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Differentiation of Teaching and Learning: The Teachers' Perspective

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Abstract The aims of this action research are: (a) to investigate the process of differentiation of teaching and learning in mixed ability classes from the perspective of teachers', and (b) to examine the effectiveness of differentiation of teaching and learning in improving reading abilities of students from the first class of the lyceum (fifteen year olds), their self-efficacy and their attitudes towards learning. This action research uses the results of pre and post tests, students' interviews before and after the intervention, class observations and teachers' diary records. The research indicates that the main obstacles teachers have to face are: (a) to define, analyze, and hierarchize reading abilities and strategies from the simplest to the most complex (b) to clarify students' readiness (c) to design lessons to address students' readiness, interests and learning style (d) flexible class organization, and mainly (e) to get rid of misconceptions about their role in the learning procedure. In addition, the research reveals the contribution of differentiation in students' learning, self-efficacy, and beliefs about learning. The most important conclusions are that teachers' self-reflection and cooperation with other colleagues play a major role in teachers' conceptual change and in enhancing teachers' efforts to deconstruct the curriculum according to their students' needs. Finally, respecting students' individuality leads to the improvement of their knowledge and skills and motivates them to learn.

Keywords Action Research, Differentiated Teaching and Learning, Reading Comprehension

1. Introduction

The literacy level of societies correlates with their ability to progress in the socio-economical and political area (Unesco Institute of Statistics, 2014) [1], and at the same time the acquisition of writing defines either the participation of a person in social and cultural aspects of life or his marginalization (Barton, 2006; Blackledge & Hunt, 2004) [2,3]. This raises the question as to what degree the effective development of literacy (as it is defined in each educational system) is achieved not only in the educational system of Cyprus, but in international systems as well.

Research data from Cyprus – such as the results of PIRLS-2001 for reading (Papanastasiou & Koutselini, 2008) [4], and the poor performance of fifteen year olds in reading according to PISA results (OECD, PISA 2012) [5] – indicate that the way students are taught to read is ineffective. The data aren't very promising not even in countries like the USA, where the performance of 25% of adolescents is lower than the average (NAEP, 2013) [6] and almost half of secondary school students do not possess the appropriate reading skills required to study at college (ACT, 2012) [7].

On the other hand, it is obvious that the ineffectiveness of teaching and learning the reading skills and strategies that an efficient reader ought to master is related to the inability of teachers to differentiate their instruction in mixed ability classes (Guthrie, 2008; Irvin, Meltzer, & Dukes, 2007; Koutselini, 2008; Tomlinson, 2009) [8-11], as a result of ineffective pre and in-service education (Hardré & Sullivan, 2008) [12]. Well-educated teachers in differentiation of teaching and learning know what knowledge is and how it is acquired according to constructivist theory (Hargreaves, 1998; Santangelo & Tomlinson, 2012) [13,14], have a deep knowledge of their subject, can ascertain correctly the individual as well as the common needs of their students and adapt the curriculum, the teaching strategies, the source, the activities, the assessment and the learning environment, in such a way that they meet students' needs, their interests and learning profiles (Subban, 2006; Tobin & McInnes, 2008) [15,16]. The differentiated learning procedure presupposes teachers who are capable of studying and taking their students' different biographies and biotheories into consideration (Koutselini, 2010a) [17].

Simultaneously, it is noted that as differentiation is not just a teaching strategy but also an innovative way of thinking about teaching and learning (Tomlinson, 2009) [11], its successful implementation is based primarily on the perceptions of teachers of what learning is and how it can be

achieved (Moon, Tomlinson & Callahan, 1995) [18]. By implication, this raises the question of what is the best way of training and retraining teachers, so as to achieve conceptual change, which will then motivate them to engage consciously in the diversification of teaching techniques, as well as the acquisition of the necessary knowledge and skills required in their application (Santangelo & Tomlinson, 2012) [14]. Researchers (Ruys, Defruyt, Rots, & Aelterman, 2013) [19] point to the need for further research which examines in greater depth how teachers understand, engage with and respond to diversity in their classrooms (Humphrey et al., 2006). However the question remains: In what framework can teacher training be achieved? (May, 2007; Ruys et al., 2013) [20,19]

Nevertheless, even though theoretically it is believed that the successful teaching of literacy presupposes the differentiation of the teaching process, the product and the content according to the learning aims and student needs, which need to be investigated systematically and in depth (Guthrie, 2008; Irvin, et al., 2007) [8,9], researchers have indicated that there is limited research data on the improvement of adolescents' literacy skills through differentiated instruction (Biancarosa, & Snow, 2004; Cantrell & Carter, 2009) [21,22].

The challenge of teaching students of heterogeneous classes was faced by the teachers who took part in this research too. The teachers chose action research in order to answer the questions related to effective teaching of reading comprehension in mixed ability classes, because they knew that action research contributes to progressive teacher autonomy, giving him/her the ability to reconstruct the curriculum according to students' needs and to effectively solve broader educational problems (Koutselini, 2010b; Mclaren, 2010) [23,24]. The results of current research contribute to the broader discussion about the prerequisites of successfully teaching reading comprehension in mixed ability classes, because action research contributes to the progress of educational knowledge through a bottom-up approach rather than a top-down one (Carr, & Kemmis, 1986) [25].

Thus, the present research poses the following questions:

(a) What are the problems/challenges teachers facing in their effort to design and implement differentiated lessons in their class and how do they handle them in order to successfully teach in mixed ability classes?
(b) What is the effect of teachers' active involvement in action research in their training and further professional development?
(c) To what extent can differentiated instruction and learning contribute to the improvement of students' learning skills?

2. Methodology

Two Greek teachers participated in this action research. The first teacher, who had twenty-one years of teaching experience, participated in the research in the context of her doctoral studies. The other had a Master's degree in Special Education and ten years teaching experience. Fifteen years old students ($N = 82$) from four classes (in the first year of the Lyceum) were taught reading comprehension from October 2012 to April 2013 according to the principles of differentiation. In order to investigate the effectiveness of the actions developed, a control group of 81 students, who were from four different departments and in their first year at the lyceum, were taught by two other teachers in a monolithic, undifferentiated fashion. It is important to mention that Secondary Education in Cyprus is a six-year educational program for students between the ages of 12 and 18. It is made up of the Gymnasium (Lower Secondary School), where the main concentration is a general humanistic education. Education is compulsory until the age of 15. From there students attend the Lyceum (Upper Secondary School), a more flexible educational system which offers various specializations depending on the inclinations, skills and interests of the students.

Quantitative and qualitative data were used to investigate the special learning conditions in classes and for a thorough analysis of the phenomena (Lazos, 1998) [26]. Pre and post tests were given to the students in each of the four classes in which the differentiated teaching and learning was implemented - the experimental group - and to the students from the four other classes in which no differentiation in teaching occurred - the control group. Qualitative data were collected via the use of teachers' journals, class observations, lesson plans and student and teacher interviews. The control group consisted of 81 students who were taught by two other teachers. The experimental and the control group were similar in the number of boys and girls, the origin and the education of parents as well as the fathers' occupation. Differences appeared in the mothers of the students of the two groups; in the control group a larger percentage (22%) of mothers had graduated from college while 14% had graduated from university. In the experimental group 13% of the mothers had graduated from college with 7% of the mothers having graduated from university. Another difference had to do with the mothers' occupations; in the control group 47% of mothers were employed in service occupations and 11% were employed in occupations which required tertiary education. In the experimental group these percentages were 32% and 6%, respectively.

For the analysis of quantitative data the Rasch model (Quest Program) and Multiple Regression analysis (SPPS 19) were used. The independent variables were entered into the model step by step according to the stepwise method. Additionally, the t-test for dependent samples was implemented in order to investigate the permanence of the experimental group's reading skills according to the tests which were given in May and October 2013. For the analysis of the qualitative data content (Marshall & Rossman, 2011) [27] and discourse analysis were used (Gee, 2011) [28].

3. Results

3.1. The Contribution of Action Research on Teacher Development

A study of the qualitative data indicated that the difficulties teachers face in the beginning of their efforts to differentiate their lessons related to:

(a) First and foremost the lack of a structured curriculum based on prerequisites, substantive and transformational knowledge and skills which can function together in every class and from class to class. Therefore, the questions recorded in the teachers' diaries were highly pertinent: "What knowledge/skills should a good reader possess? What reading strategies should he or she develop to become an autonomous reader?"

(b) Secondly teachers' inability to sufficiently ascertain their students' readiness even though they had studied the results of the pretest.

A study of teachers' first lessons indicated that the difficulties also related to:

(a) Teachers' inexperience in designing appropriate activities in order to address students' readiness, interests, learning style and incentives.

(b) Inflexible class organization and weaknesses in the organization of group work which resulted in teachers not being able to manage the class and teaching time being wasted.

(c) Teachers' misconceptions such as the idea that the teacher is the source of knowledge and has to transfer it to his or her students and that the teacher has to complete the syllabus even if the students have knowledge gaps.

(d) Teachers' fear and uncertainty about their ability to successfully differentiate their lessons.

The thorough study of the actions which teachers implemented to overcome the difficulties contributed to the answer in the second research question. On the one hand, the data reveals the crucial role of lesson observation, teachers' diaries, and teachers' meetings, as well as discussion about the merits and defects of their lessons, and teachers' self-reflections regarding conceptual change and in their persistence in the achievement of their aims. One of the teachers reflecting on her involvement in the action research pointed out:

> "Even though the problems were complicated, I coped with them with greater courage and willingness to solve them than I did previously. My colleague and the interest of my students made me strong. I did not give up as I used to do before and I didn't adopt a traditional way of teaching. Everything was done after study and hard design. We investigated the reasons for the problems and looked for and found solutions. We did not work intuitively or incidentally as I had done in the past."

On the other hand, the contribution of self-reflection in the reexamination of misconceptions which arose and which proved to be obstacles in differentiating teaching is obvious in the following extract from one teacher's interview:

> "In the past, I strongly believed that the students learn only when I give and explain the new knowledge. I would give examples and write the most important information on the board. I was disappointed when I found out that few students had learned the new information I had taught. My participation in the research helped me realize a lot of things. I must admit that I enjoyed the fact that the lessons were not teacher-centered, that students found and discussed information through the activities. Many times, I was surprised by the maturity of their answers".

The teachers studied the relevant literature, cooperated and found out the appropriate solutions for solving the initial problems. During the action research, they implemented the following actions to overcome the difficulties:

(a) The first thing was the development of a Program in reading and comprehension in the A΄ class of the Lyceum in which the knowledge and skills a literate person masters are defined and analyzed according to the relevant literature (Vacca, Vacca & Gove, 1995) [29]. In this Program students mastered the following reading skills and had to:

- Identify and underline information explicitly expressed in the text.
- Recall with accuracy information explicitly expressed in the text.
- Combine information from different parts of the text to complete an answer.
- Make inferences from the text by correlating information from different parts of the text and text information with their pre-existing cognitive schemata (as regards the theme or the structure of the text or the social, historical, geographical etc. context).
- Use pre-existing conceptual and cognitive schemata to interpret information, feelings and situations.
- Identify and comment on the representations of reality that appear in the text, focusing on the writer's intentions and assumptions arising from the text.
- Evaluate the effectiveness of the text in relation to its target audience, by producing and utilizing criteria regarding the form and content of the text.
- Evaluate their own path to understanding the text, through monitoring, coordination and correction of all the reading strategies they use to achieve their purpose more effectively.

(b) In addition a thorough study of the results of the pretest, as well as a clarification of which reading skills had been achieved and at which level by each student, was conducted. In such a way the starting level of each student, as well as the zone of his/her proximal development, was defined with

accuracy.

(c) Moreover, an analysis and hierarchy of the teaching objectives from the simplest to the most complex was conducted and in this way a definition of prerequisites, substantive and transformational knowledge and skills was facilitated. For example, the aim of making inferences from the text, which was found to be very difficult for students, was analyzed in simple steps. Students identified and underlined information relevant to the question, correlated the latter information with pre-existing cognitive schemata, found relations (similarity, contrast, cause-effect etc.) and expressed their line of reasoning. In carrying out these activities, teachers afforded students with the opportunity to work alone initially and then to work with the person sitting next to them, or with members of a larger group. Teachers also moved around the classroom, sitting next to students, watching their progress, listening to their questions and providing them with appropriate feedback, thus guiding them towards the discovery of knowledge. In this way, the provision of ready-made knowledge was avoided, and the path to knowledge was rewarded rather than the end result.

(d) Furthermore, teaching reading strategies and developing metacognitive skills (Erickson, 2009; Ness, 2008) [30,31], as well as skills of student autonomy learning (Afflerbach & Meuwissen, 2005; Irvin et al., 2007) [32,9], were implemented – the latter reading strategies included: a preview, strategies for understanding unknown words, posing questions, finding and underlining important information in the text, synthesis of information, creation of a concept map with the main information and the relations between it, paraphrasing the text, and self-regulation and redesign of the path towards understanding.

(e) Another action implemented was the selection of various texts (printed and electronic texts, comics, pictures, video clips) of graded difficulty, with the active involvement of students, with the texts being consistent with their readiness and interests (Alvermann, 2002; Rasinski & Padak, 2004) [33,34].

(f) The design of authentic activities which presupposed reading also helped teachers meet the different interests of students (Lenters, 2006; Reutzel & Clark, 2011) [35,36]. Such activities included writing articles in the school magazine, preparing speeches in order to take part in a debate, finding solutions to problems students have to cope with.

(g) Efforts were made to meet the different student learning profiles. This entailed:

- Using visual and auditory stimuli and various codes (language, pictures, charts, diagrams).
- Connecting new and pre-existing information and giving suggestions on how to organize the latter.
- Giving activities which allowed students to work alone (e.g. text production by using information from the texts studied in class), or with the members of their group (e.g. debate on a subject that arises from the texts).
- Allowing students to choose between guided activities which presupposed a series of steps (e.g. collect their classmates' opinions about the use of Greeklish), and creative activities that allow students to choose how they work (e.g. write a text to protest).

(h) A non-competitive class climate was achieved through motivating students to cooperate with their classmates, through emphasis on the process of accomplishment of each activity instead of the final result and through individual feedback or team feedback (Tomlinson & Imbeau, 2010) [37].

(i) The development of cooperation skills (active listening, respect for different opinions, discussion by using arguments and cooperation in order to successfully obtain common objectives) was achieved. At the same time, a code of behavior was applied which was created with the active involvement of the students. Self-evaluation and peer evaluation were also promoted with positive behavior in group work being rewarded and roles being assigned.

It is obvious that working within an active research framework, teachers were freed from the obsession to complete the syllabus disregarding their students, realising the need for teaching learning strategies enabling students to learn how to learn and from passive recipients of information to become actively involved in the learning process, becoming students who know how to discover and produce knowledge (Ivey & Fisher, 2006; Koutselini & Patsalidou, 2015) [38,39]. They developed problem solving skills, searching for underlying causes, developing activities to eradicate them. They evaluated and redesigned their actions responding to students' views. Actions they developed proved their occupational emancipation and maturity (Koutselini, 2010a) [17] and contributed positively to the teaching of reading skills as well as altering students' perceptions on learning and the learning process. Teachers felt more effective as a result of their actions (Carr & Kemmis, 2010) [40]: "Now that we have completed this effort I am excited, as I have learnt new methods of teaching and I also felt that my students responded'' (teacher b).

3.2. The Contribution of Teaching on Learning Outcomes

The direct and active involvement of teachers in responding to students' differences contributed to the successful teaching of reading skills. The Hierarchical Regression Analysis showed that the distribution of the performance of students of the experimental and the control group was interpreted by the participation in the intervention and by the performance in the pretest only. The participation in the intervention contributed more to the interpretation of the distribution of the performance (38%) than the performance in the pretest A1 (21%) (Table 1).

Table 1. Hierarchical Regression Analysis for variables that explain the performance in the posttest A2

Independent variables	B (SE)	β
Second step		
Participation in the intervention	*1.66 (0.12)*	*0.73***
Performance in the pretest A1	*0.68 (0.08)*	*0.47***

Notes. R^2=0.59 for the second step *p<0.05, **p<0.01, ***p<0.001

It is very important to mention that, according to the Hierarchical Regression Analysis, the variables of gender (boys had lower performance than girls), classes of teacher b' and low education of mother (primary and or lower secondary school) interpreted - before the implementation of intervention - the 26% of the distribution of the performance in the pretest A1 (Table 2).

Table 2. Hierarchical Regression Analysis for variables that explain the performance in the posttest A1

Independent variables	*B (SE)*	*β*
Boys	*− 0.76 (0.11)*	*− 0.46 ****
Classes of teacher b'	*− 0.38 (0.13)*	*− 0.2 **
Mothers' education (Primary or and lower secondary school)	*− 0.31 (0.14)*	*− 0.15 **

Notes. R^2= 0.26 *p<0.05, **p<0.01, ***p<0.001

Nevertheless, after the intervention, the variables of gender and mother's low education did not affect the interpretation of the distribution of the performance in the posttest A2. This reveals that the impact of the intervention stopped the negative role of these two variables in students' performance in pretest A1 and shows the catalytic role of the intervention in boys' performance as well as in the performance of students whose mothers have low education. At the same time, the students of teacher b' increased their performance by 1.66 points in posttest A2 as a result of their involvement in the intervention, whilst their performance in pretest A1 remained constant.

Additionally, according to the t-test in dependent samples, the performance of students of the experimental group in the comprehension of informative text remained at the same level five months after the intervention. The relative analysis shows that they performed better in posttest A2 which was given in October 2013 ($\overline{x}$ = 0.75, SD= 0.76) than in the posttest A2 which was given in April 2013 ($\overline{x}$ = 0.71, SD=0.88). This variance was not statistically significant (t= −0.49, df= 77, p> 0.05).

Student discourse analysis revealed a broadening of students' knowledge regarding the meaning and the dimensions of reading after the intervention. Low performance readers mentioned the cognitive dimension of reading, moderate and competent readers mentioned the critical dimension of reading and more competent readers defined the metacognitive dimension as well. Simultaneously, students used this knowledge to evaluate themselves as readers and to clarify their difficulties in reading comprehension. On the contrary, before the intervention a great number of students (56 out of 82) stated that they did not experience any problems in comprehension.

At the same time, student discourse analysis showed that the number of reading strategies students knew and used increased after the intervention (Table 3). Additionally, the majority of students declared that their reading skills had improved due to their newfound knowledge of reading strategies.

Table 3. Reading Strategies students (N = 82) know and use before and after the intervention

Reading Strategies	*before	**after
Preview	55	73
Find and underline important information in the text	32	66
Write keywords or points next to each paragraph	6	24
Carefully reread a text or paragraph in order to identify keywords, correlate the words with known information and to reword what they perceive as important	45	54
Use the context for understanding unknown words	29	61
Use a dictionary	26	47
Analyze the parts of words or find the family tree to which the word belongs	6	45
Find synonyms or antonyms of words	5	44
Find the definition of a word in the text	3	22

Notes. * The number of students who declare that they know and use each strategy before the intervention according to discourse analysis.
** The number of students who declare that they know and use each strategy after the intervention according to discourse analysis.

It was also found that before the intervention students believed that knowledge was comprised of an amount of difficult and "*useless*" information which the teacher presents, explains and writes on the blackboard or in leaflets, whilst students have to listen to, read or rewrite this information in their notebooks, in order to learn it as the teacher wants. However, after the intervention the meaning of knowledge changed for the students. They mentioned the reading skills and strategies they had learnt and the contribution of these skills and strategies in their comprehension of a difficult text. Students considered these skills and strategies useful and permanent knowledge which equipped them with the skills to find information in a text, something which they could not master previously. As a result, their feelings of *"desperation"* were eliminated.

According to students' comments, after the intervention, the resources which were used in the lessons were interesting. The learning environment became not only creative but also one of acceptance, encouragement and the expression of personal interest. In this environment many opportunities were given to students to cooperate with their classmates, to communicate, to exchange opinions and express their disagreement. In such a way, this learning environment motivated the efficient as well as the less efficient students to learn. It was obvious that this learning environment was different from the competitive and authoritarian climate

which they had experienced before.

4. Conclusions

In this research the catalytic role of the direct and active involvement of the teachers in the solving of problems which arose in the class is obvious. Solutions to the challenges of teaching in mixed ability classes are not given by experts nor are they imposed by an external authority. On the contrary, teachers should investigate, find and design solutions according to a cyclic, spiral procedure from student needs assessment to definition, analysis and hierarchy of the objectives of learning and teaching, and then to the design and implementation of differentiated lessons, evaluation and redesign depending on the new needs of students. In this way teachers can become autonomous (Tricarico & Yendol-Hoppey, 2012) [41]. The benefits for the teachers are obvious, because by moving from theory to practice, they can acquire skills which enable them to design and apply differentiated lessons and feel self-confident and enthusiastic about their students' success.

Teachers get rid of positivism and algorithmic procedures of curriculum development - products of modernity - which have as their aim the transmission and reproduction of the dominant culture (Giroux, 2010) [42]. On the contrary, they become involved in a cyclic, spiral and heuristic procedure, in which the needs, as well as the obstacles the social structures and people's interaction impose are realized by the teachers. Thus, teachers assume responsibility for solving problems and in so doing achieve their emancipation (Koutselini, 2010a) [17]. In this procedure of their occupational emancipation and maturity the role of conceptual change is crucial. Conceptual change is achieved through their active involvement in the reconstruction and adaptation of the given curriculum to the micro level of the classroom, and through reflection and cooperation between the teachers themselves. This confirms research data which indicates that in order for teachers to realize their sub-conscious perceptions and possible misconceptions about teaching and learning it is necessary for them to have the opportunity to reveal and understand their false beliefs, as well as how these affect the transformation of their theoretical knowledge into active teaching (Giroux, 2010; Hargreaves, 1998; Koutselini, 2010a) [42,13,17].

The positive results of the intervention on students' performance and the improvement of their knowledge about the dimensions of reading and comprehension reveal how successfully the teachers taught, which is in agreement with research data which shows the contribution of differentiation of learning and teaching to students' performance (Antoniou, Kyriakides & Creemers, 2011; Farkas, 2003; Valianti, 2010) [43-45]. Simultaneously, the results of current research contribute to the wider discussion on the preconditions of effective teaching and learning reading skills among adolescents (Biancarosa & Snow, 2004; Cantrell & Carter, 2009; May, 2007) [21,22,18]. The better performance of students in the posttest correlates with the development of reading strategies. This result supports research data which highlight that the effective use of reading strategies distinguishes the competent readers from the non-competent ones (Afflerbach & Meuwissen, 2005; Irvin et al., 2007) [32,9].

From interviews conducted the belief of the majority of students that they have improved as readers shows the enhancement of their self-efficacy. The latter correlates with actions which teachers adopted, something which pupils were aware of as their interviews indicated. The above mentioned actions included teaching to address students' readiness (Tomlinson, 2005) [46], teaching reading strategies (Afflerbach & Meuwissen, 2005) [32], providing essential feedback in order for them to improve their reading skills (Carpenter & Pease, 2013) [47], as well as teachers' sincere interest, acceptance and encouragement (Subban, 2006) [15]. It should be mentioned that teachers listened to their students' voices in order to address their diverse particularities (Koutselini, 2008; Tomlinson, 2009) [10,11].

Taking into consideration that among the aims of differentiation of teaching and learning are the active involvement of students in problem solving, the development of critical thinking (O'Brien & Guiney, 2001) [45] and cooperation skills (Carpenter & Pease, 2013) [44], as well as attitudes and skills of self-regulation and autonomous learning (Tomlinson, 2005) [46], in a dynamic learning environment (Straham, Kronenberg, Burgner, Doherty & Hedt, 2012) [49], it is worth noting that students who took part in this action research confirmed the achievement of these aims, expressing positive comments on their role in the production of knowledge as well as the conditions under which they worked. It is obvious that learning is the outcome of quality teaching which is not based on what the teachers do, but on how and on what students are working on and how they feel, a finding which is reflected in the most vivid way in the following extract from one of the students:

> "The lesson was more interesting than lessons in previous years. When we studied a text, the way we saw the world changed and sometimes we managed to change the attitudes of the members of our group … it was fun to cooperate with my classmates… We found out knowledge … All my classmates were more active than in any other lesson … The students, who used to remain silent in other lessons, were active in this one".

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