a gap between the above described teaching world and the messages sent by the Ministry of Education.

Action Research

Action Research, according to A. H. Halsey (1972, p. 165) is small-scale intervention in the functioning of the real world and the close examination of the effects of such interventions. Kember & Gow (1992) attribute the birth of the phrase action research to Lewin, who in the 1950s used this term to describe a process of social research leading to social change, characterized by “active participation and democratic decision making”. Lewin’s ideas of action research can be summarized as comprising of four elements: planning, executing, reconnaissance, evaluating. In a definition adopted by a National Invitational Seminar on Action Research (quoted by Carr & Kemmis, 1986, p. 164-165; Altrichter et al., 2002) the terminology used by Lewin is slightly different for educational action research: *planning, acting, observing* and *reflecting* (Box 2).

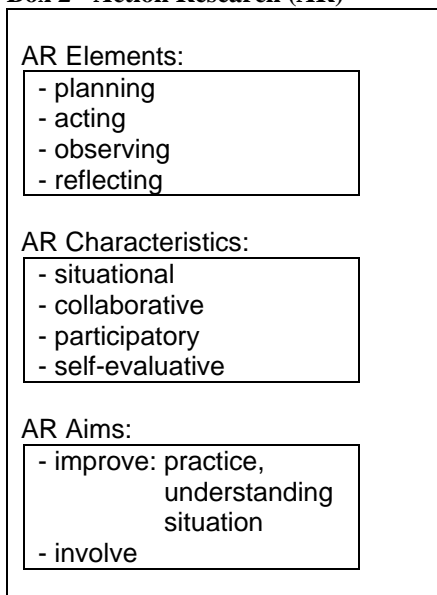
However, action research had its birth in education only in the 1970s, thanks to the writings of Stenhouse (1975, p. 142) in which he described his idea “that an educational science in which each classroom is a laboratory, each teacher a member of the scientific community”, giving birth to the idea of the teacher-researcher.

The elements before mentioned are the ‘active’ part of action research, but behind them we have four other features of action research. These elements are identified by Cohen & Manion (1980, 1984), that are its characteristics (Box 2): it is *situational*, because it is concerned with diagnosing a problem in a specific context and attempting to solve it in that context; it is usually *collaborative*, where teams of researchers and practitioners work together on a project; it is *participatory*, team members themselves take part directly or indirectly in implementing the research; and it is *self-evaluative*, because modifications are continuously evaluated in a spiral process.

¹ Procedure for students’ assessment for which students do not have to pass an exam in case of negative marks in one or more subjects, but have to attend recovery course.

² In the past, teachers had 15 teaching hours per week + 3 hours of stand-by. Nowadays they have 18 effective teaching hours per week.

Box 2 - Action Research (AR)



Carr & Kemmis (1986, pg. 165) clearly and succinctly describe the two essential aims of all action research (Box 2):

[...] to improve and to involve. Action Research aims at improvement in three areas: firstly, the improvement of a practice; secondly, the improvement of the understanding of the practice by its practitioners; and thirdly, the improvement of the situation in which the practice takes place. [...] Those involved in the practice being considered are to be involved in the action research process in all its phases of planning, acting, observing and reflecting.

Carr & Kemmis (1986, pp. 201-203) define three kinds of action research, when ‘facilitators’ work with teachers and others in establishing teacher-research projects. Depending on the facilitator role, the different kinds of action research are: *technical*, *practical* or *emancipatory* action research. Technical action research takes place when facilitators have coopted practitioners into working on externally-formulated questions which are not based in the practical concerns of teachers. Practical action research takes place when facilitators form cooperative relationships with practitioners, helping them to articulate their own concerns, plan strategic action for change, monitor the problem and effects of changes, and reflect on the value and consequences of the changes actually achieved. Emancipatory action research takes place when the practitioner group takes joint responsibility for the development of practice, understandings and situations, and sees these as socially-constructed in the interactive processes of educational life.

The research discussed in this article concerns *practical* Action Research because, as Johnston (1994) largely discussed, external intervention is most often needed to initiate action research with teachers. In fact, through this kind of action research, there is classic process consultancy with the facilitator in the action but not of the action (Kosmidou and Usher, 1991). However, later in this report it will be shown how the teachers of this study needed an involvement of the facilitator in the cooperation of the action.

Professionalism

The goal of this research was to discover whether the involvement in such research processes can contribute to the revitalization and professionalism of experienced Mathematics teachers. Before discussing the research in more details, an overview of the intentions regarding professionalism is now given.

It was decided to put attention on professionalism, because it is positively related to students' affective educational outcomes (Cheng, 1996). In this report the focus is narrowed only on some of the concepts of professionalism, taking into account only few of the indicators of professionalism (Box 4). In this way it is easier to indicate whether Action Research has any influence on some indicators of a teacher's professionalism.

In Box 03 it is shown how some of the elements and characteristics of Action Research might influence a teacher's professionalism is given.

Literature

For this research Action Research was used as a vehicle to achieve the goals; in the literature there are several examples of successful projects using such a strategy to benefit teachers both personally and professionally (Johnston, 1994; Elliott, 1990; Ferrance, 2000; Elliott & Adelman, 1996; Henson, 2001; McKernan, 1994).

In this research there was no attempt to teach the teachers Action Research, because for such an attempt, as also McKernan (1994) claims, *a single semester is not enough* and *action research is easier to do than to 'teach'*. The aim was instead to involve the teachers in the processes of Action Research, for which purpose the researcher took the role of facilitator in order to undertake a small project based on *practical* action research. The role of facilitator was in this case crucial, because people involved in education do not 'naturally' form action research groups; rather, some external motivation or intervention is usually needed (Carr & Kemmis, 1986; Johnston, 1994; Kosmidou & Usher, 1991). When the dual roles of both researcher and facilitator are assumed by the person working in *practical* Action Research, as in this project, methodological purity must be sacrificed to the needs of the research strategy being used (Elliott & Adelman, 1996). Stenhouse (1981) claims that the researcher/facilitator in this case must justify herself to practitioners, not practitioners to the researcher. Thus, by assuming the role(s) of facilitator-researcher, the researcher gained the trust and confidence of the teachers, which helped them become involved, and encouraged them to critically self-reflect, a very important practice for teachers (Hinett, 2002). A facilitator should provide the aid to create the conditions where self-reflection is more likely to be achieved (Kosmidou & Usher, 1991).

RESEARCH QUESTIONS

The problem identified in the Italian educational system is a gap between the real teaching world and the professional teacher described by the Ministry of Education. This gap might be due to teachers' demotivation, which often happens to teachers after some years of experience. In this research it was aimed to find out whether Action Research has any influence on teachers' motivation. This problem concerns teachers of all subjects, but the focus of this research is on Mathematics teachers only.

The first research question is:

RQ1: What contribution does the involvement of experienced Mathematics teachers in a practical Action Research project make in their revitalization?

The traditional response to the gap mentioned is to resign oneself and keep on teaching in the way one has always taught and therefore follow one's predecessors' footsteps. The expected outcome of involving teachers into the processes of Action Research is to obtain a different and positive response to the traditional one, as for example through an awakened interest in students' learning needs.

Revitalization and motivation are not the only aims of this research. It was also aimed to understand if Action Research has any influence on the professionalism of a teacher, and in particular to discover if it has a positive influence. So the second question is:

RQ2: What contribution does the involvement of experienced Mathematics teachers in a practical Action Research project have on their professionalism?

Regarding a teacher's professionalism, in this research the focus was on the following indicators: teaching and reaching the majority of the students; updating one's teaching and having interest in other colleagues' strategies; having both content knowledge and pedagogical content knowledge, and study the topic/subject from different angles.

Lastly, there was an interest in identifying successful strategies which can bring teachers into the involvement of the processes of Action Research. It was provided more than one way to introduce the collaborative teachers to Action Research. Therefore the third research question is:

RQ3: How can a teacher be involved in the processes of a practical Action Research?

DESIGN OF THE RESEARCH

Methodology

In this research it was aimed to find a way to facilitate teachers to face their profession in a better way through the years. The researcher undertook this research having as a point of reference the principles of Action Research and with the aim to involve individually the teachers in two projects based on *practical* action research.³ Nevertheless it should be noticed that the teachers did not actually conduct Action Research, but they were involved into its processes through the researcher's support.

The researcher's role was a bit unusual, because it had a dual nature. On the one hand, the researcher studied the effects of the intervention, which could be considered as in-service training, aiming to the teachers' improvement of their motivation in teaching and professionalism. On the other hand, the researcher was involved with the teachers as *supporter*, *advisor*, *observer* and *developer*. As *supporter* the researcher collaborated with the teacher during the lesson planning and development of the learning activities phases. During the classes the researcher acted as an *observer* and mainly did not have any involvement in the teaching itself. In the Action Research phase, the researcher provided support to the teacher as *advisor* during the introduction and during the class meetings. Throughout the research the researcher gave full availability to *develop* teaching/learning material for the teachers involved in this study.

³ Practical action research is research in which the practitioners are supported by a facilitator (which in this case is the researcher of this study) to define their concerns, to plan a strategic intervention, and to observe and reflect on the effects of such intervention.

In order to study the possible effects of Action Research on teachers’ professionalism, teachers needed to be involved in the processes of a project based on practical Action Research such as *planning, acting, observing and reflecting*.

Box 03 - Influence of Action Research on a teacher's professionalism

AR elements	Influence on teachers:	Reasons:
planning the intervention	Self-monitoring through critical self-reflection	The planning might start from a critical self-reflection of the teacher, during which s/he can analyze the strategies s/he already adopted to study its limits, and plan new actions.
	Interest in other colleagues’ strategies	When planning strategies to overcome the teacher’s concerns, the teacher and the facilitator might explore other strategies, taking inspiration for example also from other colleagues.
	Keeness to study a topic/subject from different angles	In order to plan a strategy for action, the teacher and the facilitator might take into consideration using activities/strategies that explore the topic/subject from different angles.
using the intervention	Updates in their teaching	Using properly the intervention in one’s teaching means that the teacher is updating her/his teaching by using a different activity/strategy.
	Well organized good classroom environment	While using a new activity/strategy the teacher might put efforts in creating a good classroom environment, so that students can benefit of the new setting.
observing and reflecting on the effects of the intervention	Acknowledgement of students’ opinions and difficulties	Observing the effects also means to ask students their point of view. Teachers might take into consideration, for example, giving students a questionnaire to fill in.
	Updates in their teaching	At the moment of reflecting on the value and consequences of the changes achieved, the teacher actually just experienced to approach the topic/subject from a different angle.
	Consideration of others’ strategies	If students give suggestions about the new activity/strategy, teachers might take it into account.
	Personal content knowledge and PCK ⁴ of the subject	Experiencing a new activity/strategy might enable the teacher to discover new ways in which the students learn, or new approaches to reach their students.
	Keeness to study a	At the moment of reflecting on the value and

⁴ Pedagogical Content Knowledge (PCK) is a concept introduced by Shulman (1986, 1975), defined as “the ways of representing and formulating the subject that make it comprehensible to others” (1986, p. 9).

topic/subject from different angles	consequences of the changes achieved, the teacher actually just experienced to approach the topic/subject from a different angle.
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Box 4 - Indicators of Professionalism in teaching

I consider a teacher professional when s/he:

- teaches and reaches the majority of the students;
- updates her/his teaching;
- considers students as human beings, considering their problems, for examples;
- has pedagogical content knowledge (PCK) of the subject;
- monitors her-himself through critical reflection;
- has interest in other colleagues' strategies;
- is keen about studying a topic/subject from different angles;
- organizes a good classroom environment;

Instruments for Data Collection

The qualitative instruments to collect data consisted of: teacher pre-questionnaires, teacher interview and informal talks, the vice-headmaster interview, classroom observations, and students' questionnaires.

Pre-Questionnaire with the teachers:

The purpose of the pre-questionnaire was to find out more about the teacher, foster her/his curiosity, and initiate a process of reflection. Through the questionnaire it was possible to obtain information such as the teacher's experience in teaching and research, and some insight into her/his attitude towards the teaching profession. Analysis of the pre-questionnaire gave the researcher a first impression of the teachers' teaching style.

Interview and informal talks with the teachers:

The interview was an opportunity for the researcher to ask and discuss in a deeper way some of the points of the pre-questionnaire, such as: attitude toward teaching, teaching style, and possible differences with colleagues' teaching. In this way the teacher had the opportunity to reflect on the questions asked in the pre-questionnaire, and to formulate maybe more complete *a posteriori* answers. However, the teachers naturally talked about some of the questions from the questionnaire to explain better their point of views or opinions.

The informal talks, depending on the situation, had different designs and aims. The main goal of the informal talks was to discuss the teacher's opinion and point of view on the different stages of the intervention. I expected that through the informal talks I could obtain to get the teachers reflecting and thinking, and giving data about the effects of Action Research in their teaching and attitude.

Interview with the Vice-Headmaster:

The interview with the vice-headmaster was a strategy to discuss the cultural setting of the school, some details about the in-service trainings offered by the school and other issues related to the teachers' status in the school.

Class observations:

The researcher's class observations had a dual purpose: to inform the teacher with a perspective from *outside* on her/his teaching; and to provide data answering the research questions. The teachers used the researcher's class observation as an instrument to study their own practice and to have a broader view of their students' behavior and attitude during the class.

For the researcher, the class observations were an instrument to obtain a further insight into the effects of Action Research in the teachers' teaching and attitude.

Questionnaires for the Students:

The questionnaires for the students had a dual purpose: to inform the teachers about the intervention they did in their class; and to give the researcher a broader view, from students' perspective, of the teachers. The teachers used the questionnaires for the students as an instrument to ask their students opinion and suggestions about the intervention. For the researcher, the questionnaires for the students gave data to describe the Action Research undertaken by the teachers. Through the analysis of the students' answers, the researcher could study the effects on the teachers of Action Research.

Profiling the teachers

First of all it was needed a clear picture of the teachers, subject of the research. In this first part some generic information about the teachers were collected, such as years of teaching experience; attitude toward teaching Mathematics; and I identified some of the factors for teachers' demotivation in the teachers' talk and /or the teacher's pre-questionnaire.

The teachers' projects

Analyzing the transcripts and observations of the classes, it visible the extent to which the teachers and the researcher worked cooperatively in projects based on practical Action Research. The different aspects were how the concerns were articulated, strategic action for change was planned, problems and effects of changes were monitored, and how the teachers reflected on the value and consequences of the changes actually achieved (Carr & Kemmis, 1986). Following the principle of practical Action Research methodological choices were taken such as giving the teachers the chance to work on concerns they outlined; giving the teachers the freedom to refuse suggestions, and therefore planning together alternative strategies for the intervention and the observation of such intervention.

Towards the answer of RQ1

In order to answer this question it was considered a common response by teachers to the problem identified in this research, which is the teachers' demotivation and different reasons for it (Box 1). It is not uncommon that teachers resign themselves, keep on teaching in the way they have always taught, and therefore follow their predecessors' footsteps. In this research two teachers were involved in two different projects based on practical Action Research, and they were suggested different teaching styles or learning activities to adopt in their practice. Hence, one should be able to understand whether revitalization took place by analyzing if there was any change in the teachers' attitudes and reactions to the suggestions and therefore be able to answer the first research question. In fact teachers were given the opportunity to reject the suggestions, so that it would be possible to verify whether a spontaneous change took place.

Towards the answer of RQ2

It was showed how some elements of action research (planning, acting, observing and reflecting) might positively influence a teacher's professionalism. In order to answer this second research

question one should analyze the teachers' pre-questionnaires, attitudes and reactions in class during the involvement of the processes of Action Research. The analysis aims to identify events that can determine teachers' action or reflection, labeling them as indicators of professionalism. For events of action and reflection it is meant moments/parts in the transcripts in which is possible to identify actions that can have professional influence, such as taking into consideration suggestions; rejection/agreement and use of the suggested activities/strategies; critical reflection on teaching, strategies eventually adopted, others' opinions; and willingness to address students' problems.

Towards the answer of RQ3

In order to answer this third question the analysis of data should result in a description of each strategy adopted in the research, and the extent to which each strategy worked in the involvement of the teachers in the processes of Action Research. The pilot teacher's transcripts provide an additional source of comments and opinions concerning the potential use of the Booklet.

Piloting

In this research there was the opportunity to pilot the Booklet, which was a developed strategy to introduce teachers to Action Research. A pilot teacher read, commented and answered questions in the Booklet, and afterward discussed with the researcher possible uses of such a strategy as an introduction to Action Research. An analysis of this informal talk, and the pilot teacher's answers in the Booklet and on the pre-questionnaire provides an understanding of its possible uses.

ANALYSIS

An analysis of findings in this study is possible only after a description of the two teachers who participated in this research. One focus of this analysis is to find reasons for teachers demotivation, or fear of demotivation.

A description of the two teachers' project will follow

Mr. Frank⁵

Mr. Frank is a teacher with 35 years of teaching experience and very close to his retirement. From the way he talked and gave opinions about teaching Mathematics and described students' behavior I conclude he likes Mathematics, and that he would like to transmit his knowledge to his students. But when his students do not show interest towards his subject, he becomes frustrated and angry. Mr. Frank is a teacher with a rather peculiar attitude towards teaching. On the one hand he is content to go on teaching, but on the other hand he claims:

I would change my job. I don't know what I will find, but I will change (1.1 610-611, 1.2 47-48).⁶

One of the reasons for his dissatisfaction could be that his teaching has hardly changed since he began 35 years ago, while students have undergone a continual and rather rapid change.

Concerning his teaching aims the teacher claimed that he prefers the students to understand the theoretical part of Mathematics and to mathematize their thinking.

⁵ The names used in this article are not the real ones.

⁶ Notations in brackets refer to parts of the transcripts (Saeli, 2007). The first number refers to the transcript file; the italicized numbers to the line numbers. For example: 1.1: *195, 407-408*, means the transcript no. 1.1, line numbers *195* and *407-408*.

Since changes in the students do not go along with the teacher’s aims, the result is that the teacher becomes frustrated, and the students pay even less attention in his class to the point that some stay away from class for weeks at a time.

Mr. Frank seems to be a teacher with no openness to change, and whose reasons of frustration and demotivation are the educational debt and the students’ social change.

Ms. Giusy

Ms. Giusy is, from an Italian perspective, a relatively young teacher with 26 years of teaching experience. From her talk I got a strong impression of how much she cares about her students and how she tries to attract their attention and motivate them. One of her main aims is to approach students’ needs and to make mathematics classes more pleasurable, things that seem to make her an approachable, caring teacher.

I tried to approach their [students’] needs, to their requests and I did everything to try to make more pleasurable mathematics classes (2.10 62-63 and **Errore. L’origine riferimento non è stata trovata.**).

Ms. Giusy is a pragmatic teacher who has profited from her experience, learning from students and from her own mistakes. She believes that of course teachers need a good content knowledge, but an individual’s pedagogical content knowledge comes mainly through experience. She underlines how a good combination of both preparation and experience gives good results in class.

Further, she emphasizes how the actual situation and the students are different from the past. In her opinion the diversity among students is due to the many social changes throughout the years and the need to face new situations.

Even though the teacher did not seem to be demotivated, two factors apparently made her worry a bit: the fear that with the increase in teaching years the motivations to upgrade oneself might reduce; and the change in social development among students in a negative direction.

The teachers’ projects

The two teachers’ projects are summarized in the two tables below (Box 5 and 6), describing the following aspects: identification of a problem, proposed intervention to the problem, use of the intervention, instruments of intervention, teachers’ reflections on the intervention. The identification of the problem influenced the choice of the classes (2nd and 3rd grade) by each teacher.

FINDINGS

The goals of this research was to test whether Action Research can be a strategy to revitalize teachers after some years of experience, which means to help them to change in, for example, undertaking new activities or strategies in their teaching. Another aim of this study was to see if involving teachers in the processes of Action Research had any influence on their professionalism. The last aim was to learn about some of the factors that bring teachers into the involvement of the processes of Action Research.

Box 5 - Mr. Frank's project

Stage of the project	Description
The teacher identifies a problem	in the 2 nd grade 7 out of 17 students were unwilling to study

The researcher proposes interventions for the plan	- activities about Babylonian Mathematics ⁷ - use of group work
The teacher uses the intervention	the teacher uses group work in his class
The researcher gives instruments for the observation of the intervention	- the use of the researcher’s class observation - the use of students questionnaire
The teacher reflects on the effects of the intervention	- the teacher suggests improvement of group work - and considers students’ suggestions

Box 6 - Ms. Giusy’s project

Stage of the project	Description
The teacher identifies a problem	in the 3 rd grade the majority of the 21 students refuses to do the homework
The researcher proposes interventions for the plan	use of group work
The teacher uses the intervention	the teacher uses twice group work in her class (one of which spontaneously)
The researcher gives instruments for the observation of the intervention	- the use of the researcher’s class observation - the use of students questionnaire
The teacher reflects on the effects of the intervention	- the teacher suggests improvement of group work - and considers students’ suggestions

Influence on the teachers’ revitalization

In order to understand whether revitalization took place, one should analyze the change in teachers’ reactions and attitudes to the suggestions and different aspects of the processes of Action Research. The description of the two teachers’ reactions will follow.

Mr. Frank

At the beginning of this research Mr. Frank gave no sign of an attitude or willingness to change: he found his teaching to be the right one. However, later when he started engaging in the processes of Action Research, it became possible to identify moments of change in Mr. Frank’s teaching and attitude. In fact, not only he did agree to use group work in his class, during the group work

⁷ For further information see Radford, L., and Guérette, G. (2000).

organized with the researcher, there were signs of change as he began to adopt a different teaching style. Passing from a teacher-centered group work activity, he conducted a student-centered approach, by providing individual groups of students with help.

Ms. Giusy

From the beginning Ms. Giusy demonstrated an attitude and a willingness to change in order to address her students' needs. I had chance to observe that, in a way, this teacher had mainly a student-centered *way of thinking*, while her original teaching style could still be described as teacher-centered. Through the processes of Action Research it became possible to observe how Ms. Giusy changed her practice, by adopting a more student-centered teaching strategy during the group work approach. Furthermore, the teacher showed interest in adopting other strategies.

Summary

It can be said that involvement in the processes of Action Research might help teachers, since it has been shown how the two teachers participating in the two different projects exhibited signs of change in their practice. In fact, both teachers restructured their classes to include student-centered activities such as group work. This change was for Ms. Giusy a reason for an update and a way to find a handhold to prevent herself from becoming like *them* (her demotivated older colleagues). On the other hand it seemed that Mr. Frank was not aware of the change in himself, maybe because he was so close to his retirement that he did not have the willingness to accept the changes that actually occurred.

Influence on the teachers' professionalism

Participating into the processes of Action Research might influence a teacher's professionalism took in consideration in this study.

Mr. Frank's influence

An overview of how Mr. Frank has been influenced in his professionalism through this small project based on *practical* action research may be found in Box 7. Connections are made between some of the main events of my work with the teacher and the effects of such activities on the teacher's professionalism.

It can be said that Mr. Frank has been slightly influenced in his professionalism during his involvement into the processes of Action Research, probably because he was so close to his retirement.

Mr. Frank showed resistance to change at the beginning of this study but, as we have seen, through the processes of action research, he took the chance to change. Some details follow.

While we were planning an intervention to his problem (7 out of 17 students were unwilling to study) he agreed to use group work in his class. This means that he took into consideration others' strategies which he later used in his class. Use of group work in a class does not mean by itself to update one's own teaching, but this teacher achieved make a successful group work activity by adopting a new teaching approach, and thus updated his teaching. Through this new approach, Mr. Frank achieved also to organize a good class environment. In fact, from a scenario in which only one group was working on the task, he achieved that all the groups worked on the problem. Moreover on the questionnaire, the majority of the students positively commented that the class was an opportunity to help each other and understand better Mathematics.

That the teacher agreed to give the students the questionnaire is a sign that he acknowledged students' opinions and difficulties, we might say, for the first time. In fact this teacher, in the pre-questionnaire, claimed that *he never asked his students about his own teaching*.

While reading students' answers, Mr. Frank used one of the answers as a cue to consider his role in group work, and then critically monitored himself through reflection. This can be considered as the *momentum* in Mr. Frank's project, in which the teacher for the first time talked about himself as possible cause of a problem. This reflection brought the teacher to propose a suggestion for the improvement of group work, updating in this way his teaching, where group work represents a possible improved strategy to adopt.

Ms. Giusy's influence

It can be said that Ms. Giusy has been positively influenced in her professionalism during her involvement into the processes of Action Research. Evidence is found in her talk during the meetings and in my observations.

An overview of how Ms. Giusy has been influenced in her professionalism through this small project based on *practical* action research may be found in Box 8. Connections are made between some of the main events of my work with the teacher, and the effects of such activities on the teacher's professionalism. Ms. Giusy showed willingness to change since the beginning of this study, and she profited as this study influenced her professionalism. Some details follow.

While we were planning an intervention to her problem (the majority of her 21 students refused to do the homework), Ms. Giusy agreed to use group work in her class, which means that she took into consideration others' strategies. She showed further interest in other strategies since, once I showed her the activities about Babylonian Mathematics, she insisted on having copies. Furthermore, she showed interest in studying the topic from different angles, since such activities were an opportunity to teach the second degree equations with a different approach from the traditional one.

Once this teacher used group work in her class, she adopted a very natural student-centered approach. Thus she updated her teaching, and at the same time she organized a good classroom environment. From my class observations it was possible to see how all the groups were working on the task and, from the student questionnaires it was possible to read how the majority of the students found group work an occasion to help each other and understand Mathematics better.

After this first experience with group work, Ms. Giusy reflected with me about the strengths and weaknesses of the group work strategy, the reasons for not using it in the past, and possible future uses. Through this discussion the teacher monitored herself through critical self-reflection. Perhaps because of the latter, the teacher decided to include the group work strategy in her repertoire. In fact, during the subsequent class, there was the *momentum* to Ms. Giusy's work: she spontaneously used group work. At the end of this class the teacher enthusiastically agreed to ask students their opinions about group work through a questionnaire, which means that not only did she acknowledge students' opinions and difficulties, but she also considered them. As confirmation for the latter, while reading the only negative answer from the students, she wanted to address the problem of a single student. This was a sign that not only did she want to reach the majority of her students, she wanted to reach all of them. Finally she considered a student's suggestion a competition in the class and she reflected on further uses of group work. These are signs that the teacher considered her students' ideas and that she was able to extend her repertoire.

Strategies that brought the teachers into the involvement of the processes of Action Research

During this research I studied two strategies that could bring teachers into involvement in the processes of Action Research: a *practical* involvement and the Booklet, for which the pilot provided teacher comments.

Practical involvement is a strategy that requires the researcher to accompany the teacher throughout all of the processes of Action Research. This technique was successful. Evidence for this was provided by the two teachers who participated in the main part of this research. Even though the teachers were not fully aware that they were undertaking a small project involving the processes of Action Research, they covered all the fundamental steps, achieving different results along the way. This strategy was a tailor-made, in-service training for teachers, which needed the full participation of the researcher in order to shape the intervention to the needs and preferences of each teacher.

The Booklet was developed to be part of the designed strategy to introduce teachers to action research. It was piloted on site during this research by a third teacher. The pilot teacher suggested that such a booklet might be a good introduction to Action Research. From her talk and answers to the questions of the Booklet it is evident how such a strategy engaged even the pilot teacher in processes of Action Research, such as critical self-reflection. However, since the booklet was hardly used by the teachers, it is not possible to infer if such a strategy effectively involves teachers into the processes of Action Research.

Box 7 - Mr. Frank's professional activities

When	Event	Effects on teacher's professionalism
3 rd Meeting	– agrees to use group work in his class	– takes into consideration others' strategies
2 nd Class	– helps the groups individually	– updates his teaching by adopting a new teaching style – organized a good class environment
4 th Meeting	– agrees to give his students the questionnaire	– acknowledges students' opinions and difficulties
5 th Meeting	– reflects on a student's suggestion – considers his role in group work – makes suggestions for improving group work	– acknowledges students' opinions – monitors his role through critical self-reflection – updates his teaching

Box 8 - Ms. Giusy professional activities

When	Event	Effects on teacher's professionalism
1 st Meeting	– agrees to use group work	– takes into consideration colleagues' strategies
2 nd Class	– uses group work	– updates her teaching by adopting a new teaching style – organizes a good class environment
1 st Meeting	– reflects about group work – reflects about her status as teacher professional	– monitors her teaching through critical self-reflection

	<ul style="list-style-type: none"> – asks for a copy of the Babylonian Mathematics activities 	<ul style="list-style-type: none"> – has interest in others’ strategies – is keen to study the topic from different angles
3rd Class	<ul style="list-style-type: none"> – spontaneously does a second group work activity 	<ul style="list-style-type: none"> – group work becomes part of her teaching repertoire
2 nd Meeting	<ul style="list-style-type: none"> – enthusiastically agrees to give students the questionnaires 	<ul style="list-style-type: none"> – considers and tries to address students’ needs
3 rd Meeting	<ul style="list-style-type: none"> – reflects on further uses of group work – considers a student’s suggestion – wants to address the problem of another student 	<ul style="list-style-type: none"> – extends her repertoire – considers her students’ ideas – wants to reach and teach all of her students

Conclusions and recommendations

In this study I tried to find out whether involving experienced Mathematics teachers in the processes of Action Research through a small project based on this strategy might revitalize and influence them positively. As discussed earlier, the results of this study are positive, and in part they were expected. Reasons for such expectations were based on the achievements of other researchers and knowledge from the literature.

For this research I used Action Research as a vehicle to achieve my goals; in the literature there are several examples of successful projects using such a strategy to benefit of teachers both personally and professionally (Johnston, 1994; Elliott, 1990; Ferrance, 2000; Elliott & Adelman, 1996; Henson, 2001; McKernan, 1994). My aim was instead to involve the teachers in the processes of Action Research, for which purpose I took the role of facilitator in order to undertake a small project based on *practical* action research. The role of facilitator was in this case crucial, because people involved in education do not ‘naturally’ form action research groups; rather, some external motivation or intervention is usually needed (Carr & Kemmis, 1986; Johnston, 1994; Kosmidou & Usher, 1991). In this research we saw how even Mr. Frank, who seemed reluctant to self-reflect, achieved this goal in his *momentum* aspect.

As professional development, it can be said that the intervention described in this report was successful, since it overcame most of the constrictions of professional development practices described by Díaz-Maggioli (2004, pp. 2-5). In this research overcoming such constrictions was done by employing bottom-up decision making, using a variety of delivery modes of professional practice, supporting the transfer of professional development ideas to the classroom, and ensuring the specific application of classroom practice which took into account the subject being studied and the age of the students.

Repeating such an intervention on a larger scale might be not possible because it requires the researcher/facilitator to adapt and shape the intervention individually for each teacher, and this would require much time and effort. However a possible solution might be to propose action research as a required course in student teacher programs. In my research I could see how teachers actually got involved in an Action Research project while working with a master’s student. The new teaching generation could in this way make the practice of Action Research more commonly known so that, according to Posh (1996), it becomes a key-strategy to use in facing teaching for the first time and teaching in a new school environment that is taking shape under current social changes.

My recommendations for further research are mainly related to the limitations I encountered during my experiment using hindsight. For this study I had the opportunity to work separately with two teachers with different types of characters, teaching styles, and learning needs. What perhaps would have made Mr. Frank less skeptical towards new teaching methods and novelties in teaching would have been a collaborative project with Ms. Giusy (Díaz, 2004; Carr & Kemmis, 1986; Brydon-Miller et al., 2003; Raymond & Leinenbach, 2000; Doerre Ross, 1984). A problem encountered in this research was the lack of time to make proper use of the Booklet. A solution might be to give the in-service training beforehand, in which the Booklet is used as a text, so that the teacher might have more time to read it. During the training, the teacher and the researcher/facilitator could discuss the salient points.

The main limitation of this research was the lack of time to complete the cycles with both teachers. For the case of Mr. Frank the problem was that he informed me only when the intervention was initiated that he would retire within a few months. Ensuring the cooperation and involvement of such a teacher was pretty hard. For the case of Ms. Giusy, the problem was that she got involved in the intervention so late that there was no time to cover all the planned steps. A further limitation was the impossibility to use video recordings. This might have helped to speeded-up the process of critical self-reflection (Whitehead, 1989).

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