



Teachers' Views and Practices Relating to the Teaching of Mathematics in other Disciplines

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Abstract Teaching mathematics applications in various fields is one of the main topics of mathematics education these days. This has led to the development of STEM education (Science, Technology, Engineering, and Mathematics) in recent decades, which connects these disciplines using trans-disciplinary or interdisciplinary approaches. Applications of mathematics have grown in importance due to their integration into everyday life as well as their ability to support students' understanding of the subject and enable them to apply their knowledge in a variety of contexts. Given their significant influence in this approach, it is crucial to examine teachers' perspectives on and experiences with teaching mathematical applications.

The study was carried out in Israel in 2021. 221 math teachers from post-primary schools are taking part. The research tool for this study was a questionnaire designed to gather information from teachers about their practices for integrating applications into their lessons and their opinions about teaching applications of mathematics. It was based on the scientific literature. There are both closed-ended and open-ended questions on the survey. Both quantitative and qualitative analysis was done on the responses

According to the study's findings, 42.5% of Israeli teachers instruct students in mathematical applications. Upon analyzing the responses provided by the educators who instruct in mathematical applications, it was found that 47% of the teachers were instructing in physics applications, 47.5% were integrating them into their lessons on a few occasions per semester, and 52.1% were instructing through student presentations. According to the participants, piquing students' interest in mathematics (44.3%) and inspiring students to learn mathematics (34.8%) are the two most significant advantages of teaching applications of mathematics. Time constraints (30.8%) and teachers' inability to teach mathematical applications in other disciplines (24.6%) are the two biggest barriers to teaching applications of mathematics.

Keywords teaching applications' benefits, challenges in teaching applications, application of mathematics, STEM.

1. Introduction

Because it is essential to human functioning in many critical domains of the modern world, mathematics is important. It serves as a foundation for the advancement of science and technology studies as well as logical-quantitative thinking. As a result, it is crucial to teach applications of mathematics in order to help students connect the subject to real-world situations, view mathematics as a field that can support their personal growth, and view mathematics as a practical tool that can enable them to create unique things in the real world.

The primary issue in mathematics education is that high school students often struggle to make the connections between the mathematical concepts they are taught in the classroom and their everyday lives in the contemporary world (Nkhase, 2002). After graduating from high school, many students are ignorant of the



importance of mathematical applications, knowledge, and skills for success in life, in their future academic endeavors, and in choosing a career. This can be explained by the instructional strategies that are employed, which do not help the student develop his critical thinking and comprehension skills or show him the relevance of mathematics. Through the application of these techniques, students solve textbook exercises in an algorithmic and procedural manner, gaining knowledge. Many students only take math classes in order to pass their exams. It is crucial to demonstrate how mathematics is used in other academic fields in order to foster in pupils a love of the subject, inspire a desire to learn it, and help them see its value in everyday life without fear or hesitation. By then, they will be studying it with enthusiasm and enjoyment, which will alter their perceptions of and attitudes toward mathematics and enhance their performance in it and related fields. Numerous studies on the application of mathematics in other fields and STEM (Science, Technology, Engineering, and Mathematics) education have demonstrated the value and efficacy of this kind of instruction for both teachers and students.

2. Literature Review

A few facets of teaching mathematics applications in other domains, like engineering, finance, transportation, etc., were emphasized by Chick & Stacey (2013). In this instance, the application domain is becoming more important than mathematics. It takes expertise in both application and mathematics to solve a given problem because interactions take place all throughout the solution. Additionally, the application field evaluates the solution's success.

The researchers also recognized that completing workbook exercises and giving them to the teacher is a routine aspect of teaching mathematics. Teaching routine problems has a connection to getting students ready for national exams because, in many cases, these tests use certain well-defined problem types (Marchis, 2009a; 2009b). It also has an impact on students' performance because routine problems make up the majority of the problems in textbooks and workbooks (Kolovou, van den Heuvel – Panhuizen, & Bakker, 2009; Marchis, 2012); or because teachers lack the confidence to tackle difficult problems (Silver et al, 2005).

However, teaching mathematics is difficult and involves solving problems that are not quick fixes. These kinds of problems should be prioritized because they have the potential to improve students' problem-solving skills. Problems that cross multiple disciplines and emphasize applying mathematics to other domains rather than just mathematics itself are typically difficult and good for honing higher order thinking skills.

The phrase "STEM education" is becoming widely used in education around the globe. Many nations understand that in order to meet the challenges of the future, they will need laborers with sufficient and appropriate knowledge and skills from STEM disciplines. Even with all of the research and attention that STEM has received, there are still a lot of debates and problems (Gao, Li, Shen, & Sun, 2020).

3. Methodology

The study's objective

The purpose of this study is to ascertain the views and practices of educators regarding the application of mathematics to other academic fields.

The research tool

A questionnaire designed for this investigation and derived from the scientific literature served as the research instrument. The purpose of the questionnaire is to gather feedback from educators regarding their thoughts and methods for teaching mathematics applications to other subjects. The demographic section and the research topic-related questions make up the two main sections of the questionnaire. Ten questions, the majority of which are closed, make up the demographic section. There are eighteen questions in the second section, fifteen of which are closed (multiple choice, check box, scale, affirmations measured on a 5-level Likert scale) and three of which are open.

Individuals Involved

In the study, 221 math teachers from post-primary schools in Israel took part. It was a voluntary participation. Every participant responded to every question on the survey. The participants' average age was 41.1 years, and their average length of teaching experience was 16 years. The majority of participants are Arab, with 25% of them being female educators. Of the participants, half hold an MSc degree and the other half have a BSc. About



half of the participants teach at the middle school level, while the remaining participants teach at the high school level.

Table 1 provides a list of these participants' demographics.

Variables		Frequency	Percent
Gender	Male	82	37%
	Female	139	67%
Nationality	Arab	201	91%
	Jewish	20	9%
Degree	BSc degree	99	44.8%
	MSc degree	119	53.8%
	PhD degree	3	2.4%
Level of class they teach	Middle school teachers	99	44.8%
	High school teachers	122	55.2%
Level of computer and technology control	Excellent	85	38.5%
	Good	108	48.9%
	Medium	28	12.7%
Type of school in which they teach	Theoretical	183	82.8%
	Religious	3	1.4%
	Technology	23	10.4%
	Private	12	5.4%

Analyzing Data

The SPSS software was used to quantitatively analyze closed-ended questions. Frequency, percentage, mean (M), and standard deviation (SD) are included in the results. The categorical analysis was used to qualitatively examine open-ended questions.

4. Results and Discussion

Teachers' perspectives on the advantages of teaching mathematical applications

Applications of mathematics are seen as important by teachers (M= 4.24, SD= 0.52; scaled from 1 (not important at all) to 5 (very important)). Additionally, they were asked to rate several advantages of teaching mathematics applications on a 5-level scale (Table 2). The participants believe that each of the benefits listed is legitimate because their average is greater than four and their standard deviation is less than 0.80. The greatest mean was attained when it came to broadening pupils' perspectives and emphasizing the value of mathematics.

Table 2.: Perceptions of educators regarding certain advantages of teaching mathematics applications

Benefi	Mean	Standard deviation
arising students' interest for Mathematics	4.15	0.72
motivating students for learning mathematics	4.18	0.68
showing students the importance of mathematics	4.32	0.65
exercising mathematical knowledge	4.20	0.70
developing competency of using a mathematical knowledge in different context	4.30	0.60
improving achievement of students in mathematics	4.10	0.72
expanding the horizon of the student	4.34	0.63
developing a positive attitude towards mathematics	4.26	0.72

In a separate set of closed-ended questions, participants were requested to identify the top two benefits of teaching mathematics applications based on a provided list. The top three benefits were sparked by students' interest in mathematics (98 participants, 44.3%), inspired students to learn mathematics (77 participants, 34.8%), and demonstrated the value of mathematics to students (21 participants, 9.5%).

Table 3.:The frequency of teaching applications of Mathematics

Frequency of teaching applications	Frequency	Percent
once a week	28	29.8%



few times a semester	45	47.9%
once a semester	8	8.5%
once a year	2	2.1%
other	11	11.7%

Conclusion

According to this study, 42.5% of the teachers surveyed said they integrate mathematical applications into other subject areas. Higher computer-user proficiency makes one more receptive to educational apps. The field where applications are most integrated is physics. Fifty percent of educators who incorporate applications into their lessons do so a few times per semester. The methods used to teach applications are either passive, with the teacher providing the material, or active, with the students being given tasks to complete while they figure out how to apply the mathematical knowledge. Although fewer than half of the respondents teach applications, the majority of Israeli educators believe that it is crucial to teach mathematics applications because they spark students' interest in the subject, encourage them to learn it, and demonstrate its significance to them. The participants have reported certain challenges, despite the importance of teaching applications of mathematics. The most frequent challenges include time and curriculum constraints, a lack of equipment for demonstrations, and a teacher's lack of scientific and methodological knowledge for teaching applications in other disciplines.

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