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The impact of contextual teaching and learning on improving student achievement in economic mathematics

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ABSTRACT

The effectiveness of teaching strategies in improving student achievement in mathematics has been a topic of ongoing research. In Kosovo, vocational schools, especially those with an economics focus, face challenges in student engagement and achievement in mathematics, particularly in solving contextual problems related to economics. This study examines the impact of contextual teaching and learning (CTL) on students' mathematical problem-solving skills in economics, as well as students' attitudes toward this approach. This action research study employed a quasi-experimental design with a pre-/post-test approach. The research was conducted at the vocational high school "Andrea Durrsaku" in Kamenica, with 40 twelfth-grade students enrolled in the department of economics. The intervention lasted for six weeks, during which students engaged in problem-solving tasks related to economics using the modified CEICT (connection, experience, implementation, collaboration, transfer) model. Data collection included a pre-test, post-test, and a questionnaire with open-ended questions to measure students' attitudes toward the contextual approach. Results from the pre- and post-test indicated significant improvement in student achievement, particularly in solving contextual problems in economics. Students demonstrated better problem-solving skills after the six-week intervention. Additionally, the majority of students reported positive attitudes toward CTL, appreciating their relevance to real-life situations and their collaborative nature. The findings suggest that CTL significantly enhances student achievement in mathematics, particularly in the context of economics, by making learning more relevant and interactive. Students' positive attitudes toward this approach highlight its potential to foster deeper engagement and understanding. This research underscores the importance of integrating contextual learning strategies into vocational education to improve outcomes and better prepare students for real-world challenges.

Keywords: contextual teaching of mathematics, contextual learning, economic mathematics, academic achievement, mathematics education

INTRODUCTION

Teaching and learning are quite complex processes and as such research on them never ends. Research oriented to these processes pushes us towards change which ensures successful teaching and learning, to achieve the general educational goals and development of society. Furthermore, education develops human personality, thoughts, relationships with others and prepares people for life experiences. It provides us with information in various fields in general and our specialization in particular; especially what we need to master in our work. To achieve this progress, mathematics education is of particular importance, especially the applications of mathematics in solving real life problems (Piercy, 2019). Moreover, when we face problems from the real world, to solve them, we have to use different applications and different strategies from mathematics. This helps us to make sense of mathematics by examining a particular context which makes learning mathematics more interesting. In our research conducted with students of economics, the teaching of mathematics is given special importance by focusing on improving the learning outcomes in mathematics. In the traditional teaching methodology, the teacher explains new concepts and procedures and the students have to listen, and they are not incorporated at all in the activities of the lesson. The consequence of this is that students, in addition to being very passive during the lesson, must memorize things (Hiebert, 1986). Therefore, another approach is required in the teaching of mathematics, which is confirmed by different authors. Paris (2011) who emphasizes that classroom assignments play a pivotal role in influencing students by directing their attention to specific aspects of content and providing strategies for solving mathematical problems. Contextualized instruction emphasizes the connection between ideas and fostering deeper thinking (Glynn & Winter, 2004). This approach contrasts with traditional, subject-specific teaching, which primarily focuses on presenting and reviewing information while linking concepts to each other. Furthermore, contextualized teaching encourages students to organize and integrate their knowledge by engaging with their logical thinking from diverse perspectives, while working towards solving relevant problems (Paris, 2011).

Regarding teaching strategies, it is important to recognize that adapting instructional methods is necessary when it is observed that many students struggle to keep up with the lessons (Felder & Spurlin, 2005). Tomlinson et al. (2003) also recommended that teachers implement contextualized instruction to cater to students' readiness, interests, and diverse learning needs within a varied classroom environment. This approach to reform promotes increased student engagement and fosters the development of their learning potential.

The nature of our research problems mainly uses algebraic knowledge, therefore, results from various studies (Witzel et al., 2003) show that students who learned how to solve algebraic transformation equations through contextualized instruction scored higher on both post-instruction and post-tests. In addition, those exposed to contextualized instruction made fewer procedural errors when solving algebraic variables (Witzel et al., 2003).

This research presents the importance of contextual teaching and learning (CTL) with special emphasis on Kosovo. In this research we will compare the effects of CTL with the effects of traditional teaching. The outdated methodology of traditional learning in Kosovo has left students with many shortcomings, because they are used to the principle that they should only listen to what the teacher explains and do not have interactive conversation at all (Thaqi & Giménez, 2014). This led to the poor development of mathematical knowledge, which is evidenced by the very poor result in PISA (2015, 2018) testing, where Kosovo is quite bad in the ranking (KEC, 2024). Through contextualization students are helped to solve tasks in more appropriate ways and they are encouraged to learn the subject of mathematics (Novita et al., 2012). This approach to learning makes it easier for them to solve the various problems that arise (Jupri & Drijvers, 2016).

The students at our schools have shown low results in mathematics (PISA, 2015, 2018) and one of the reasons is precisely the fact that the tasks of the PISA test are largely contextual. PISA is a project of the Organization for Economic Co-operation and Development and aims at student assessment. This assessment is held every 3 years. But, since Kosovo educational system is constantly reformed, then why do our students fail in PISA testing, what problems arise in this program and how to achieve positive results?

As in other areas, mathematics assignments present real-life problems. So, students are valued for their creative abilities, how they would manage to find solutions in their future fields of work, because the problems at work are not solved by definitions, but by cases of concrete examples. For this reason, CTL is a methodology that could provide a solution to the above-mentioned problems and in the future our students could have better results in PISA tests. Through this methodology, students learn that the mathematical and economic problems cannot be solved with a definition and one formula, but through analyzing and developing tasks from real life. When a student learns with this method, he/she develops critical thinking and can face future challenges.

The Kosovo pre-university education curriculum also aims to prepare Kosovo's children and young people to face the challenges of the 21st century, and to actively generate new competitive knowledge for the global labor market–MASHT (2016). The Kosovo curriculum is structured in two main components:

1. **Conceptual component** (already developed) represented by the Kosovo curriculum framework:
    a. The national qualification framework (NQF) considers many changes in the education system since 2001 when the curriculum was developed, as well as the new challenges identified during the period 2001-2008. These challenges require young people to develop skills to use knowledge, skills and attitudes in the context of real-world problem-solving and thus achieve the desired competencies as expressed in the NQF.
2. **Operational component** (currently under development) represented by:
    a. Kosovo core curriculum for formal levels of education (primary, lower secondary, and upper secondary).
    b. Subject syllabi for grade 1-grade 12 (to be developed during the experimental phase of curriculum implementation).
    c. Supporting documents: once developed the Kosovo curriculum will include supporting documents, textbooks, teaching and learning materials, teacher guides, CDs and software, assessment, examination materials, quality assurance monitoring and assessment tools.

Vocational schools and their success are also very important issues for analysis. Based on the perception gained from university studies, students at vocational schools show poorer results, not only in the entrance exams but also in success during studies, including when the field of study is the same as vocational secondary education (Bottge & Cho, 2013). Graduation exam results in recent years for high school students prove the fact that students at vocational schools (including economic schools) have lower results than high school students (MASHT, 2018).

One of the reasons that vocational school students underperform and are less motivated to learn mathematics is the small number of mathematics lessons per week (Berisha, 2024), i.e., only two or three hours per week, compared to the gymnasium where students have five hours of mathematics a week. This fact is confirmed by the result of the graduation test of 2015 (MASHT, 2015), where approximately 81.5% of students from gymnasiums passed the test, while students at vocational schools significantly less. Through this research, we examined the use of contextual teaching in vocational schools and its effect on student achievement in mathematics.

MATERIALS AND METHODS

Many teachers think of active learning as any strategy that deviates from the traditional format of lectures, where a teacher imparts knowledge by talking about it. Chickering and Gamson (1999) suggest that for students to be active, they need to do more than just listen. Strategies such as collaborative learning, integrated learning, problem-based learning, and work-based learning can be used to encourage and stimulate thinking at the highest level.

CTL is a teaching system based on the philosophy that students learn by relating new information to their prior knowledge as well as their experience (Johnson, 2002). CTL is a system that stimulates the brain to create patterns that express meaning. CTL generates meaning by linking academic content to the context of the student's life (Johnson, 2002). Many researchers have shown the positive effect of using contextualization in the process of teaching and learning mathematics (Young et al., 2012).

According to Berns and Erickson (2001), contextual teaching helps students relate the content they are learning to contexts in which that content can be used in life. For CTL to be successful, the learning process must change. In the past, careers and technical education created and pursued a task-based curriculum. Students were prepared to perform the specific tasks required for a job. Although the learning skills to perform such tasks may be important in some programs, CTL requires that part of the curriculum be placed in a broader framework that integrates the content of other subjects into the learning process for students. The goals of learning are to think about how to find information, adapt to change, and communicate effectively. During contextual learning, students should be aware of how the work they do relies on the skills they already have (reading, writing, logic, etc.), which is often lacking in many students. Valenzuela (2018) showed in his study that students who made real-life conclusions based on mathematical contextualization were willing to discover patterns that helped them make connection with new mathematical concepts.

Contextualization helps students understand concepts by linking previously acquired concepts to new concepts. The ideal bonding process would be like this: students review what they already know about the new concept; they learn and practice the new concept; and they relate what they have learned in a re-reading scenario (Berns & Erickson, 2001).

It has been shown that the use of CTL strategies increases the possibility of transferring knowledge from the classroom to real life situations, which also increases the possibility of higher achievement of students and mastery of the subject (Greeno, 1997).

In this paper, it examined whether students at vocational schools in Kosovo learn more effectively when taught through CTL. Education can be a force for change (Thaqi, 2009). Quality education should engage students to actively learn and guide the formation of the necessary values they need in life. Mathematics is one of the most important sciences used in everyday life, as well as in supporting the advancement of science and technology (Case et al., 1992; Gooding, 2009; Seifi et al., 2012).

Contextual learning can be evaluated as a learning approach that recognizes and demonstrates the natural conditions of knowledge. Through in- and out-of-class relationships, a contextual learning approach makes the experience more relevant and meaningful for students to build knowledge that they will apply during lifelong learning. Contextual learning is a concept that connects the material that students are studying in the context of the material used, and the relationship between how one learns or how students learn.

Purpose of Research

The purpose of this research is to examine the impact of CTL on students' achievement in mathematics. Specifically, the research will examine whether CTL will improve students' skills in solving contextual problems from economics. Also, the research will examine the attitudes of students regarding CTL when solving contextual problems from economics, in vocational schools, respectively the direction of economics. According to the purpose of the research, we defined *research questions*:

1. What impact does contextual teaching have on improving student achievement in mathematics?
2. What attitudes do students have about contextual learning when solving contextual problems from economics?

The methodology of the research is action research that utilizes quasi-experimental design (2016). The research was conducted at the vocational high school "Andrea Durrsaku" in Kamenica, department of economics, which was attended by one-group of 40 students with pre- and post-test quasi-experimental design of the twelfth grade. The pre-test was conducted first, followed by a 6-week intervention period, and after the intervention a post-test was conducted. The model CEICT by Crawford and Witte (1999) has been modified for the intervention (CEICT is an acronym for strategies: *connection, experience, implementation, collaboration,* and *transfer*) which are strategies for engaging students in the classroom.

The first strategy, *connection,* means learning in the context of a person's life experiences and linking his experience to the problem-solving process. *Experience* is about teaching helping students build new knowledge by orchestrating practical experiences within the classroom. *Implementation* is defined as learning by applying concepts. The strategy *collaboration* aims to foster collaboration among students. When they work in groups, they are more successful than when they work individually. *Transfer* is a teaching strategy that is defined as the use of knowledge in a new context or situation. Using these five strategies, tasks with contextual content were solved, respectively from the subject of economics, and in the end the post-test was implemented. During the intervention the questionnaire with three open-ended questions was used to measure students' attitudes.

The intervention lasted a total of 6 weeks and was attended by 40 students, who were participants in this research. The participants in the research are twelfth grade students, who represent our sample, which is a non-probability sample, specifically a purposive sample. The data collection procedure started with a meeting of students together with the school principal, where they explained the steps we will follow during these 6 weeks. A very important element of this process is that in this research the

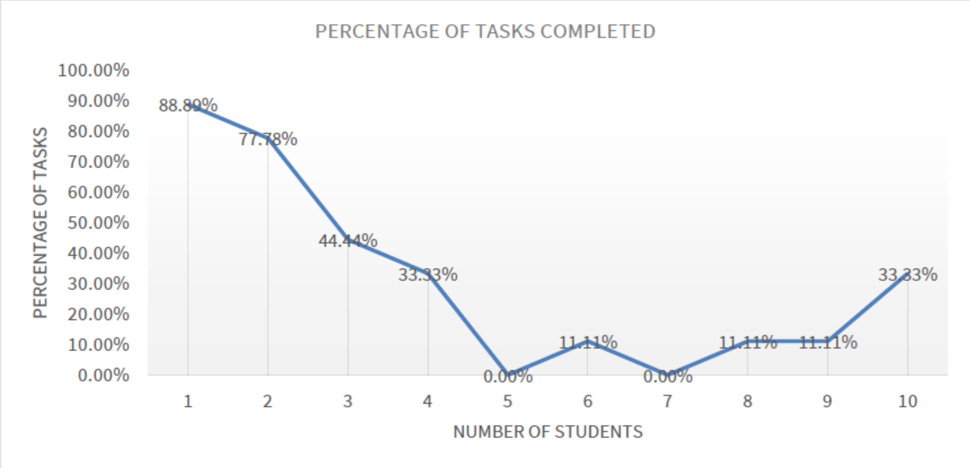

Figure 1. Percentage of correct solutions per task in pre-test (Source: Authors' own elaboration)

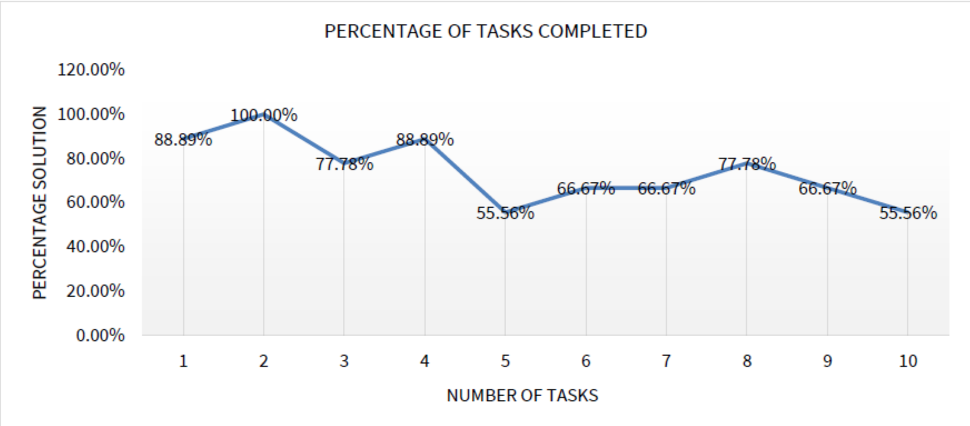

Figure 2. Percentage of correct solutions per task in the post-test (Source: Authors' own elaboration)

code of ethics has been respected, personal data have been confidential and have not been misused, for which the students have been informed in advance. The participants were given the pre-test, which contained 10 contextual tasks from the subject of economics. Then, in a period of 6 weeks, tasks with contextual content from the subject of economics were solved, and these tasks were explained using five strategies (connection, experience, implementation, collaboration, and transfer) to solve them.

The intervention started first by explaining the percentage as a basic element of economics (although, the students learned about the percentage in the seventh grade). Assignments were taken from books which contain applications of mathematics (Trençevski et al., 2011). We used literature outside of school textbooks, because the books commonly used by teachers do not contain enough assignments that are adequate for vocational school students. After that, each student was asked to make a connection between tasks from the past lessons and tasks from real life which is the meaning of the CTL methodology (Crawford & Witte, 1999). Many examples were worked through during this research and all tasks were based on real life, each task was explained in detail and each student was monitored. To assess whether the CTL methodology has influenced students, it is necessary to have a post-test.

DATA ANALYSIS AND RESULTS

To understand correctly and accurately the impact of this methodology, this analysis is divided into two parts: pre- and post-test analysis.

Pre- and Post-Test Analysis

The first part of this analysis is the pre-test analysis (**Figure 1**). Forty students were given 10 mathematics tasks before the implementation of the CTL methodology. The tasks were from the mathematics curriculum.

Pre-test results show that students have a lot of problems with solving contextual problems.

The graph of post-test results presented in **Figure 2** shows that the CTL methodology improved students' achievement in the subject of economic mathematics.

Besides the analysis of pre- and post-test total results, here we present the analysis of results for two typical chosen tasks–task 4 and task 7. All tasks can be seen in **Appendix A** and **Appendix B**.

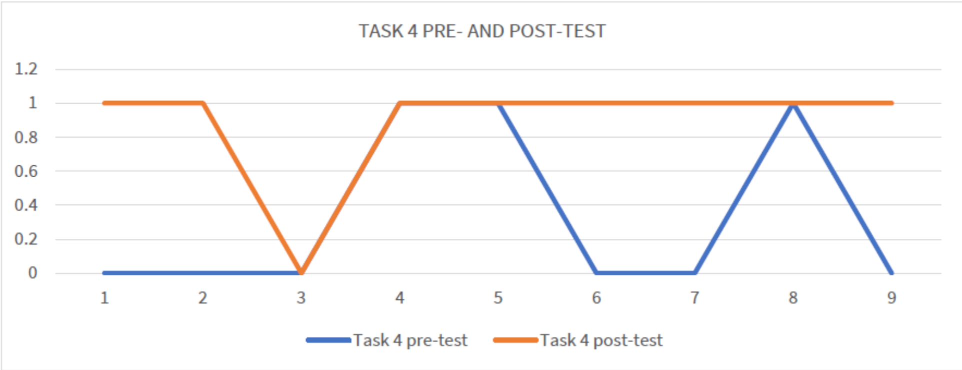

Figure 3. Graphic comparison of task 4 in pre- and post-test (Source: Authors' own elaboration)

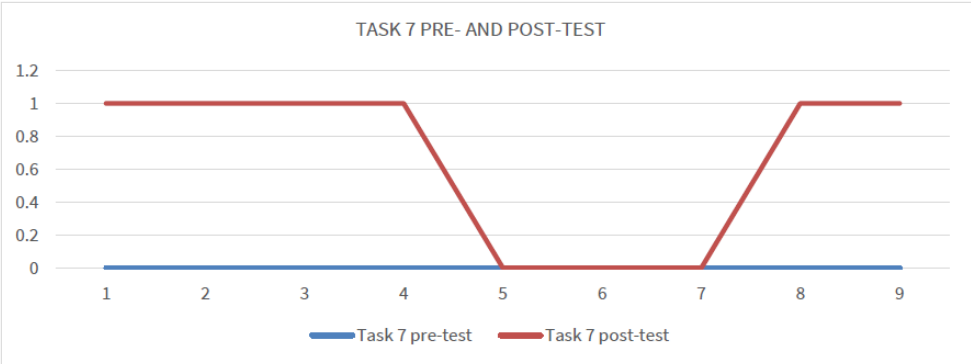

Figure 4. Graphic comparison of task 7 in pre- and post-test (Source: Authors' own elaboration)

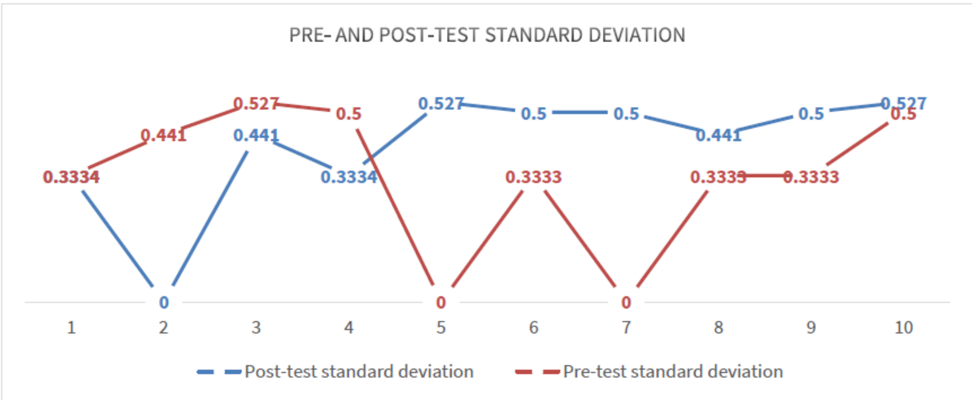

Figure 5. Graphical comparison of standard deviation in pre- and post-test (Source: Authors' own elaboration)

As presented in **Figure 3**, there were only 33.33% correct solutions for task 4 in the pre-test, a result that is not so satisfactory considering that the students will have to face these types of tasks in the future, whether during their studies or even during their work in the field of economics. But after the intervention, the results were improved and 88.89% of all participants solved it correctly.

The percentage of correct solutions of task 7 increased from 0% in pre-test to 66.67% after the intervention (**Figure 4**).

In **Figure 5**, the standard deviations are presented in pre- and post-test. Before analyzing the standard deviation for each task separately, we need to clarify that the higher the correct percentage of task completion the lower the standard deviation. What is worth noting is that when the task solving result is 0% or 100% correct, the standard deviation in both cases is 0 (**Appendix C**).

In **Figure 5** we can clearly see the change of standard deviation for each task solved. It is worth noting that in the standard deviation comparison graph we have two separate cases, the case in the 5th task in the pre-test, where the number of correct solutions is 0% and the case of the 2nd task, where the number of correct solutions is 100%. In both cases the standard deviation is 0, since as we said above, in the minimum and maximum value of the correct answers the value of the standard deviation is 0.

Another case where the change of standard deviation is noticed in the 4th task, where in the pre-test the correct solution of tasks was 66.67% and consequently the standard deviation has a value of 0.5, while in the post-test we have a better result, specifically o 88.89% and now the standard deviation dropped from 0.5 to 0.3334.

Table 1. t-test: Paired two sample for means

	Variable 1	Variable 2
Mean	0.31110	0.74447
Variance	0.098220302	0.022080631
Observations	10	10
Pearson correlation	0.748114978	
Hypothesized mean difference	0	
df	9	
t-statistics	-6.091039486	
P (T ≤ t) one-tail	9.06024E-05	
t-critical one-tail	1.833112933	
P(T ≤ t) two-tail	0.000181205	
t-critical two-tail	2.262157163	

Table 2. Cohen's *d* for effective size

	Mean	Standard deviation	n
Pre-test	0.31	0.313401184	10
Post-test	0.74	0.148595529	10
M_1-M_2	-0.43		
Pooled standard deviation	0.245255921		
Cohen's *d*	-1.767011367		

One of the things that is very important in all this research is that of the t-test done to see the comparison of the validity of the pre- and post-test result. During the performance of the t-test in my research it was noticed that all the research was accurate.

From **Table 1**, we see that the p-value has resulted smaller than $\alpha = 0.05$ which means that the average score in the post-test differs greatly from the average score in the pre-test, so we can say that the difference between them is significant.

We also used "Cohen's *d* for effective size" which is a measure of effect size used to assess the difference between two groups (**Table 2**).

Cohen's $d = -1.76$ indicates a very large difference between the two groups. This is a significant effect, this value indicates that the difference between them is more than twice the standard deviation, which is an indication of a clear and significant difference.

Questionnaire Analysis

The questionnaire itself contains 3 questions where all the questions were open (see **Appendix D**). The purpose of these questions was to understand the attitudes of students regarding teaching and contextual learning, in fact these students have managed to acclimatize to the term and tasks of "CTL".

All students involved in this research have expressed the desire in future textbooks, including in their math textbooks tasks from real life, with special emphasis on economics, because according to them they will prepared for faculty as well as for work.

Also, this research has given these answers to students who are extremely satisfied with the way this method is developed, noting that this methodology has enabled students to jointly develop the concept of developing mathematical tasks in groups. The greatly appreciated experience by the students is that in addition to the possibility of solving real tasks from everyday life on their own, they have managed to master group learning, this is considered an important point in life as in the future no one will be able to work alone in a certain sector.

Below we present some of the typical student responses, which were taken from all the responses we received. The answers to questions about what problems you would like to include in your math textbook are as follows:

> Student A: "Since I am a student at vocational school and in the future, I am a student of the Faculty of Economics, I would like our textbooks to have more tasks with percentages, tasks with calculation of interest rates, etc.".

> Student N: "To include in our textbooks more material in the field of economics, from real life and more data on assignments".

Students' answers to the second question: "How does the way of learning affect when the teacher helps you build new knowledge by orchestrating practical experiences within the classroom" are:

> Student L: "Help from the teacher to complete the tasks by orchestrating practical experience is useful, as a result we have managed to solve the tasks more easily".

> Student B: "When we orchestrated an experience within the classroom, we understood the requirement of the task and with the teacher's instructions we achieved the desired result".

The question "How do you find yourself working in groups in solving tasks with context from economic mathematics" are answered as follows:

Student R: "When we work in groups, we have more ideas about a problem, and we achieve results much faster".

Student G: "I found myself very well when we discussed the tasks with the group."

As I presented above during the analysis of the questionnaire the students were asked three questions where they gave their comments. Their interest has been mainly in the fact that in the future they want the textbooks to include tasks from real life, mainly from the economy, to have interactivity in the lesson, as well as the access of the teacher in relation to them to be more open in so that they interact together to achieve the best possible results.

As a teacher I have noticed that teaching and contextual learning has significantly influenced the improvement of mathematical knowledge in these students and the group work was successful, which is also noticed by their requirements in the questionnaire.

DISCUSSION

The main contribution of this research is the knowledge about the effectiveness of the teaching approach and contextual learning through strategies CEICT of Crawford and Witte (1999) in relation to improving students' critical thinking.

Also, the results of this research have shown that teaching and contextual learning enhances students' abilities to make mathematical connections, and student achievement is higher when students are asked to make mathematical connections with direct instruction, which supports the results of Berns and Erickson (2001), where according to him contextualization helps students to understand concepts, linking previously acquired concepts with new concepts.

In this study it was shown that the use of teaching and contextual learning strategies increases the possibility of linking the tasks presented in the classroom to real life situations, which also increases the possibility of mastering the subject. Which the results of (Greeno, 1997) who say that contextual teaching strategies help students gain new knowledge, based on real life situations also increases the possibility of improvement and higher achievement of students and mastery of the subject. These findings suggest that contextualized lessons were more effective than traditional teaching methods. According to Misquitta (2011) which examined the effectiveness of combining contextualized techniques with explicit teaching methods to help students struggling with fraction equivalence in mathematics. The contextualized approach utilized concrete tools such as fraction circles and strips, along with visual representations like pictures of fraction circles and polygons, as well as relevant algorithms. Meanwhile, explicit teaching followed a structured model-lead-test sequence, incorporating an advanced organizer, corrective feedback, and cumulative reviews. The study's results demonstrated that the intervention program, which combined contextualized and explicit teaching strategies, effectively improved students' performance in tasks related to fraction equivalence. When students engage in discussions about the context related to the material, they can better organize solutions to problems within that context. Moreover, if they can apply the context to their learning, they demonstrate progress towards mathematical literacy. Finally, when students are able to communicate effectively, they can also interpret their mathematical knowledge to solve problems across diverse contexts (Afni & Hartono, 2020). For these reasons, we have decided on an inquiry strategy which is based on constructivist learning, where students develop their knowledge through problem-solving activities to increase their understanding (Beigie, 2008), skill development and scientific learning (Oates, 2002). Kenyon (2003) noted that inquiry-based science learning is an approach that can be used by teachers in teaching science that emphasizes improving student achievement through the development of new knowledge from their environment.

During the analysis of the data, it was noticed that there was a significant difference between the pre- and post-test points, this shows that students have improvements in mathematics after the intervention through contextual teaching.

During various internships as a teacher I have noticed that there is a low motivation to learn the subject of mathematics, especially by students at vocational schools, because the impression has been gained that the subject of mathematics is a difficult subject and does not find application in problem-solving from everyday life. Through various tasks from the real context, I have tried a little to change this misconception in students. The students who participated in the research are students of economics and in the future claim to have the profession of economists, who if they want to master this profession need good knowledge of mathematics.

Since economics is the main pillar of a country and the work of economists has a great deal to do with the subject of mathematics, then we as teachers must work to the maximum in order to increase the will and desire of students to learn the subject of mathematics and enable them to solve mathematical problems which find application in everyday life.

Contextual problems emphasize the dynamic, active nature of mathematics and how mathematics enables students to make sense of their world. The questions are designed to stimulate mathematical thinking and to stimulate discussion among students in the classroom, in such a way that there is collaboration between students and to form the connection of previous concepts with the new concepts they are learning. Students are encouraged to develop and explain their reasoning and problem-solving strategies (Pehkonen et al., 2013). Approaches to contextual problems are not direct, where even the student with difficulty in mathematics can recall a formula or equation and substitute values to arrive at the answer. Even students with difficulty in mathematics are expected to understand the context of the question and the mathematical concept given in the form of the question. Thus, through solutions of tasks with real context, we can help students who are stuck in the subject of mathematics and help them to break down problems into smaller parts and present to them CEICT model strategies for solving mathematical problems.

The use of contextualization is at a low level in schools and colleges of different countries and really the same problem lies in the schools of our country. The reason for the low use of contextualization may be the lack of school materials (textbooks) enriched with contextual problems, and the lack of importance of introducing these problems into the learning process.

While studies show the importance of using contextualization, then if schools want to use it as a practice they should formulate plans, first to train teachers on the importance of contextualization, formulate textbooks that contain more contextual tasks and then apply this plan to students. , motivating them and making the subject of mathematics easier and more understandable.

My study involved a small number of students, and the intervention had a certain time, which is not enough for the students to understand correctly the importance of the contextual tasks and it was more difficult to raise to the right level the motivation to learn the subject of mathematics being shown to have wide application in everyday life.

For other studies, we suggest including a larger number of students, a larger number of assignments, and a longer intervention time.

It also encourages researchers to summarize a larger number of contextual tasks in such a way that teachers have material on which to base themselves during lessons.

CONCLUSIONS AND RECOMMENDATIONS

While studies show the importance of using contextualization (Gravemeijer & Doorman, 1999; Perin et al., 2010; Valenzuela, 2018) then if schools want to use it as a practice they should formulate plans and apply it to students, motivating them and making the subject of mathematics easier and more understandable.

Based on the analysis of the results of this research we have come up with recommendations:

1. Mathematics textbooks contain more contextual tasks related to contextual problem-solving in real life.
2. Conduct teacher training to learn about the importance of contextualization and to learn strategies that make it easier for students to learn.
3. Teachers in their work with students to select tasks from the teaching content that include solutions to contextual problems and to use other resources.
4. Teaching students appropriate problem-solving strategies, to implement them in contextual problem-solving.

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Declaration of interest: No conflict of interest is declared by authors.

Data sharing statement: Data supporting the findings and conclusions are available upon request from the corresponding author.

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APPENDIX A: PRE-TEST

Tasks From Mathematics

Gender: F/M

Dear student!

We have prepared some math tasks for you.

You do not need to write the name, but please try to recall everything you have learned before to get a good result.

1. Find 340 + 8% of 340.
2. How percent is 18 of 84?
3. Find 624 - 25% of 624.
4. How much is 375 - 12% of 375?
5. Can you find 7.2% of 18,000 than 7.2% of the result obtained?
6. Find the 6% of 13,000 then this results discount by 6%.
7. Find the percentage increase of the number 500 to 925.
8. Can you find 420 - 14% of €420.
9. If 2,350 has increased 12% and then from the new result find 12%.
10. You have 8.5% of 12,000.
    a. Find 8.5% of the result obtained.
    b. Find 7% of the result on part a.

APPENDIX B: POST-TEST

Tasks From Mathematics

Gender: F/M

Dear student!

We have prepared some math tasks for you.

You do not need to write the name, but please try to recall everything you have learned before to get a good result.

1. The price of a Sony TV is €250. After two days this price is expected to increase by 11%. Find the new price.
2. In the market sector a total of 80 items were checked. It was found that 20 of them have expired. What percentage of items are expired?
3. The average salary of employees in a cleaning company has reached the value of €480 after an increase of 15%. How much was this salary before the increase?
4. After the 12% increase, the price of a washing machine was 224. How much was the price before the increase?
5. An investor deposits €20,000 in his savings account, while interest of 8.5% goes to his current account and is spent in full. How much is the interest in the fifth year?
6. If €6,000 is invested for three years with an interest rate of 8%, what will the final value of the investment be?
7. Find the percentage change in the price of a laptop if it has increased from €220 to €245 within a month.
8. "HP Deskjet" printer is sold at a loss of 12%. If the goods are sold for €380. What was the price in the beginning?
9. The price of an air conditioner for cooling from €1,400 has increased by 20% and then from the new price has been reduced by 20%. What is the price now?
10. A bank pays 7.5% interest per year on deposited money. If you have deposited €2,000 in this bank.
    a. How many euros will you have at the end of the first year?
    b. What about at the end of the second year?

APPENDIX C

Table C1. Mean and standard deviation in pre-test

Assignments	Number of students	Percentage of each task in the pre-test (%)	Standard deviation for pre-test
Task 1	40	88.89	0.3334
Task 2	40	77.78	0.4410
Task 3	40	44.44	0.5270
Task 4	40	33.33	0.5000
Task 5	40	0.00	0.0000
Task 6	40	11.11	0.3333
Task 7	40	0.00	0.0000
Task 8	40	11.11	0.3333
Task 9	40	11.11	0.3333
Task 10	40	33.33	0.5000

Table C2. Mean and standard deviation in post-test

Assignments	Number of students	Percentage of each task in the post-test (%)	Standard deviation for post-test
Task 1	40	88.89	0.3334
Task 2	40	100	0.0000
Task 3	40	77.78	0.4410
Task 4	40	88.89	0.3334
Task 5	40	55.56	0.5270
Task 6	40	66.67	0.5000
Task 7	40	66.67	0.5000
Task 8	40	77.78	0.4410
Task 9	40	66.67	0.5000
Task 10	40	55.56	0.5270

APPENDIX D: POST-TEST

Please answer the following questions in your opinion, your answers will be anonymous.

1. Describe what tasks you would like to include in your math textbooks.

   ____
   ____
   ____
   ____
   ____

2. How does the way of learning affect when the teacher helps you to build new knowledge by orchestrating practical experiences within the classroom?

   ____
   ____
   ____
   ____
   ____

3. How do you find yourself working in groups on solving context-based tasks in economic mathematics?

   ____
   ____
   ____
   ____
   ____