

Investigating the Impact of Differentiated Instruction in Mixed Ability Classrooms:
It's impact on the Quality and Equity Dimensions of Education Effectiveness

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Abstract

This paper presents the results of a study concerning the application of differentiated instruction in mixed ability classes, in which 24 elementary classes of 479 Cypriot pupils participated. The study provides evidence about the effect that systematic differentiated instruction in mixed ability classes has on students' achievement. The results of the experimental group of the research that had received differentiated instruction were compared by multilevel regression with the results of the control group that had not received differentiated instruction. The comparison aimed at investigating the difference in achievement between the two groups and the identification of other factors that affected students' achievement between and within these groups. A multilevel structure equation model was used to demonstrate the relations and the impact of the change of teaching practices, monitored by a differentiated instruction observation key, over students' achievement. Along with the main research question determining the impact of differentiated teaching on students' achievement, research results gave substantial evidence over the dimensions of quality and equity of education effectiveness. Quality and equity dimensions of education effectiveness consists of main conflict issues for differentiation instruction in mixed ability classrooms. Based on the results of the study presented, this articles' main target is to discuss how differentiated instruction can promote equity and quality for all in mixed ability classrooms.

Introduction

Educational effectiveness has been one of the main problems encountered in modern societies' educational systems. Research reveals that educational systems fail to meet the challenge of providing quality and equity, leading to achievement gap (Brooks-Gunn & Duncan, 1997; De Civita, Pagani, Vitaro, & Tremblay, 2004; Strant, 1999), between different groups of students. Evidence supports that achievement gap increases during schooling (Fryer & Levitt, 2004, 2006). These findings declare that education has failed to fulfill its mediating role and educational systems have not found the way to be effective for all. Narrowing the achievement gap has been the main aim of socially directed educational systems, in order to achieve equity. Although many curriculum reforms and policies were formed based on providing and promoting equity trough enchainment of quality in education, the results of such efforts around the globe have not been very promising.

Traditional and undifferentiated instructive approaches that do not facilitate the construction of knowledge for all students in mixed ability classrooms are seen as one of the basic factors causing this problem (Valiande, 2010). Supporters of differentiation and its effectiveness state that it is the only way for effective teaching for all students in mixed ability classrooms (Tomlinson, 1999, 2001; Koutselini, 2006). Differentiation guides the planning and instruction in mixed ability classrooms based on students and their needs, facilitating the construction of knowledge for each and every student based on its prior knowledge and dexterities.

The study presented in this article, is mainly an effort to put differentiation in practice, by fulfilling the key presuppositions for effective differentiated instruction and evaluating its implementation and its effectiveness, aiming at finding a way to act in the best interest of all students in mixed ability classes.

Differentiated Instruction

Theoretical Background of Differentiation

The technocratic and positivist tradition that led to knowledge and content oriented educational practices has raised strong criticism based on its failure to mediate society's needs (Apple, 2003; Guba & Lincoln, 1989; Habermas, 1978; Giddens, 1976). The limitations and weaknesses of the technocratic tradition bring out the need for new theoretical framework for educational practices. A theoretical framework, in which students are the center of any decision and any action to be taken. A theory and practice on how to guide students in their own learning path. Students are not commodities and schools are not factories producing specific kind of working units. Differentiation entails a solid proposal of such framework and is presented as the answer to the limitations and weaknesses of the technocratic tradition (Valiande, 2010). The theory of differentiated instruction is based mainly on the theory of social constructivism (Vygotsky, 1978) and emphasizes the active participation of students in the learning process where the construction of knowledge emerges due to the interactions of students with their environment (other students, teachers, knowledge, educational material etc).

The teacher, who entails the key to a successful differentiated instruction (Valiande & Koutselini, 2008, 2009; Valiande, 2010), is challenged to facilitate learning for students of different readiness level, interests, learning profile (Tomlinson, 2003), socio-economic and cultural capital and psycho-emotional characteristics, all features that can affect the construction procedure of new knowledge.

Differentiated instruction that was first proposed as a teaching practice by Tomlinson, (1999) is seen as the change of the teaching process based on teaching routines that correspond to the large span of students' differences in mixed ability classrooms, such as student's readiness, interests and learning style (Tomlinson 1999, 2001). Furthermore, differentiation can be defined as the instructive approach by which teachers modify the curriculum, their teaching methods, the educational sources used, the learning activities and the evaluation methods according to and in correspondence with students' differentiated needs, in order to maximize the learning opportunities for every student (Bearne, 1996).

Differentiation constitutes an innovating, constant reflective procedure of effective teaching and learning that cannot be met by readymade lesson plans. The planning and the instructional choices of a lesson plan based on differentiation can only be used effectively when chosen by the teacher, according to students' needs and other personal characteristics (Valiande & Koutselini, 2008, 2009; Valiande, 2010). Students' learning style, their interests, their talents, their skills, their competences and their cultural background will guide the teachers through his final decision concerning the kind of differentiated teaching to be chosen (Hall, 2002).

Although Tomlinson's proposal for differentiated instruction corrects deficiencies of the positivist instruction paradigm by imposing a more student-centre instruction model, it fails, at the same time, to identify and take into consideration several students' personal factors that affect and determine learning, such as the socioeconomic status of the family, students' level of self-perception and other specific characteristics arising from students' life outside school. While differentiation theory calls on equity by responding to students' needs, simultaneously education is formed responding to society's call for the rise of standards, through strictly countable tests and their results, becoming a means for the reproduction and the creation of social and academic inequalities (Apple, 2006).

Differentiation proposed and used in this study is based on critical pedagogy shifting away from positivist and technocratic learning processes (Apple, 2006; Friere, 1978). Critical differentiation takes differentiation a step further than Tomlinson's proposal, by focusing simultaneously on students' needs and the factors affecting students' learning in the school environment and outside school, in order to plan a differentiated learning process accordingly

(Koutselini 2008). Koutselini proposes that differentiated instruction should be seen in the framework of a meta-modern curriculum (Koutselini, 2006) which offers a critical framework for the theory and practice of differentiation. In a metamodern curriculum differentiation is not actually a teaching process but rather a “learning process”, where emphasis is placed on the interaction of student, knowledge and teacher in an open and flexible learning process (Valiande & Koutselini, 2009). Differentiated teaching is the learning process in which students are facilitated to construct their knowledge by maximizing motivation for cognitive and metacognitive growth that will eventually improve academic outcomes for all students (Koutselini & Gagatsis, 2003) and strengthen their explanatory faculty.

Differentiated Instruction in the framework of constructivism could be the answer to the problem of increasing diversity and school failure in mixed ability classrooms. Construction of knowledge is a unique personal learning process, where each and every person understands and gains meaning of new knowledge based upon their prior knowledge and their personal beliefs and needs. In a constructivist learning process where differentiation is applied, a child-centered teaching approach sees every student as a unique “biography” and not as a copy of the same picture. Consequently, differentiation is the correspondence to the needs of each student and the facilitation of construction of knowledge for each and every student that cannot be considered as a transfer of knowledge (Koutselini, 2006).

Effectiveness of Differentiated Instruction

The theory that supports differentiated instruction has great impact in teaching all over the world bringing major changes in the way teachers envision and practice teaching. Although we have witnessed curriculum changes that promote the implementation of differentiation, literature lacks of substantial research evidence supporting differentiation theory (Hall, 2002). Research support on differentiation theory is limited and is mainly based on individual theories, upon which differentiation theory and practice has been developed. The first attempt on research on differentiation constitutes of a growing number of studies and small scale research that show and support the enhancement of teaching and learning through differentiation (Tomlinson, 1999; Good & Brophy, 2003) and provide evidence for positive effects on students’ achievement (Pfannenstiel, 1997; Chall, 2000; Kim, 2005).

A growing body of research has emerged the last few years concerning the implementation and effectiveness of differentiated instruction. Most of these studies referred to specific groups of students, gifted students and students with disabilities (Tieso, 2005; Baumgartner, Lipowski, & Rush, 2003; McQuarrie, McRae, & Stack-Cutler, 2008 ; Rock, Gregg, Ellis, & Gable, 2008; Geisler, Hessler, Gardner & Lovelace, 2009) or focused on the implementation of differentiation and teachers’ attitudes towards differentiated instruction (Tomlinson, 2001; Tomlinson, Moon & Callahan, 1998; Blozowich, 2001; Brimijoin, 2002; Johnsen, 2003). Only a small number of studies investigate the effectiveness of differentiation on the whole and under certain conditions, showing the precedence in academic outcomes of students that were taught by differentiated instruction (Gayfer, 1991; McAdamis, 2001). The present study, contrast to previous studies on differentiation, examines the implementation and effectiveness of differentiated instruction for all students and at the same time evaluates it’s power to bring equity and quality in education effectiveness.

Equity and Quality dimension in differentiated instruction

Equity in education has become a common concern with a focus on positive attempts to achieve equity in different educational systems (Moreno Herrera & Francia, 2004). With mixed ability classrooms being more diverse than ever by the increase number of students from several ethnic races and cultures, students with different ability and readiness levels, special education students and students from different socioeconomic background, educational equity gains new meaning and is more prompt than ever. A big part of educational research all over the world aims at identifying effective instructive methods for

mixed ability classrooms since mixed ability classrooms are perceived as the means to promote equity. Equity has been misinterpreted. Equity cannot be exhausted through the provision of equal opportunities as “a matter of dividing educational, and education-related, resources more equally or fairly” (Lynch, 2000) nor can it only apply as equal treatment for students in order to reduce discrimination. Equality in access to educational material and the equal treatment of students can only be a start towards equity itself, since equity must be seen in a more holistic way promoting simultaneously equity of results and equity of access, treatment and opportunity.

Equity in education can be achieved by teaching students corresponding to their level of readiness, their interests and their learning style, maximizing their opportunities for personal learning and growth (McLaughlin & Talbert, 1993). In this framework, equity in education and social justice can only be met if teachers find the way to correspond to the diversity of their students (Gamoran & Weinstein, 1995) through differentiated instruction. One can state that equity is the opportunity all groups of students have in a mixed ability classroom, in achieving the maximum concerning the goals of the curriculum, according to the personal abilities and competences of each student ensuring equal access to knowledge.

In the existence of a growing achievement gap one can suppose that equity in education has not been met. Apple (2006) supports that this is a result of the commodification of education that brought unequal access to quality of education. Researches justify the creation of the achievement gap as a result of students’ social inequalities, differences between genders and differences between students’ ethnic races (Strand, 1999). These students’ characteristics, by which students are grouped in order to be studied, are not clearly and uniquely identify, as there is an overlapping of students’ groups because of common characteristics between group members from different groups. For example we cannot and should not assume that underperforming students always come from disadvantage family, from a specific students group (specific ethnic group or a specific SES group). That’s why the whole picture as a synthesis of its details that will lead us to a realistic picture of student’s needs must guide every teacher, in order to find ways to be effective for all. The dynamic character of Differentiated Instruction theory provides the teacher with a framework for his instruction by which ensures both quality and equity dimension of effectiveness. Evidence to support differentiated instruction’s ability in promoting equity and quality dimension of effectiveness will be presented later on in this article.

If we define quality dimension of educational effectiveness, as the quality of instruction provided to all students which effectively supports their personal learning and leads them to higher achievement levels, we can assume that equity dimension is met simultaneously. Equity dimension of effectiveness is accomplished if quality instruction allows all students to pursuit personal higher attainment according to their own knowledge, dexterities and competences. Willie finds that quality and equity can and must be interlinked and by doing so “education, should focus neither on cultivating excellence at the expense of equity nor on cultivating equity at the expense of excellence. In a well-ordered society, the goal of education is to seek both excellence and equity because they are complementary. One without the other is incomplete” (Willie, 2006).

Differential Effectiveness

The lack of equity dimension of effectiveness can be closely linked to differential school effectiveness. Even though research findings on differential school effectiveness are mixed and contrary, several studies show differential effect in relation with prior knowledge and ethnicity (Nuttal, Goldstein, Prosser, & Rasbash, 1989; Thomas Sammons, Mortimore & Smees, 1997; Tomlinson, 1999) with the more consistent evidence revealing differential school effects relating to prior achievement (Jesson & Gray, 1991; Sammons, Nuttall, & Cuttance, 1993; Campell, Kyriakides, Muijs, & Robinson, 2004; Kyriakides, 2004). Most of the studies on differential effects examine the differential effect between schools and are

mainly concerned with the investigation of achievement gap between schools, paying little attention to the extent teachers and school perform consistently for all students' group (Kyriakides, 2004). As Strand (2010) supports, there is a need for studies with focus on within school gaps in order to identify, study and understand the factors affecting the achievement gaps that simultaneously formed and increase equity gaps.

Education effectiveness research major aim through the years was to identify and determine the characteristics of effective teaching that will provide all students with equal opportunities (Kyriakides, 2007). Most of these studies tried to create an effective instructional model with a "generic way" of effectiveness for all students (Cambell et al., 2004). Although the determination of an effective model for all will be ideal, this could not be the case considering that instruction in mixed ability classrooms means dealing and instructing students from different cultures, different learning styles and personalities, different socioeconomic status and other characteristics that needs to be encounter. Research has shown that specific instruction characteristics can be more or less effective with specific group of students (Stenberg, 1988; Dunn, Griggs, Olsen, Beasley, & Gorman; Kyriakides, 2005; Creemers & Kyriakides, 2006). The results of studies on effectiveness support that specific teaching characteristics impose a differential effect on different group of students, inducing the need to identify general characteristics of differentiated instruction that will allow the teacher to adopt his teaching according to the characteristics of different students' groups in his classroom in way that learning will be supported for all, without favoring specific groups.

Differentiation seeks to bring quality in education without the creation of differential effectiveness, since differentiation should maximize the effectiveness for all and as thus allow for equity dimension of effectiveness to be accomplished. As the theory of differentiation supports both quality and equity of effectiveness, the present research is seeking for evidence to support this statement.

Research Aims

This article, studies a) the effects of differentiated instruction on students achievement in mixed ability classrooms and b) the dimensions of quality and equity effectiveness of differentiated instruction, implemented by Cypriot teachers in order to improve their effectiveness. Although the Cypriot curriculum supports the theory and practice of differentiated instruction and differentiated instruction was set by the Cyprus Primary Education Department as the official aim of primary education for the school year 2002-2003, almost none or little change has been made by teachers on their teaching practices towards differentiation. Our research has shown that this is not allocated to teachers believes concerning the effectiveness of differentiation. In contrast this is due to their lack of knowledge and training on differentiated instruction practices and the lack of support, differentiation material and time to organize differentiated instruction (Valiande, 2010).

This study had three basic aims. The first aim was to determine whether findings from the research provide substantial evidence for the effectiveness of differentiation in mixed ability classrooms. The effectiveness of differentiated instruction and its effects on students' achievements is being supported by studies concerning specific groups of students, gifted students and students with disabilities (Baumgartner, Lipowski, & Rush, 2003; Tieso, 2005; McQuarrie, et al. 2008; Rock, et.al 2008; Geisler et al.2009). Only a limited number of studies investigate to a certain extent the effectiveness of differentiation for all students in mixed ability classrooms (Gayfer, 1991; McAdamis, 2001).

A second aim was to determine the characteristics of effective differentiated instruction by using and testing the observation key for differentiated instruction (Valiande, 2010). The observation key is based on the educational literature, of the last decade, on differentiation (Tomlinson, 1999; Koutselini, 2006, 2008) by which effective differentiation teaching practices and procedures are being presented mostly on a theoretical basis. The main

aim was to test differentiated instruction characteristics as implemented by teachers in their classrooms, that participated in the study, and at the same time investigate the effects of those characteristics on the quality of teaching and students' achievement.

A third aim was to evaluate the equity and quality dimension of differentiated instruction based on the results of effectiveness of differentiation for different group of students. Although differentiated instruction is based on the assumption that all students' learning is supported by taking into account all different aspects of their needs and competences, this is still something that has to be proven. In order to investigate and determine the equity and quality dimension of effectiveness by differentiated instruction, the existence of a differential effectiveness by differentiation was investigated.

Method

The study presented in this article was conducted during the school year of 2008 -2009 in Cyprus primary schools. Convenience sampling was used to select elementary classes (n=24) that participated in the study. The pupils (n=490) who attended the 24 Year 4 primary classes and the volunteer teachers (n=14) that differentiated their instruction constitute the sample of the study. The experimental group of the study was formed by the students of the 14 classes that received differentiated instruction. The control group was formed by the other 10 classes that accepted to participate in the study. The teachers of the control group did not receive any training or support on differentiation throughout the research and did not differentiate their instruction in any way. All the thirteen schools participated in the study were situated in Nicosia Educational District.

Fourteen volunteer elementary teachers teaching in Year 4 primary school classrooms started training on the theory and practice of Differentiated Instruction from the previous academic year (April 2007-2008). The researcher planned training seminars for educating and preparing participant teachers to implement differentiation in their every day teaching practice. The training provided teachers with knowledge concerning the main aspects of the differentiation theory and most important helped them to understand how to translate differentiation theory into practice by realizing the main axes of differentiated instruction. Teachers learned how to design a lesson plan based on differentiated instruction theory and most important they learned how this lesson plan can be modified reflectively according to upcoming needs of their students. As differentiated instruction is a highly reflective procedure, it is at the same time strongly depended on teacher's sufficient preparation that will give him the relative options to maneuver the lesson reflectively.

Although teachers were given several lesson guides that were adopted accordingly to students' needs, teachers cooperate with each other and with the researcher in preparing differentiated lesson guides based on the Cypriot curriculum and the book of year 4 primary school classes. All teachers used these lesson guides in order to achieve an overall consensus of what was taught in all the classes participated in the study. Lesson guides were shared to all teachers through a web site created especially for this research. The participant teachers continued to receive training and support all through the research. Immediate feedback was given to the teachers by the researcher and a discussion followed the observed lesson in order to help the development of teachers in differentiating their instruction. Furthermore, an online forum was created that gave teachers the opportunity to exchange ideas and share their thoughts with the whole team of teachers participating at the research. The researcher was able through the forum and her personal email to address all the problems and the questions of the teachers.

Multiple sources of data collection were used in this study in order to answer the research questions. Evaluation of students' prior attainment and their educational progress was made by written tests, a literacy test and a test to determine students' comprehension level. Both tests were administered to all the Year 4 students of the twenty four classrooms participated in the research ($N = 490$) twice: (a) at the beginning of school year and before the

introduction of differentiated instruction (October, 2008) and (b) at the end of the implementation of differentiation instruction (May 2009). Therefore, I could compare the attainment of students of the experimental group that were taught by differentiated instruction, before the introduction of differentiated instruction and at the end of its implementation with the attainment of students in the control group classrooms which did not received differentiated instruction in the corresponding tests.

Information about students' family socioeconomic status was collected through a questionnaire completed by the parents. Quality of differentiated teaching was measured through an observation key for differentiated instruction used for reporting on lesson observations by the researcher. The observation was developed based on Koutselinis' work on the characteristics of differentiated Instruction (Koutselinis, 2006b, 2008) and consisted of 18 statements-questions about the basic characteristics of effective differentiation instruction in likert scale.

Research Results

Effectiveness of Differentiated Instruction

The effectiveness of differentiated instruction was investigated separately for each test with multiple regression analysis. Investigation of the extent to which students' factors, such as education and occupation of father and mother, gender, student's group (experimental or control group), students' socioeconomic status and their prior achievement in both literacy and comprehension tests can predict student's achievement was contacted by multiple regression analysis (MRA). Stepwise method was used for both analysis and all students' factors as presented above entered the analysis. Models created by the two multiple regressions are presented in Table 1.

Table 1: Model summary of Multiple Regression analysis, correlation coefficient R and R², Adjusted correlation coefficient R² for the comprehension test and literacy test (N=490)

	Model	R	R ²	Adjusted R Square
Model Comprehension Test	1	0,570 ^a	0,325	0,324
	2	0,647 ^b	0,419	0,416
	3	0,653 ^c	0,426	0,422
Model for literacy Test	1	0,629 ^a	0,39	0,394
	2	0,707 ^b	0,50	0,497
	3	0,733 ^d	0,54	0,534

a. Predicting Variables in the Model: Students' achievement in comprehension pre test /literacy

b. Predicting Variables in the Model: Students' achievement in comprehension pre test/literacy pre test, Students group (control/experimental)

c. Predicting Variables in the Model: Students' achievement in comprehension pre test, Students group (control/experimental), fathers university education

d. Predicting Variables in the Model: Students' achievement in literacy pre test, Students group (control/experimental), Students' achievement in comprehension pre test.

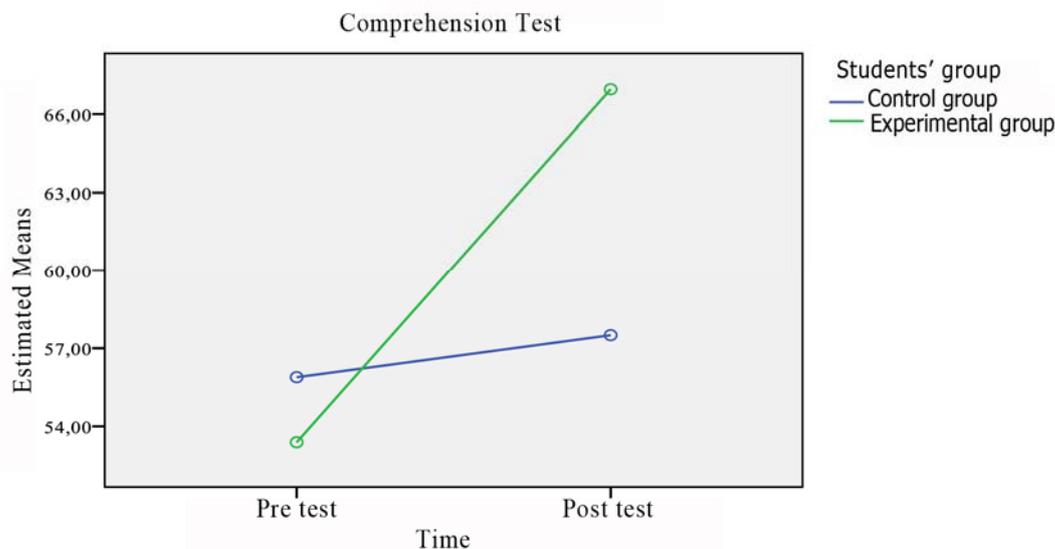
As shown in Table 1, model 1 and model 2 of multilevel regression analysis for both tests show that prior achievement in pre testing and differentiated instruction are the main predicting variables for students' achievement. Fathers' university education which was the only family factor entered in model 3 for the comprehension test has a minor predicting value

and it's not taken into consideration. Prior achievement in comprehension test adds to the model for the literacy tests (model 3).

These results show that students' prior achievement and their group (experimental or control group) explain to some extent student's achievement in post test. In the analysis of the comprehension test students' prior achievement and their group interpret (R^2) 42% of the variance of students achievement in post comprehension test. Each of the predicting variables had a significant ($p < .01$) zero-order correlation with students' post achievement. Similar to these results are the results of the literacy test, where prior achievement of students in literacy test, students' group and students' prior achievement in comprehension test interpret (R^2) 54% of the variance of student achievement in literacy post test. The three regression models according to the criterion t appear to be statistically significant ($p < .05$) with a weighted constants of $Var_1(\text{prior literacy ach.}) = 0.49$, $Var_2(\text{students' group}) = 0.34$, $Var_3(\text{prior ach. Comprehension}) = 0.23$.

The correlation between students' group (experimental or control group) and post achievement in comprehension test is represented in graph 1. The difference between the average students' scores of the experimental group and the control group for the comprehension test is shown by the slope of the achievement line. Experimental group's achievement line is greater than the slope of the achievement line of the control group, suggesting that progress in the experimental group was significantly higher than the progress of the control group in the comprehension test even though the achievement of the control group in comprehension pre test was lower than that of the experimental group.

Graph 1: Graphical representation of students' achievement in pre and post comprehension test of the experimental and the control group



Although the effect of family factors on students' achievement was identified on prior achievement the same effect is not being identified in the multiple regression analysis. This is due to multicollinearity of variables in the regression analysis and can be mainly explained based on the idea that family factors affect students' achievement indirectly through students' prior achievement.

These results show that no other factor contributed to the change in student's achievement, further than the intervention of differentiated instruction. Furthermore, it is shown that with-in the experimental group there was none specific group of students that were favored or disadvantaged by differentiated instruction. On the contrary, students achievement from all groups of students (socioeconomic group, achievement group and groups

characterizes by other family factors) was higher in both tests (comprehension test and literacy test).

Equity dimension of Differentiated Instruction

As mentioned above, variables concerning students' family characteristics and students' SES did not enter in any of the regression models due to multicollinearity of variables. The indirect effect of SES on students' achievement in the post test and especially the reduction of this effect by the intervention of differentiated instruction has been further investigated in order to determine its existence and its effect on students' achievement. From a regression analysis performed to determine the predicting value of student's prior achievement on students' achievement on the post test, the values of non-weighted residuals were extracted that show the difference in students' achievement between the pres and post test. Then two multiple regression analyses were conducted in order to determine the degree of impact of SES on students' progress in the two groups of the research (experimental and control). Both analyses generated similar results, with the multiple regression model of the experimental group showing a regression coefficient ($R^2 = 0.064$) lower by 1.1% compared to control group regression model ($R^2 = 0.075$) (table 2). The difference between the two models is too small to answer our research question and thus it was necessary to further investigate this research question.

Table 2: Correlation Coefficient R, Regression coefficient R^2 and Statistical Adjusted regression coefficients of prediction model for students' progress (control and experimental group) in literacy test in relation with their SES

Model	R	R^2	Adjusted R Square	df	F	sig
Experimental Group	0,274	0,075	0,070	1	16,008	0,001
Control Group	0,252	0,064	0,060	1	18,754	0,001

a. Variable Participating: SES

In order to investigate further the effect of SES on students' progress, one- way factor analysis of variance (One-Way ANOVA) was conducted on the experimental group literacy test data. The variance of the difference in students' achievement in the literacy test was explored based on regression unstandardized residuals for the categories of SES. While a factor analysis of variance was found to be significant ($F = 3,130$, $p = 0.015$ $df = (4,255)$), multiple comparisons between categories of SES for criterion Post-hoc Scheffe revealed that no statistically significant difference exists between different SES categories, leading to the conclusion that differentiated Instruction did not favor students from certain social groups.

In contrary, one- way factor analysis of variance (One-Way ANOVA) for the control group showed a statistically significant difference in the variation of the change in students' achievement in the categories of SES ($F = 7,369$, $p < 0.001$, $df = (3,256)$). In further investigation through, multiple comparisons of the categories with post-hoc Scheffe criterion revealed a statistically significant difference in average change of students' achievement from lower socioeconomic families in relation to the change of students' achievement of upper middle socioeconomic families. Statistically significant differences were also found between the average change of students' progress in middle and upper middle socioeconomic families.

Differentiated Instruction, as shown by the above results, contrary to traditional teaching, which adversely widens the achievement gap between students of different social background, accomplished in a short period of time to maintain the opening of the achievement gap between students from different socioeconomic background. Although this

result does not show the narrowing of the achievement gap, it reveals the potentials that differentiated instruction has in leading to the narrowing of the gap if implemented with consistency over a longer period. Implementation of differentiation in this study has made a big step in facing the negative effects of socio-economic factors on students' achievement, by managing diversity effectively, providing learning opportunities for all students from all socioeconomic groups something that did not occur in the control group.

Differentiated Instruction Characteristics

In assuring the consistent implementation of differentiated instruction by all teachers participated in the research and in order to identify the characteristics of their instruction, observation key was created and used by the researcher to observe the instruction process of the fourteen teachers. The observation key was created based on the main characteristics of differentiated instruction (Koutselini, 2001, 2006) and consisted of 18 criteria on a 5 points likert scale. For the validation of the observation key initial values for each criterion were equated through rasch, in order to equate the degree of difficulty in implementation of each criterion between the first and second observation and thus determine the degree of its difficulty. Out of the 18 criteria of the observation key, 13 criteria was able to be equated. The estimates in logits for the thirteen are shown in Table 3 and refer to differentiated instruction characteristics that could be applied by the teachers in a high frequency and without any difficulties (0 - (-3) or appear less frequently and with difficulty (0 - 3).

Table 3 :

Codigs and Estimates in logits for Differentiated Instruction Observation Key Criteria

Codings	Estimates (in logits)
Time the teacher uses for comments on student's general behavior and way of working during teaching	-2.13
Time the teacher uses to more explanations and examples during teaching	-1.77
Time the teacher uses for direct teaching or asking questions during teaching	-1.27
Degree of activities variation during teaching	-1.02
Extent to which the teacher provides students with personalized support and help during teaching	-0.89
Time the teacher uses to provide students guidelines for their work during teaching	-0.21
Extent to which opportunities are given to students from all readiness levels to participate in the learning process	0.58
Degree of opportunities given to students to restore basic knowledge and skills during teaching	0.60
Degree of opportunity given to students to recover prerequisite knowledge during teaching	0.82
Extent to which lesson activities are prioritized	1.05
Degree of control over the accomplishment of the lessons' objective during teaching	1.29
Extent to which the individual work of students varies based on their interests and talents	1.18
Extent to which the teacher differentiates students' homework	1.89

Further analysis was conducted for the initial and final values of the observations based on 2 variables, the key criteria for differentiated instruction as shown in Table 3 and the data gathered from lesson observations of teachers based on the key criteria of differentiation. The statistical values of the analysis on Differentiated Instruction observation key using the Rasch model are presented in Table 4. The reliability values of the model, both in relation to the criteria of the observation key and the values gathered for teacher' observations, (initial and final) are as high ranged from 0.81 to 0.88.

Table 4:
Fit indices emerged by using the Rasch model to analyse the data of the observation instrument for Differentiated Teaching

Parameters		Initial Values	Final Values
Mean	Criteria	0	0
	Teachers	-0.12	0.18
Standard Deviation	Criteria	0.94	0.93
	Teachers	0.89	0.79
Reliability	Criteria	0.82	0.81
	Teachers	0.88	0.85
Mean infit mean square	Criteria	1.03	1.04
	Teachers	1.02	1.03
Mean outfit mean square	Criteria	0.98	1.01
	Teachers	1.06	1.05
Infit t	Criteria	0.04	0.03
	Teachers	-0.02	0.06
Outfit t	Criteria	0.08	0.07
	Teachers	-0.05	-0.08

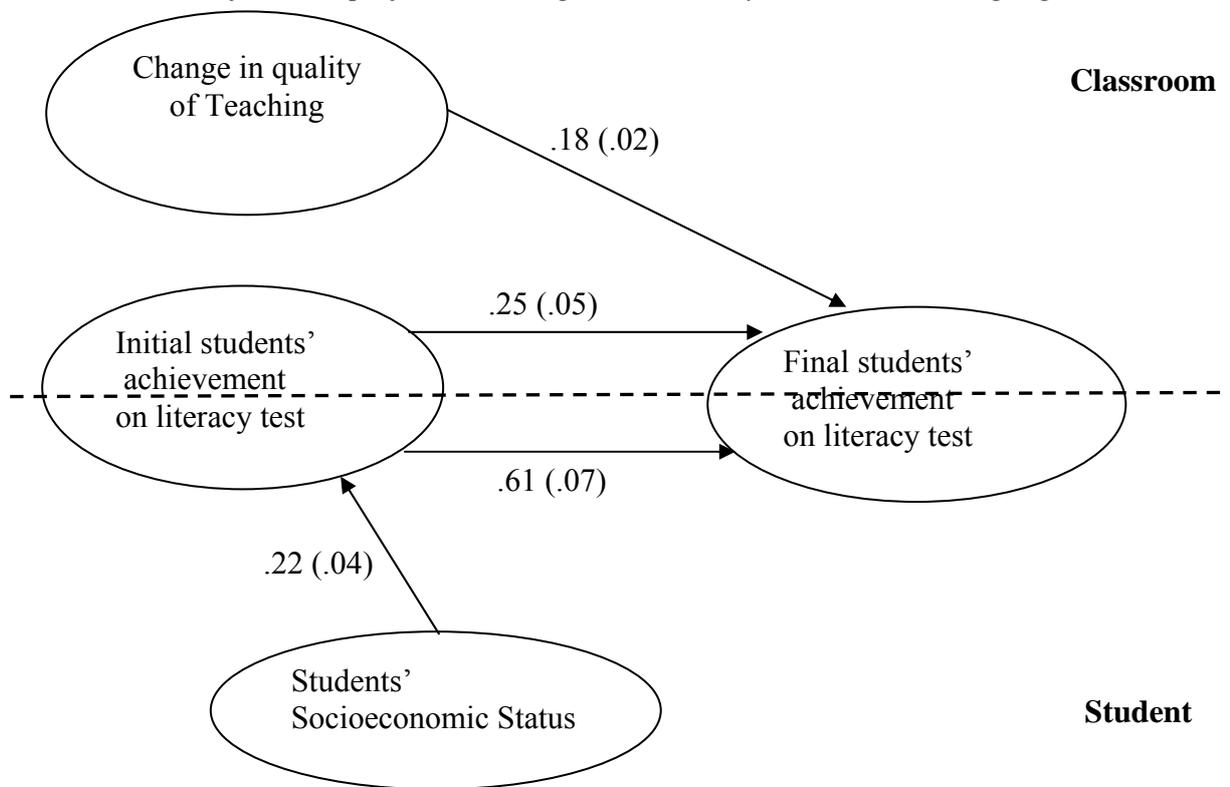
A comparison of the initial mean value (-0.12) and final mean value (0.18) of the observation key with a constant mean of 0, indicates that teachers were able to change their teaching based on the criteria of Differentiated Instruction observation key, increasing the mean value on the observation key up to 0.30 logits. Values of the model Mean infit mean square and Mean outfit mean square are very close to 1 and values for infit and outfit the range -0.08 - 0.08, values are close to 0, giving validity and reliability to the observation key. Based on these data, the observation key comprises a valid and reliable research tool that can be used for the observation of differentiated instruction. Simultaneously, these results answer one of the research's aims by describing the way and the degree of differentiated instruction is implemented by the teachers in order to meet the diverse needs of their students.

Effect on quality of differentiated Instruction on students' achievement

The data concerning the change in the quality of teaching, as presented above, resulted in the creation of a theoretical model (Figure 1) in order to study and determine the effect of the change in teaching practices on students' achievement. Based on the theoretical model, a Multilevel Structure Equation Model was created. The results of the analysis of structural equations, confirms the hypothesis of the effect of change in teaching, which was based on

differentiated instruction, on students' final achievement. Effect values and statistical error (in brackets) of the variables participated in the model are presented in diagram 1.

Diagram 1: Multilevel Model Analysis (Multilevel SEM) the effect of variables at class level and the level of student performance in general literacy tests (Greek Language).



The effect of change in teachers' instruction on students' final achievement was calculated at 0.18, which is considered as a small effect. Similarly, the influence of the initial performance of the class (0.25) on class final performance indicates that the improvement of the mean achievement score of the classroom is related to the class initial achievement mean score. Moderate effects were observed by students' socioeconomic status over their initial achievement (0.22). While initial student's achievement, on student level of multilevel SEM, show to have a major impact on student's final achievement (0.61) concerning each student separately. According to multilevel SEM results presented above, modifying and improvement of teacher's instruction based on the theory of differentiation bring similar improvement in students' achievement. The smaller the change in teachers' instruction, the smaller the effect in students' achievement and progress. Even though the effect size of differentiated instruction on students' achievement is minor, this does not consist of problem in supporting differentiation as an effective teaching practice, considering the limited time of the intervention for the implementation of differentiated instruction and the conditions under which the intervention took place, while teachers were still in a learning process on how to differentiate their instruction.

Discussion

Based on the theory and practice of differentiation this study responded to its fundamental objective in providing evidence to support the theory of differentiation, its basic principles and presuppositions, and confirm its effectiveness in mixed ability classrooms. These findings provide the educational scientific world, with the empirical data required (Hart, 1992; Kronberg, York-Barr, Arnold, Gombos, Truex, Vallejo & Stevenson, 1997; Tomlinson, Kalbfleisch & Layne, 1998; Conway, Arthur-Kelly & Pascoe, 2004) to support the effectiveness of differentiation for all students in mixed ability classrooms.

Differentiated Instruction in mixed ability classrooms was possible through systematic training and support, provided to teachers that participated in the study in order to implement differentiation in their every day instruction. Core instruction principles of effective differentiation are defined to be the following: the instruction planning based on constructivism learning theory, the hierarchical order of learning activities, the maximization of students active participation in the learning process, the reduction of teachers talking time during teaching, the variety of activities, the students work according to their personal pace, the personalize support to students, the differentiation of activities according to students' interests and the learning profile and continuous evaluation of students' achievement with a parallel evaluation of the effectiveness of learning process. Training and support for teachers has proved to be a key to the successful implementation of differentiated instruction by teachers and it is defined as a basic need for effective implementation and the reason for the failure of implementation of differentiation in a similar study (Callahan, Tomlinson, Moon, Brighton, & Hertberg, 2003).

The documentation of the effectiveness of differentiated instruction of language course in mixed ability classrooms confirms views of other research attempts on differentiation, according to which, differentiation can be effective for all students regardless of their readiness level, their gender or their socioeconomic status (Tomlinson, 1999; Gayfer, 1991; Koutselini, 2006). Although effectiveness of differentiation consisted the main aim for a number of previous studies, most of these studies target group was: specific groups of students (talented or disabled), a small number of students in a specific area of a subject, for a very limited time based on a certain focus (Baumgartner et al., 2003; Tieso, 2005; Geisler, et.al., 2009). The present study and its results concern the whole classroom population for a whole school year in the instruction of language providing valid evidence that differentiation is plausible and effective for all students in mixed ability classrooms.

Quantitative data, as presented in detail above indicate a statistically significant difference between students' achievement taught by differentiated instruction and students that that did not received differentiated instruction. Difference between the two students groups through two separate regression analysis one for each language tests (literacy and comprehension tests) led to the creation of prediction models for students' final achievement. Students' group (experimental or control group) and students' prior achievement participated in the models, where variables like gender and variables for students' socioeconomic background (parents education and parents education) that failed to enter the models and were not capable of increasing the prediction power of the models.

The effect size of differentiation on students' achievement on literacy test was estimated at 0.34 and the corresponding effect on the comprehension test was estimated at 0.31. Although the effect size for both tests is fairly small these results were to some extent expected. The intervention for the implementation of differentiated teaching lasted only 6 months. During these months, an effective intervention could only make a limited difference to students' achievement and thus no dramatically differences were expected in the effect size. Previous research on effectiveness on differentiation supports that its effects are not immediate and may not be visible before some years of its implementation (McAdamis, 2001). Ann Hess (1999) describes the process of implementing differentiation as an ongoing evolutionary process and argues that for differentiation instruction to become a teacher's permanent instruction practice will need up to seven years.

Effectiveness of differentiation in teaching language courses show by the present research to constitute an answer to the question raised by Hodge (1997), whose research on the effects of differentiation on students achievement showed that differentiation improves students' achievement on standardized mathematics tests but this did not happen for language standardized tests. The results of this study answer Hodge's (1997) question whether differentiation can be effective for teaching language.

The positive change in students' achievement has shown that differentiation can be considered as an effective theory of learning in mixed ability classrooms. Triangulation of data and methods was achieved in this study providing further validity and reliability to the research results. Effectiveness of differentiation has been found comparing the achievements between the control and the experimental group and at the same time the quality of differentiated instruction has been proved to have an effect on students' achievement.

Showing the effectiveness of differentiation is very important but perhaps one of the most important finding of this study is the confirmation of the social-oriented character of differentiation and differentiated instruction. Although the socioeconomic status of students was correlated with the initial performance of students, there was no effect of SES on students' progress, confirming that differentiation can maximize learning outcomes for all students regardless their socioeconomic background (Koutselini, 2008). Furthermore, the evidence found through the one-way factor analysis of variance (One-Way ANOVA) show a statistically significant difference in the variation of the change in students' achievement in SES's categories for the control group that was not instructed by differentiated instruction. The same analysis conducted for the experimental group did not show any statistical difference in the variation of students' change in achievement.

Based on this evidence, effective differentiation has accomplished to promote equity dimension of effectiveness by providing all students with the opportunity to improve their achievement regardless their SES. Differentiated instruction implemented by teachers in the experimental group managed in a small period of time of the intervention to maintain the achievement gap size stable in contrast with the control group where the achievement gap was increased supporting evidence of previous research that achievement gap increases during schooling (Phillips, Grouse, Ralph, 1998; Strand, 1999; Fryer & Levitt, 2006). A longitudinal survey conducted in Cyprus provided evidence of the progressively negative school impact on students' achievement and the year by year increase of the achievement gap (Kyriakides, et al., 2008). The results of the present study concerning the control group are in line to the previous survey.

These results confirm one of the basic axes of differentiation theory, by which differentiation is the answer to education call for social and educational equality (Gamoran & Weinstein, 1995; Ducette, Sewell, & Shapiro, 1996; Darling-Hammond et al., 1999; Schoenfeld, 1999; Koutselini 2006b, 2008; Valiande & Koutselini, 2008, 2009), providing all students with opportunities for personal development regardless of their socioeconomic status.

Differentiation has in chorus accomplished to promote the quality dimension of effectiveness. Although quality dimension of effectiveness can be assumed by the positive results on students' achievement that were taught by differentiated instruction, the results of the multilevel SEM supports further the existence of an effect of quality differentiated instruction in students' achievement. According to the findings of multilevel SEM, quality of differentiated instruction corresponds to the degree of effectiveness over students' achievement. Quality of teaching accomplished by differentiated instruction is omitted to all students providing them the help they need to improve based on their personal strengths and needs, leading to equity in results by improvement in achievements for all.

In the Cypriot educational context, the findings of the study provide a comprehensive proposal to address educational inefficiency. An implementation of differentiated instruction based on the main characteristic of effective differentiated teaching as shown by the present study can enhance the learning process and improve students' achievement. Differentiation is not the easy way out of ineffectiveness but we know that it constitutes a proposal for achieving effectiveness for all students. Differentiation is feasible, effective and necessary in order to promote quality and equity dimensions of effectiveness based on the evidence of the research presented. Of course, there is still a long way for research in order to determine through longitudinal studies the effectiveness of differentiation over time, for all students, in different educational levels (primary, secondary) and across subjects.

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