



## TEACHING STRATEGIES APPLIED BY EDUCATORS TO TEACH MATHEMATICS TO STUDENTS WITH MILD INTELLECTUAL DISABILITIES

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### **Abstract:**

The main purpose of education in general is to help students with intellectual disabilities to use their potential to the fullest extent possible to be able to participate in all social activities. In this paper, we present the data and findings obtained from the research conducted on 100 educators who teach mathematics and are related to the strategies applied by the educators to teach mathematics to students with intellectual disabilities.

**Keywords:** intellectual disabilities, mathematics, secondary school level

### **1. Introduction**

Bishop (1985) highlights the important role of the teacher by stating that mathematics education in practice is, and should be, mediated by the teacher. The teacher has a very important role in the learning process as his choices in terms of planning, organization, and implementation of teaching affect the learning of mathematics by students. The personality traits and elements of the professional composition of the teacher play a very important role in mathematics education (Agaliotis, 2011).

Many researchers agree that it is very important to place more emphasis on the teacher's belief system (Buehl & Beck, 2015). These beliefs act as a filter through which teachers make their decisions influencing the teaching practice itself. Especially in mathematics education, teachers' usual beliefs relate to the nature of the subject matter, teaching, and learning. The social practices of mathematics education cannot be understood without taking into account the teacher's belief system in relation to the nature of mathematics, its teaching, and its learning.

Based on this, Ernest (2004) argues that whatever the teacher's beliefs about the nature of mathematics, the only thing that is sure is that they have many educational and pedagogical implications for the teacher's content choices, the organization, and the way of teaching implementation. For example, if a teacher perceives mathematics as a

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predetermined set of rules and procedures, then he or she will ask students to practice framed exercises in order to be able to solve them (Anderson, & Östlund, 2017).

Grootenboer and Marshman (2016) argue that a change in the teacher belief system is not simply a matter of presenting new data. On the contrary, the central beliefs are quite strong and have arisen through experience, and any change needs to occur after experiencing new pleasant experiences in conjunction with reflection on these experiences. However, the teacher's practices in the classroom are not so easy to understand as they are not determined solely by the teacher's knowledge and beliefs about mathematics education. The teacher's beliefs can be activated at some point in the teaching practice, as the teacher's internal factors interact with various external variables of the social context, such as class, school, or national education policy (Buehl & Beck, 2015). From a socio-cultural perspective, as teaching and learning are treated as framed in social practices, several factors are considered to influence the teacher's decision-making and teaching practices.

According to Handal (2003), there is a dialectical relationship between teacher beliefs and teaching practices, which is mediated by contextual factors (e.g. classroom or school culture). That is, the teacher's decisions and practices regarding mathematics education should be determined in relation to many different factors, such as the expectations of the school and the parents, the national education policy, and the chances of teachers cooperating in school. In this way, the teacher forms his professional identity, which Collopy (2003: 289) defines as "*the set of interconnected beliefs and knowledge about the subject, teaching, and learning, as well as and personal self-efficacy and orientation towards the profession and change*".

Van Zoest and Bohl (2005) also emphasize the individual knowledge, beliefs, intentions, and expectations of the teacher on the one hand, and the ways in which he or she has learned to think, act, and interact on the other side. There is a dialectical relationship between the teacher's professional identity and teaching practices, where professional identity emerges through the teaching practice, but at the same time identity influences the ways in which the teacher analyses and interprets his teaching practices (Root, et al., 2018).

## **2. Aims of the research**

The present research focuses on investigating the teaching techniques that educators use to teach mathematics to students with mild intellectual disabilities. Also, the research focuses only on secondary school educators and students.

According to the aim of the research, the following research questions are investigated:

- Are the teaching techniques used by participants to teach mathematics to students with mild intellectual disabilities affected by the level at which they teach learning strategies to their students?

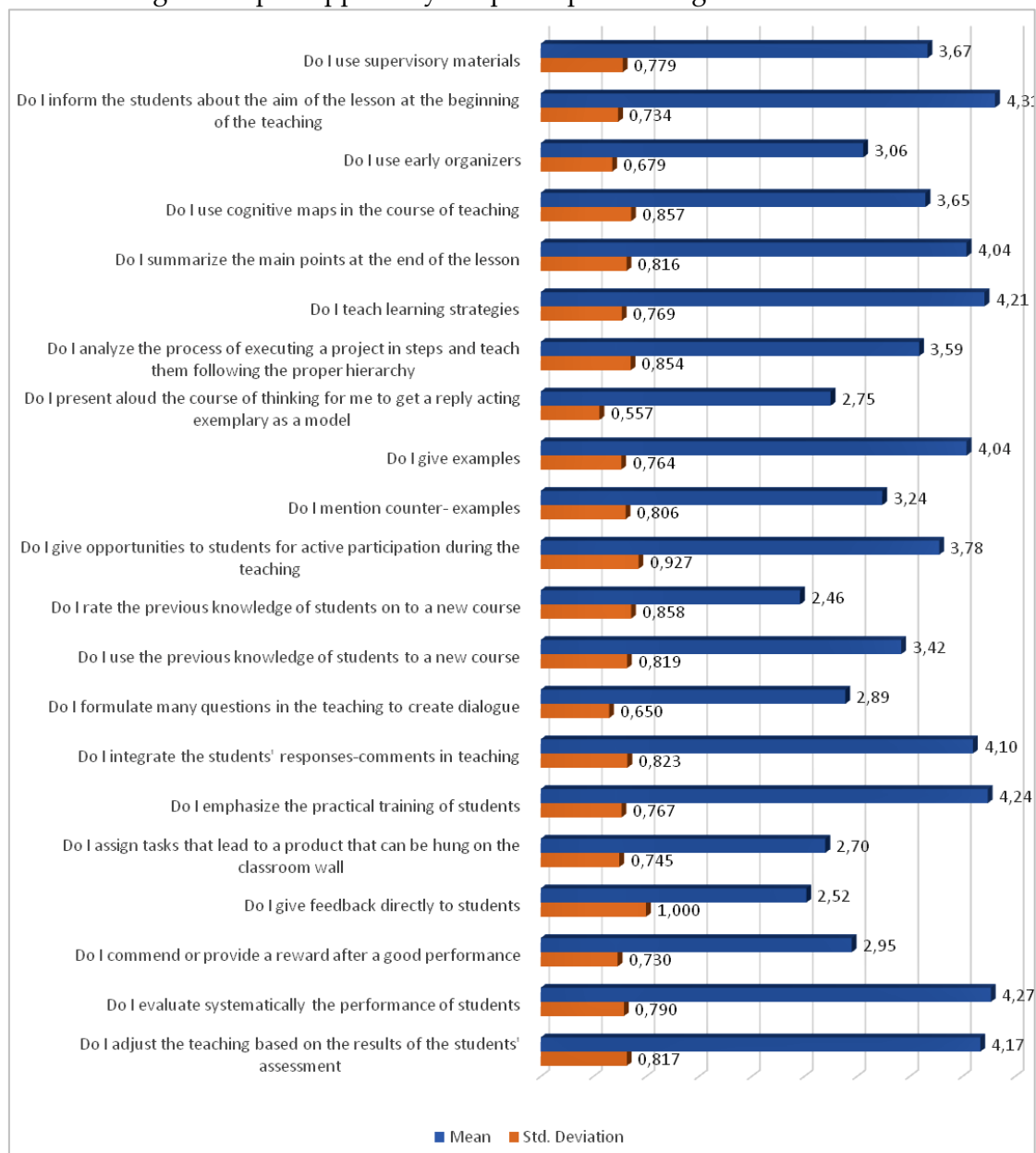
- Are the teaching techniques used by participants to teach mathematics to students with mild intellectual disabilities affected by the level to which they adjust their teaching based on the results of the students' assessment?

The sample of the research consisted of 100 secondary education teachers who teach mathematics to students with mild intellectual disabilities. The convenience sampling method was used to choose the teachers who participated in the research. This method is widely chosen because it is quite fast in gathering the needed data, cheap, efficient and simple to implement (Etikan, Musa, & Alkassim, 2016).

### 3. Data analysis

In Chart 1 which displays the descriptive statistics, the teaching techniques that the participants use are presented, using means and standard deviations. The answers accept values from 1 to 5 (1-Never, 2-Rarely, 3-Sometimes, 4-Often, 5-Always) and the higher the mean is, the more the participants use each teaching method. Between the answers "Often" and "Always", the participants are placed about informing the students about the aim of the lesson at the beginning of the teaching (4.31) and evaluating systematically the students' performance (4.27). Also, they often emphasize practical training (4.24), teach learning strategies (4.21), adjust the teaching based on the students' assessments (4.17), integrate the students' comments in their teaching (4.10) and summarize the main points at the end of a lesson (4.04). Also, they often give examples (4.04) and opportunities for active participation during teaching (3.78). Between the answers "Sometimes" and "Often", leaning to the second one, the participants appear to be about using supervisory materials (3.67), cognitive maps in the course of teaching (3.65) and analyzing the process of executing a project in steps and teach the students how to follow the proper hierarchy of the steps (3.59). On the same scale, but leaning more toward the answer "Sometimes", they place the use of previous knowledge to a new course (3.42), while they sometimes mention counter-examples (3.24), use early organizers (3.06) and provide rewards for good performance (2.95). Also, sometimes the participants formulate many questions in the teaching to create dialogues (2.89) and present aloud the course of thinking to get a reply acting exemplary as a model (2.75). Continuing, it seems that between the answers "Rarely" and "Sometimes", with a lean to the second, the participants place the frequency in which they assign tasks that lead to a product that can be hung on the classroom wall (2.70) and give feedback directly to the students (2.52). Lastly, on the same scale, but leaning more toward the answer "Rarely", they seem to rate the previous knowledge of their students on to a new course (2.46).

**Chart 1:** Teaching techniques applied by the participants using means and standard deviations



The following chapter is dedicated to investigating the research questions mentioned above.

To reply to the research questions, Chi-square ( $\chi^2$ ) test was used in order to reveal significant dependencies among the variables. This test is non-parametric and extracts 2 main tables. The first contains a crosstabulation matrix which splits the data for both studied variables and calculates the percentages in each case. Additionally, the second table contains Pearson's Chi-square and p-value, which determines whether the 2 studied variables are independent ( $p > 0.05$ ) or not ( $p < 0.05$ ).

In Table 1 the p-values of the Chi-Square tests are presented, which reveal 16 statistically significant dependencies.

**Table 1:** Chi-Square as for the level in which the educators teach learning strategies

	<b>Do I teach learning strategies?</b>
Do I use supervisory materials?	0.000
Do I inform the students about the aim of the lesson at the beginning of the teaching?	0.000
Do I use early organizers?	0.055
Do I use cognitive maps in the course of teaching?	0.000
Do I summarize the main points at the end of the lesson?	0.000
Do I analyze the process of executing a project in steps and teach them to follow the proper hierarchy?	0.002
Do I present aloud the course of thinking for me to get a reply acting exemplary as a model?	0.001
Do I give examples?	0.833
Do I mention counter-examples?	0.000
Do I give opportunities to students for active participation during the teaching?	0.000
Do I rate the previous knowledge of students on to a new course?	0.000
Do I use the previous knowledge of students to a new course?	0.413
Do I formulate many questions in the teaching to create dialogue?	0.025
Do I integrate the students' responses-comments in teaching?	0.302
Do I emphasize the practical training of students?	0.001
Do I assign tasks that lead to a product that can be hung on the classroom wall?	0.000
Do I give feedback directly to students?	0.022
Do I commend or provide a reward after a good performance?	0.000
Do I evaluate systematically the performance of students?	0.012
Do I adjust the teaching based on the results of the students' assessment?	0.039

The following Table 2 presents the p-values of the Chi-Square tests used to answer the second research question.

**Table 2:** Chi-Square as for the level in which the participants adjust the teaching based on the results of the students' assessment

	<b>Do I adjust the teaching based on the results of the students' assessment?</b>
Do I use supervisory materials?	0.000
Do I inform the students about the aim of the lesson at the beginning of the teaching?	0.872
Do I use early organizers?	0.000
Do I use cognitive maps in the course of teaching?	0.001
Do I summarize the main points at the end of the lesson?	0.000
Do I analyze the process of executing a project in steps and teach them to follow the proper hierarchy?	0.000
Do I present aloud the course of thinking for me to get a reply acting exemplary as a model?	0.004
Do I give examples?	0.001

Do I mention counter- examples?	0.000
Do I give opportunities to students for active participation during the teaching?	0.000
Do I rate the previous knowledge of students on to a new course?	0.000
Do I use the previous knowledge of students to a new course?	0.000
Do I formulate many questions in the teaching to create dialogue?	0.000
Do I integrate the students' responses-comments in teaching?	0.021
Do I emphasize the practical training of students?	0.000
Do I assign tasks that lead to a product that can be hung on the classroom wall?	0.011
Do I give feedback directly to students?	0.895
Do I commend or provide a reward after a good performance?	0.063
Do I evaluate systematically the performance of students?	0.000

#### 4. Discussion and Conclusion

The research above investigated the teaching techniques used by secondary education teachers in order to teach mathematics to students with mild intellectual disabilities. The sample consisted of a total of 100 secondary education teachers. As for the techniques that they mostly used, the participants more often seem to inform the students about the aim of the lesson at the beginning of the teaching and evaluate systematically the performance of students. Also, quite often they emphasize the practical training of students and teachers' learning strategies for their students with mild intellectual disabilities. However, less often they give direct feedback to the students about their performance and they rate the previous knowledge of students on to a new course.

Through the first research question, it is revealed that most of the participants that always teach learning strategies to their students, more often use supervisory materials, inform the students about the aim of the lesson at the beginning of the teaching and summarize it at the end, use cognitive maps and analyze the process of executing a project in steps. Also, the majority of the participants who always teach students learning strategies, present aloud the course of thinking to get a reply acting exemplary as a model, mention counter-examples and give opportunities for active participation at a higher frequency than the rest of the participants. Furthermore, most of the participants that sometimes teach their students learning techniques, more often rate the previous knowledge of students on to a new course. As for the participants that often teach their students with mild intellectual disabilities learning strategies, at a higher frequency they give feedback directly to students, commend or provide a reward after a good performance and evaluate systematically the performance of students. Lastly, the educators that always teach the students learning methods, more often formulate many questions in the teaching to create dialogue, emphasize practical training, assign tasks that lead to a product that can be hung on the classroom wall and adjust the teaching based on the results of the students' assessment.

In the second research question, it becomes obvious that the participants that always adjust their teaching based on the students' assessment, more often use

supervisory materials, analyze the process of executing a project in steps, and present aloud the course of thinking to get a reply acting exemplary as a model and mention counter-examples. Also, the teachers who always adjust their teaching, seem to give more frequent opportunities for active participation, rate and use the previous knowledge of students on to a new course, integrate the students' responses-comments in teaching and emphasize the practical training, compared to the rest of the educators. The participants that sometimes adjust their teaching to the students' assessment sometimes, at a higher frequency use early organizers, and cognitive maps, summarize the main points at the end of the lesson and formulate many questions in the teaching to create dialogue. As for the teachers that often adjust their teaching to the students' assessment, they more often give examples, assign tasks that lead to a product that can be hung on the classroom wall and evaluate systematically the performance of students, in comparison to the rest of the sample.

### **Conflict of Interest Statement**

The author declares no conflicts of interest.

### **About the Author**

Panagiotis-Christos Trichas is a special education teaching professional. He teaches mathematics to students with special educational needs. He holds a Master's degree in Special Education, as well as in Management of Educational Units. He has 10 years of professional experience in research and teaching in the field of special education. He has published articles in international conferences and scientific journals about special education and management in educational units.

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