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Expectancy-value theory as a model for understanding student motivation when solving linear equations

Senad Orhani [1]*

[1] Faculty of Education, University of Prishtina, Prishtina, KOSOVO
***Corresponding Author:** senad.orhani@uni-pr.edu

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ABSTRACT

This study aims to explore the role of expectancy-value theory as a psychological model for understanding student motivation when solving linear equations. Drawing on the basic principles of the theory, the research examines how expectations of success and perceived task value influence student engagement, persistence, and performance in this fundamental mathematical concept. The study was conducted with a group of 55 students from the "Heronjtë e Lumës" lower secondary school in Vërmica/Prizren, Republic of Kosovo, using a combination of motivation questionnaires, observations of the task-solving process, and statistical analysis of the results to identify the links between the components of the theory and actual performance. The results show that students with high expectations for success and who perceive linear equations as a concept with practical or academic value show more sustained motivation and more effective solution strategies. On the other hand, a lack of understanding of the importance of the topic is associated with low performance and task avoidance. This study highlights the importance of integrating motivational perspectives into mathematics teaching and suggests that teachers should promote an understanding of the real value of mathematical concepts, as well as strengthen students' confidence in their abilities, to increase academic success in this area.

Keywords: academic performance, expectancy beliefs, expectancy-value theory, linear equations, mathematics motivation, task value

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INTRODUCTION

Students' motivation to learn mathematics has been one of the most discussed topics in contemporary educational research. One of the most popular models to explain this phenomenon is expectancy-value theory (EVT) developed by Eccles and Wigfield (2020), which posits that educational decisions, engagement, and performance depend on an individual's expectations for success and the value they attribute to the task. This theory provides a powerful framework for understanding why some students are more motivated to tackle mathematical challenges, such as solving linear equations, while others show avoidance or passivity.

In recent studies, EVT has been used to explain factors that influence career choices and academic performance in mathematics (Fong & Kremer, 2020; Lazarides et al., 2022). According to the model, motivation in mathematics is influenced by four main components: attainment value, utility value, value of interest, and perceived cost (Eccles & Wigfield, 2020). These dimensions directly affect student engagement during learning processes, especially in concepts that require critical and abstract thinking, such as linear equations.

Meanwhile, linear equations represent one of the most fundamental and important concepts in mathematics, as they form the basis for the development of algebraic thinking and for the understanding of functional relationships. A linear equation is an expression that includes one or more unknowns, which appear only in the first degree (e.g., $2x+3=7$). Solving a linear equation consists of finding the value of the variable that makes the equality true. These equations are present in many real-life areas, such as economics, physics, computer science, and engineering, where they are used to model situations such as the cost of production, the speed of movement, or the balance of forces. In didactic terms, learning linear equations is a key point for the development of logical reasoning, analysis, and problem-solving skills, as it helps students understand the symbolic structures of mathematics and apply them in different contexts. Furthermore, research has shown that motivation and self-confidence play an important role in how students cope with solving linear equations (Akbuga & Havan, 2022; Weber et al., 2020).

A study by Weber et al. (2020) highlights that student who exhibit high expectations for success and who perceive mathematics as valuable for real life are more persistent and use effective strategies for solving mathematical tasks. These findings are also supported by research by Kirkham et al. (2023), which confirms that the "cost" component of the theory, i.e., the perception of the effort and time required to learn, can be an important obstacle to motivation at secondary levels of education.

According to Guo et al. (2017), the interaction between expectations and values has a significant impact on academic aspirations and the choice of STEM fields. They emphasize that developing an internal sense of the value of mathematics, combined with confidence in one's own abilities, is essential for improving results on concepts such as linear equations. Similarly, Cho and Hwang's (2019) study found that mathematical motivation changes significantly across the school years and is influenced by how students perceive the purpose and usefulness of mathematical concepts.

In this context, linear equations represent a particularly important area of research, as they are a transition point from basic mathematics to algebraic thinking. Recent studies, such as that of Akbuga and Havan (2022), have shown that expectations of success and utility value are closely related to performance in concepts such as calculus and, similarly, can be interpreted in the process of learning linear equations.

Although previous studies have demonstrated that EVT is an effective framework for explaining students' motivation in mathematics, most research has focused on general mathematics achievement, STEM participation, or overall academic motivation rather than motivation during the learning of specific algebraic concepts such as linear equations. Moreover, empirical evidence from lower secondary education in Kosovo remains very limited, making it unclear whether the relationships among expectancy beliefs, task value, perceived cost, and academic performance observed in other educational contexts are also applicable in this setting. Addressing these gaps, the present study applies EVT to examine students' motivation when solving linear equations and investigates the predictive relationships among expectancy beliefs, perceived task value, perceived cost, and academic performance. In doing so, the study contributes to the existing literature by providing context-specific evidence from Kosovo and by extending EVT research to a fundamental domain of algebra learning.

Problem Identification

In contemporary education systems, motivating students to learn mathematics remains one of the main challenges for teachers and education researchers. Despite the recognized importance of mathematics in the development of logical thinking and in preparing for various professional fields, many students show a lack of interest, mathematical anxiety, and low self-confidence, especially when dealing with linear equations, which constitute one of the basic concepts of algebra (Weber et al., 2020). This problem is also exacerbated by the fact that traditional teaching strategies, which focus more on mechanical rules than on conceptual understanding, often fail to foster intrinsic motivation and persistence in learning (Lazarides et al., 2022).

In many cases, students perceive mathematics as an abstract subject, separated from real life, which affects the reduction of the value of utility and the value of interest that they attribute to its learning (Fong & Kremer, 2020). This lack of perception of the practical importance of mathematical concepts negatively affects their effort and persistence to achieve success. According to recent studies, students who have low expectations for success and low perceived value for mathematical tasks are less likely to be actively involved in solving problems, resulting in poor performance and failure to meet learning objectives (Kirkham et al., 2023).

In the context of secondary education in Kosovo, there is an increased need to develop pedagogical approaches that are based on psychological theories of motivation, such as EVT, to better understand the reasons behind students' behaviors during the process of learning mathematics. EVT provides a sound theoretical framework for analyzing how expectations for success and perceived value influence engagement, persistence, and academic outcomes (Eccles & Wigfield, 2020). However, studies applying this theory to solving linear equations are still limited, creating an important research space for studies that explore these relationships in the local context.

Consequently, the main research problem that this study aims to address is related to the lack of student motivation when learning and solving linear equations, as well as the need to understand the psychological factors that influence this process. Specifically, the research attempts to uncover how expectations for success, perceptions of utility value and interest, and perceived cost of effort affect students' persistence and performance in this important area of mathematics (Akbuga & Havan, 2022; Cho & Hwang, 2019).

Purpose of the Study

The main purpose of this research is to analyze the role of EVT in explaining students' motivation during the process of solving linear equations, as well as to identify psychological factors that influence their involvement and performance in this fundamental mathematics topic. In particular, the study aims to assess how expectations for success (expectancy beliefs) and perceived values of the task (task values), including utility value, interest value, and benefit value, influence academic motivation, persistence, and results achieved in solving linear equations.

In the context of secondary education in Kosovo, there is still a lack of an in-depth understanding of the motivational factors that determine success in learning mathematics, especially for algebraic concepts that require abstract thinking. By applying the principles of EVT, this study aims to help determine the links between motivation and performance, as well as identify ways in which teachers can positively influence the building of self-confidence and understanding of the value of mathematics in students (Eccles & Wigfield, 2020).

Also, the secondary goal of the research is to develop evidence-based pedagogical recommendations that can be used to increase students' intrinsic motivation and reduce their perceived "cost" of mathematical tasks. According to Kirkham et al. (2023), one of the main challenges in teaching is managing this relationship between the perceived value of the task and the effort it requires, as this directly affects the sustainability of motivation.

In line with the main research goals, the study is expected to:

- Analyze the relationship between expectations for success and students' performance in solving linear equations.
- Assess the impact of perceived values (usefulness, interest, and benefit) on students' motivation to learn mathematics.
- Examine the role of perceived cost (effort, difficulty, and fear of failure) in student engagement during the learning process.
- Suggest pedagogical strategies that foster a sustainable climate of motivation in learning algebraic concepts.

Through this study, it is intended to contribute to the development of effective teaching practices in mathematics, combining the psychological perspective of EVT with the didactic context of linear equations, to improve the approach to students and support their academic and emotional development. As Lazarides et al. (2022) emphasize, understanding students' motivational dynamics is essential to building educational models that promote success and self-efficacy in mathematics.

Contribution of the Study

This study contributes to the existing literature in several ways. First, it extends the application of EVT by examining students' motivation in the specific context of solving linear equations rather than mathematics learning in general. Second, it provides empirical evidence from lower secondary education in Kosovo, a context that has received limited attention in previous EVT research. Third, the study simultaneously examines the relationships among expectancy beliefs, perceived task value, perceived cost, and academic performance using multiple statistical analyses, including correlation, multiple regression, ANOVA, and mediation analysis. By integrating these motivational constructs within a single empirical model, the study provides a more comprehensive understanding of students' motivation in algebra learning and offers practical implications for teaching mathematics.

Research Questions

1. How do students' expectations for success affect their motivation when solving linear equations?
2. What is the role of perceived task value (usefulness, interest, and benefit) in the sustainability of students' effort to learn mathematics?
3. Does perceived cost (effort, stress, or fear of failure) affect students' motivation and performance when solving linear equations?
4. Is there a statistically significant relationship between expectations for success and academic performance in algebraic concepts?
5. Do students show age differences in experiencing value, cost, and self-confidence during the process of solving linear equations?

Research Hypothesis

H1. There is a positive relationship between expectations for success and students' motivation to solve linear equations.

H2. There is a positive relationship between perceived task value (usefulness, interest, and benefit) and academic performance in mathematics.

H3. Perceived cost (effort, difficulty, or fear of failure) negatively impacts student motivation and engagement when learning linear equations.

H4. Students who exhibit high values of perceived usefulness and interest in mathematics have higher levels of persistence and use more effective problem-solving strategies than those with low perceived values.

H5. There are significant age differences in the perception of expectations and values related to motivation to learn mathematics.

Theoretical Reasoning

The formulation of these hypotheses is based on the basic principles of EVT, which emphasizes that motivation to perform a task depends on the individual's expectation of success and the value he attributes to that task (Eccles & Wigfield, 2020). This theory has been confirmed in many studies related to mathematics achievement, where it has been found that students with high expectations and positive perceived values are more committed and have better performance (Kirkham et al., 2023; Lazarides et al., 2022). In the context of linear equations, the hypotheses of this study aim to test whether these relationships also apply to secondary education students in Kosovo, contributing to the development of pedagogical practices that promote intrinsic motivation and academic success in mathematics.

LITERATURE REVIEW

EVT and its role in motivating students to learn mathematics, especially in solving linear equations and other algebraic concepts. The goal is to create a strong theoretical foundation for understanding how expectations, values, and cost perceptions influence the learning process and academic achievement.

Theoretical Framework of Expectancy-Value Theory

EVT, originally developed by Eccles and Wigfield (2020), posits that individuals' motivation to undertake a task depends on two main components: the expectation of success and the perceived value of the task. This theory has recently been expanded into a new version called "situated expectancy-value theory", which considers social and contextual influences on the motivational process (Jackson et al., 2025). According to this model, students' motivation to learn mathematics depends not only on internal factors but also on the educational environment, teaching methods, and relationships with teachers. A study by Hampton (2025) argues that the perception of effort (effort perception) is one of the key elements that influences how students evaluate a task and their decisions to engage in a subject like algebra. When students perceive the effort as worthwhile and achievable, their motivation to succeed increases.

Motivation in Learning Mathematics and Algebra

Contemporary research in mathematics education supports the idea that motivation is one of the most powerful predictors of academic performance (Gutterman, 2025). He suggests that positive interactions between teachers and students based on feelings of competence and emotional support can strengthen the perceived value and reduce the perceived cost of learning mathematics. An extensive analysis by Julaiha and Thaiba (2025) identified several strategies for increasing student engagement in mathematics, such as integrating real-world contexts, using technology, and applying collaborative approaches to problem-solving. These strategies, supported by EVT, help develop utility value and build meaningful connections between mathematical concepts and everyday life. Also, the study by Luc (2025) emphasizes the importance of the perceived relevance of mathematics in forming positive attitudes towards algebra, suggesting that teachers should emphasize the practical aspects of linear equations to encourage higher engagement. Also, the results of the study by Orhani (2023) reflect a literature review on the need to integrate digital didactic games in the teaching and learning of basic mathematical concepts, which affects the reduction of stress towards mathematics and increases their academic performance when solving mathematical tasks.

The Influence of Social Context and Family Factors

Another important dimension in the development of motivation is the influence of the social and family environment. Research based on the situated expectancy-value perspective emphasizes that students' motivational beliefs develop dynamically through their social and educational experiences and are closely related to their engagement and academic outcomes (Eccles & Wigfield, 2020). In an international context, Vinni-Laakso's (2025) study on basic education in Finland shows that motivational beliefs in science and mathematics develop gradually, being influenced by students' experience with their previous successes and failures. This supports the idea of Eccles and Wigfield (2020) that expectations are dynamic and change depending on the feedback that students receive from teachers and peers.

Pedagogical Approaches to Developing Motivation in Mathematics

Recently, several authors have emphasized the importance of EVT-based strategies to improve engagement and performance in mathematics. Braught et al. (2025) introduced an instrument called the expectancy-value cost lite survey to measure student motivation and perceived "cost" in theoretical subjects such as mathematics and computer science. Their findings suggest that the use of motivation measurement tools helps identify factors that hinder students' active engagement. Similarly, Zaidi Yaacob et al. (2025) emphasize the need to develop bridges between academic goals and practical applications in STEM education, using EVT as a framework for understanding how academic identity, interest, and career goals relate to students' persistence in mathematics.

Application of Expectancy-Value Theory in Solving Linear Equations

EVT in the process of solving linear equations represents an important psycho-pedagogical approach, which aims to connect the cognitive and emotional aspects of learning mathematics. This theory helps to explain the reasons why some students are more committed to learning equations, while others experience difficulties, avoidance, or lack of interest. According to Eccles and Wigfield (2020), the motivation to engage depends on expectations for success and the perceived values of the task, while psychological costs (e.g., effort, fear of failure, or lack of time) can negatively affect this engagement.

In the context of linear equations, the expectation of success is related to students' self-confidence in understanding the rules of algebra and applying the solution procedures accurately. Hampton's (2025) study shows that students who have a clear perception of effort as a productive investment achieve better results on tasks that require logical reasoning, such as equations with one unknown. These students tend to perceive error as part of the learning process, not as personal failure.

On the other hand, the perceived value of the task plays a crucial role in student engagement in learning linear equations. Luc (2025) argues that students are more motivated when they understand the practical relevance of mathematical concepts in everyday life, e.g., using linear equations to model real-world situations such as budgeting or speed and distance analysis. This helps develop utility value and the value of interest (intrinsic value), which reinforces ongoing engagement in learning.

In this context, teachers play a key role in structuring the learning environment, directly influencing the development of students' expectations and values. Gutterman (2025) emphasizes that supportive relationships between teachers and students contribute to increasing self-confidence and reducing mathematical anxiety, thus helping to increase motivation for solving algebraic tasks. Similarly, Julaiha and Thaiba (2025) emphasize the importance of interactive methods, such as group work and the use of digital tools, which can increase the perception of the value of the task and make solving equations more attractive and meaningful.

Another important component of EVT is "perceived cost," which is related to the sense of effort or stress that a student feels when solving math problems. Braught et al.'s (2025) study shows that students who perceive math tasks as too difficult or "tedious" are less engaged and have less persistence in completing them. According to this study, reducing perceived cost—by clarifying the solution steps and creating a positive classroom climate—can significantly improve students' performance and persistence in learning.

In practice, the implementation of EVT in teaching linear equations can be accomplished through three main steps:

- Raising expectations for success by providing differentiated learning, positive feedback, and examples of real achievements.
- Increasing the perceived value of the task through connecting concepts to practical and everyday situations.
- Reducing perceived cost, creating an emotionally supportive environment, and encouraging collaboration in solving tasks.

EVT in the teaching of linear equations offers an integrated approach between the cognitive and motivational aspects, making the learning process more meaningful and successful. This approach aims not only to increase academic results, but also to develop positive attitudes towards mathematics and self-confidence in students' personal abilities.

Research Gap

Despite the extensive body of research supporting EVT in mathematics education, several important gaps remain. First, most previous studies have focused on students' motivation in mathematics as a general subject or on STEM participation, rather than on specific mathematical concepts such as linear equations. Second, although expectancy beliefs, task value, and perceived cost have been widely examined, relatively few studies have investigated their combined influence on students' performance when solving linear equations. Third, empirical evidence from lower secondary education in Kosovo is extremely limited, making it difficult to determine whether the relationships proposed by EVT are applicable within this educational context. Therefore, the present study addresses these gaps by examining the role of expectancy beliefs, perceived task value, and perceived cost in students' motivation and performance when solving linear equations among lower secondary students in Kosovo. This study also contributes context-specific evidence that extends the current EVT literature.

METHODOLOGY

Research Design

This study uses a quantitative approach with a descriptive and correlational character in order to measure the relationships between expectations for success, perceived task value, and academic performance during the process of solving linear equations. This approach is suitable for statistically assessing the impact that motivational variables have on student outcomes. According to Creswell and Creswell (2018), quantitative studies are more appropriate when testing hypotheses based on certain theories is required, as in this case, the EVT, which constitutes the theoretical basis of this research. The correlative approach allows the assessment of possible links between student motivation and their performance in the subject of mathematics, enabling empirical testing of the proposed model.

Study Participants

This study involved 55 students from the "Heronjtë e Lumës" lower secondary school in Vërmica, Prizren (Kosovo). Participants were selected through a purposive sampling method, considering their active involvement in the process of learning linear equations during the school year. The group of students consisted of 27 girls (49.1%) and 28 boys (50.9%), with a mean (M) age of 12 years (standard deviation [SD] = 0.7). All participants participated voluntarily and provided informed consent, and the research was conducted in accordance with ethical standards. To maintain anonymity, the personal data of the students was kept confidential.

A purposive sampling strategy was employed because the study specifically targeted students who had recently completed the instructional unit on linear equations. This approach ensured that all participants possessed the prerequisite knowledge and learning experience necessary to provide valid responses regarding their motivation and performance. Although purposive sampling limits the generalizability of the findings, it is appropriate for theory-driven educational studies that investigate specific learning contexts.

Research Instruments

Two main instruments were used to collect data: a questionnaire on motivation according to EVT and a performance test on linear equations.

The EVT questionnaire survey was developed based on the work of Eccles and Wigfield (2020) and Kirkham et al. (2023), including 25 items organized into five subscales

Table 1. Reliability estimates for the EVT constructs

Construct	Items	Cronbach's alpha
Expectancy for success	5	.84
Interest value	5	.81
Utility value	5	.86
Attainment value	5	.83
Perceived cost	5	.79

Table 2. Assessment of statistical assumptions

Test	Result	Interpretation
Shapiro-Wilk	p > .05	Normality satisfied
Levene test	p > .05	Equal variances
Durbin-Watson	1.91	Independent errors
VIF	1.42-1.88	No multicollinearity
Tolerance	.58-.84	Acceptable

measuring the main components of the theory: expectations of success, value of interest, value of utility, value of benefit, and perceived cost. Each question was rated on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). This instrument measures students' perceptions of their mathematical abilities and their attitudes toward equation tasks.

To assess students' real-world performance, a 10-item test for solving linear equations designed according to the Kosovo lower secondary education curriculum was used. The test included problems of varying difficulty, ranging from basic equations with one unknown to equations with rational coefficients.

The questionnaire items were adapted from previously validated EVT instruments reported in the literature (Eccles & Wigfield, 2020; Kirkham et al., 2023). Prior to the main study, the instrument was reviewed by two university experts in mathematics education and educational psychology to evaluate its content validity, clarity, and relevance. Minor linguistic modifications were made based on their recommendations to improve readability for lower secondary school students. A pilot study involving 10 students was then conducted to examine item clarity and internal consistency before administering the questionnaire to the main sample.

After analysis, the questions were improved for clarity and linguistic adaptation. Cronbach's alpha for the EVT questionnaire resulted in $\alpha = 0.86$, indicating high internal reliability (Jackson et al., 2025).

The internal consistency reliability of each construct was assessed using Cronbach's alpha coefficient. As shown in **Table 1**, the reliability coefficients ranged from .79 to .86, indicating satisfaction with good internal consistency for all five EVT constructs. The highest reliability was observed for the utility value construct ($\alpha = .86$), while the Perceived Cost construct showed the lowest, but still acceptable, reliability ($\alpha = .79$). According to commonly accepted guidelines ($\alpha \geq .70$), all constructs demonstrated adequate reliability for subsequent statistical analyses.

Data Collection Procedures

Data collection was carried out in the premises of the "Heronjtë e Lumës" school. Initially, the researcher introduced the purpose of the research and emphasized that participation was voluntary. Students completed the EVT questionnaire under the supervision of the mathematics teacher and then underwent the linear equations test. The collection process took place in two separate phases: in the first phase, the motivational questionnaire was administered (30 minutes), while in the second phase, the performance test was conducted (40 minutes). All data were recorded and entered electronically, respecting the principles of maintaining confidentiality and data integrity.

The study was conducted in accordance with the ethical principles for educational research. Permission to conduct the study was obtained from the school administration before data collection. Participation was voluntary, and informed consent was obtained from students and their parents or legal guardians. Participants were informed that their responses would remain anonymous and confidential and that they could withdraw from the study at any time without consequences.

Data Analysis

The collected data were analyzed using quantitative statistical methods. Initially, descriptive analyses (Ms, SDs, and frequency distributions) were applied to describe the overall level of motivation and performance in the equations.

Before conducting the inferential statistical analyses, the assumptions underlying each statistical procedure were examined. The normality of the continuous variables was assessed using the Shapiro-Wilk test together with skewness and kurtosis statistics. Homogeneity of variances for group comparisons was evaluated using Levene's test. Prior to multiple linear regression, multicollinearity was examined using the variance inflation factor (VIF) and tolerance statistics, while linearity, homoscedasticity, and independence of residuals were assessed through residual plots and the Durbin-Watson statistic. The results indicated that all assumptions were adequately satisfied, supporting the use of the selected parametric statistical analyses.

The results in **Table 2** indicated that all assumptions required for the applied parametric analyses were met; therefore, Pearson correlation, independent-samples t-test, ANOVA, and multiple linear regression were considered appropriate for hypothesis testing.

Further, correlation was used; Pearson (r) was used to assess the relationship between motivational variables and academic performance. To test the predictive effects of expectations and perceived values on performance, multiple linear regression analysis was applied, estimating the statistical weight of each component of the EVT. Also, to identify gender differences in motivation levels and test scores, an independent t-test was used (independent samples t-test).

The mediation analysis was conducted using a bootstrap procedure with 5,000 resamples and 95% bias-corrected confidence intervals (CIs) to estimate the indirect effect.

The mediation effect was considered statistically significant when the 95% bootstrap CI did not include zero.

The results are interpreted in relation to the research hypotheses and will be compared with the findings of the international literature on EVT in mathematics education.

Study Limitations

This study has several methodological limitations that should be considered. First, the small sample size (n = 55) limits the generalizability of the results to a broader student population. Second, the use of self-reported instruments may affect the accuracy of the data due to personal perception biases. Also, the research was conducted in a single school and does not include cross-institutional variables such as teacher influence or social context. However, despite these limitations, the study represents scientific and practical value, as it provides important data for understanding motivation in learning linear equations and for the application of EVT in basic education settings.

RESULTS

This chapter presents the results of a research study that aimed to analyze the role of EVT in understanding students' motivation when solving linear equations. This section includes the results of statistical analyses of data collected through an EVT-based questionnaire and a mathematics performance test. The results are interpreted in light of the research hypotheses, focusing on the relationships between expectations for success, perceived task value, psychological cost, and academic performance.

General Description of the Data

Descriptive analysis showed that students generally display positive attitudes towards mathematics, but the level of motivation varies significantly depending on self-confidence and previous experiences in this subject. The overall M of expectations for success was M = 3.94 (SD = 0.65), which indicates a moderate belief in personal abilities to solve linear equations. In contrast, the component of perceived cost (e.g., effort and stress during solving tasks) had a higher M = 3.71 (SD = 0.58), which indicates that many students perceive the process as tedious or time-consuming.

Relationship Between Expectations, Value and Performance

The results of the correlation analysis showed that there is a strong positive relationship between expectations for success and academic performance ($r = .62$, $p < .01$). This means that students who believe they can succeed in mathematics are more likely to solve linear equations correctly.

Also, the perceived value of the task (utility and interest) showed a strong relationship with learning engagement ($r = .57$, $p < .01$), suggesting that students who perceive mathematics as useful are more engaged and motivated to

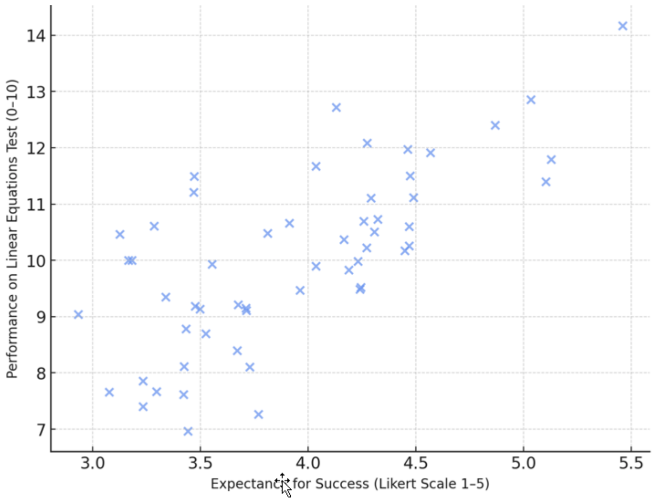

Figure 1. Relationship between expectancy for success and performance (the author's own elaboration based on the study data)

Table 3. Results of multiple linear regression predicting academic performance

Predictive variables	B	SE	β	t	Sig. (p)
Expectations for success	0.48	0.11	.41	4.37	.001
Perceived task value	0.42	0.13	.38	3.21	.002
Perceived cost	-0.35	0.14	-.27	-2.51	.015

Note. SE: Standard error & Model summary: $R^2 = .52$, $F(3, 51) = 12.87$, $p < .001$

work on challenging tasks. On the other hand, perceived cost had a negative relationship with performance ($r = -.43$, $p < .05$), indicating that stress, fatigue, and fear of failure negatively affect student outcomes.

This is the "relationship" between expectancy for success and performance, which visually represents the positive relationship between students' expectations for success and their scores on the linear equations test (**Figure 1**). The higher the expectation for success, the better the academic performance, which reinforces the central principles of EVT (Eccles & Wigfield, 2020).

These findings are consistent with the work of Kirkham et al. (2023) and Julaiha and Thaiba (2025), who confirm that improving the perception of task value is one of the most effective ways to increase motivation and achievement in mathematics.

Multiple Linear Regression Analysis

To test the influence of expectations for success, perceived task value, and perceived cost on students' performance in solving linear equations, a Multiple Linear Regression analysis was applied. This analysis allows us to assess in a combined manner how each component of EVT influences students' academic achievement (**Table 3**).

Model diagnostics indicated that the assumptions of multiple linear regression were satisfied. The Durbin-Watson statistic was 1.91, indicating independent residuals. Multicollinearity was not detected, as VIF values ranged from 1.42 to 1.88 and tolerance values ranged from .58 to .84.

Table 4. Results according to age

Age group	M			
	Performance	Expectancy	Value	Cost
12 years	6.8	3.4	3.6	4.1
13 years	7.4	3.8	3.9	3.9
14 years	7.9	4.0	4.1	3.6
15 years	8.3	4.2	4.3	3.4

The results show that expectations for success appear to be the strongest predictor of academic performance. The standardized coefficient (β = .41, p = .001) indicates that students who have higher confidence in their abilities to solve linear equations are more likely to achieve better results. This finding reinforces the basic idea of EVT, according to which perception of competence directly influences effort, persistence, and achievement in learning.

Also, perceived task value of the task resulted as a positive and significant predictor (β = .38, p = .002). Students who perceive mathematics as useful, important for daily life, or for their professional future, are more likely to actively engage in problem-solving. This shows that the value dimension is not only related to short-term motivation, but also to the formation of sustainable attitudes towards learning.

On the other hand, perceived cost showed a negative impact on performance (β = -.27, p = .015), meaning that students who experience more stress, fatigue, fear of failure, or feel that mathematics “requires a lot of energy” have lower test scores. This is consistent with the studies of Kirkham et al. (2023), who emphasize that the cost dimension acts as a motivational barrier, diminishing the positive impact of expectations and perceived value.

In summary, the linear regression model fully supports hypotheses **H1**, **H2**, and **H3** of this study. The results suggest that students’ motivation in solving linear equations is significantly influenced by their expectations for success and by how they perceive the importance of the mathematical task. Meanwhile, the perception of high cost significantly reduces involvement and performance. This model coincides with the findings of Eccles and Wigfield (2020) and Hampton (2025), confirming the validity of the EVT as a reliable theoretical framework for understanding academic motivation in the subject of mathematics.

In conclusion, the multiple linear regression analysis shows that students who believe in their abilities and who see clear value in mathematical tasks have significantly higher results in solving linear equations, while those who feel pressure, stress, and fatigue tend to perform worse. This demonstrates the importance of teaching that focuses on increasing self-confidence, creating a practical understanding of concepts, and reducing mathematical anxiety in order to increase student motivation and involvement in learning.

Results by Age Group

An important aspect of this research was the analysis of changes in students’ motivation and performance by age. The aim of this subchapter is to present how expectations for success, perceptions of value, perceived cost, and academic performance change from age 12 to 15, providing a picture of the development of mathematical motivation during the lower secondary cycle. The summary results are presented in **Table 4**, where a progressive increase in performance and expectations for success is observed from age 12 to 15, while perceived cost shows a continuous decrease. This development shows that, with increasing age and school experience, students gain greater confidence in their abilities to solve linear equations and perceive mathematical tasks as more valuable and achievable.

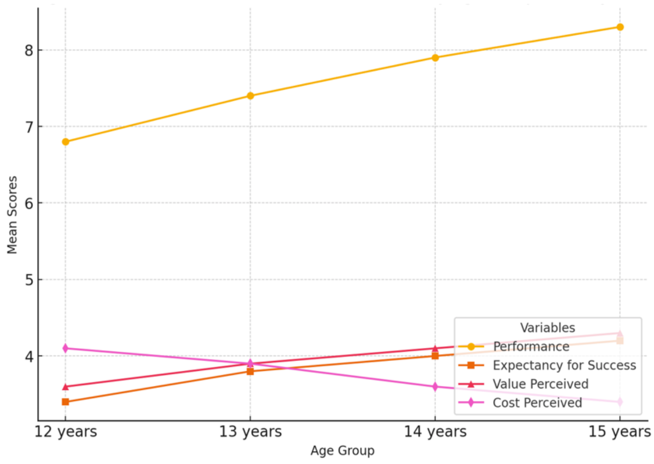

Figure 2. Trends in motivation and performance by age group (12-15 years) (the author’s own elaboration based on the study data)

As **Figure 2** illustrates, there is a clear upward trend in motivation variables (expectations and perceived value) and academic performance with increasing age. Meanwhile, perceived cost drops significantly after age 13, indicating that older students experience less fear and stress towards mathematical tasks and perceive them as more manageable.

These results are consistent with research by Eccles and Wigfield (2020) and Vinni-Laakso (2025), who emphasize that with cognitive development and teaching experience, students move from extrinsic to intrinsic motivation, building higher self-confidence and persistence in challenging tasks. In this way, age acts as an important developmental factor in how students perceive academic challenges and motivation to succeed in mathematics.

In conclusion, the results by age show that younger students (12-13 years old) often experience more anxiety and a high perception of cost, while 14-15-year-old students show more stable intrinsic motivation, higher expectations for success, and lower levels of mathematical stress. This development is indicative of a natural path of motivational maturation, which should be supported by age-appropriate teaching, positive feedback, and involvement in real-life tasks that promote critical thinking and self-confidence.

Analysis of Variance by Age

To assess whether there are statistically significant differences between the age groups of students (12, 13, 14, and 15 years old) in motivational variables and academic

Table 5. Analysis results of the difference according to age (one-way ANOVA)

Variables	F	df	Sig. (p)	Interpretation
Expectations for success	4.62	3	.008	Significant
Perceived value	2.71	3	.082	Not significant
Perceived cost	3.94	3	.015	Significant
Academic performance	6.48	3	.001	Significant

performance, an analysis of variance (ANOVA) was applied. This analysis serves to test whether motivation and involvement in solving linear equations change significantly during different stages of students' cognitive and emotional development (**Table 5**).

The results of the ANOVA analysis showed that there are statistically significant differences between age groups for some of the main variables of the motivation model. Variables Expectations for success showed clear differences depending on age ($F [3, 51] = 4.62$, $p = .008$), with students aged 14 and 15 reporting higher levels of self-confidence compared to younger students aged 12 and 13. This result suggests that with increasing age, students develop a more realistic perception of their abilities, previous experience of success positively influences future expectations, and the ability to manage failure becomes more stable.

Similarly, academic performance differs significantly across ages ($F [3, 51] = 6.48$, $p = .001$), indicating that older students (15 years old) achieve higher scores in solving linear equations compared to younger students. This may be related to cognitive development, better symbolic reasoning skills, and greater experience in learning algebraic concepts. The results are consistent with the findings of Lazarides et al. (2022), who argue that academic motivation increases with the transition to more mature stages of learning, while the role of the teacher becomes increasingly important in maintaining the sustainability of interest.

Meanwhile, perceived cost also showed significant differences between age groups ($F [3, 51] = 3.94$, $p = .015$), decreasing significantly with increasing age. 12-year-old students experienced the highest level of stress and feeling of effort, while 15-year-olds reported that solving equations is less tiring and more understandable. This result suggests that with emotional maturity, students learn to better manage task demands and feelings of pressure, which affects intrinsic motivation to succeed.

Regarding the perceived value of the task, although positive changes with age were observed, these were not statistically significant ($p = .082$). This indicates that students of all ages included in the study perceive mathematics as an important field, although the way it is experienced may vary depending on individual experience and the influence of teaching.

Overall, these results suggest that age is a developmental factor with a clear impact on students' motivational processes and academic performance. As students age, they gain more confidence, emotional stability, and the ability to cope with mathematical

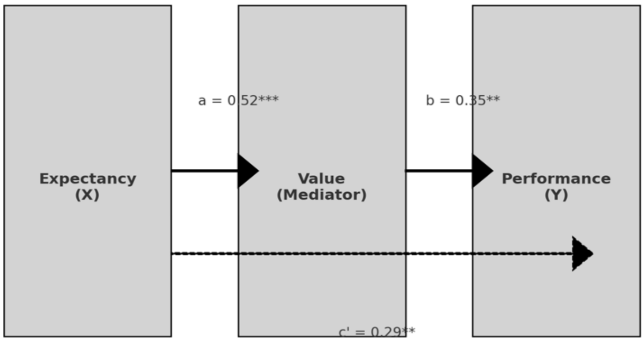

Figure 3. Conceptual mediation model (expectancy → value → performance) (the author's own elaboration based on the study data)

difficulties, while the impact of perceived stress and cost decreases. This is consistent with the findings of Eccles and Wigfield (2020), who emphasize that motivation develops dynamically depending on age and academic experience.

In conclusion, the ANOVA analysis confirms that motivational differences by age are important for understanding how students experience mathematical tasks, and that pedagogical interventions should be adapted according to the developmental stage. For younger ages, the use of methods that reduce anxiety and connect mathematics to concrete experiences is recommended, while for older students, the emphasis should be on self-efficacy, intellectual challenge, and fostering conceptual curiosity.

Mediation Analysis

To further understand how the motivational components of EVT influence student performance, a mediation analysis was conducted. This analysis aimed to test whether perceived task value acts as a mediator in the relationship between expectations for success (independent variable) and academic performance (dependent variable). Based on the literature (Eccles & Wigfield, 2020; Kirkham et al., 2023), it was expected that students who believe in their abilities (high level of expectations) would be more likely to perceive mathematical tasks as valuable, and through this perception, achieve higher performance in solving linear equations (**Figure 3**), where the arrows represent the direct and indirect effects: a (expectancy → value), b (value → performance), and c' (direct effect). The dashed line indicates that part of the effect of expectations on performance is mediated through perceptions of task value.

The model in **Figure 3** represents the hypothesis that the effect of success expectations on performance occurs partly through perceived value, i.e., students with higher self-confidence give more meaning to mathematical tasks, which improves their results (**Table 6**).

The indirect effect was evaluated using a bootstrap procedure with 5,000 resamples. The 95% bootstrap CI for the indirect effect ranged from 0.07 to 0.31 and did not include zero, indicating that the mediation effect was

Table 6. Results of the mediation analysis examining the effect of expectancy for success on academic performance through perceived task value

Tested connection	C (B)	SE	t	p	95% CI
Expectancy → value	0.52	0.09	5.78	.001	[0.34, 0.70]
Value → performance	0.35	0.11	3.16	.003	[0.12, 0.57]
Direct effect (X→Y)	0.29	0.10	2.89	.005	[0.09, 0.48]
Indirect effect (X→M→Y)	0.18	0.06	-	-	[0.07, 0.31]
Total effect (direct + indirect)	0.47	0.08	5.88	.001	[0.32, 0.63]

Note. C (B): Coefficient (B) & SE: Standard error

statistically significant. These findings support the conclusion that perceived task value partially mediates the relationship between expectancy for success and academic performance.

The results of the mediation analysis indicate that perceived value plays an important mediating role in the relationship between success expectations and academic performance. Initially, it was found that success expectations positively affect perceived value ($B = 0.52$, $p < .001$), indicating that students who believe in their abilities tend to consider mathematical tasks as more important and valuable.

Also, perceived value was found to have a positive effect on academic performance ($B = 0.35$, $p = .003$), meaning that the higher the sense of importance of the task, the greater the effort and engagement of students in solving linear equations.

The direct effect of expectations on performance remained significant even after the inclusion of value ($B = 0.29$, $p = .005$) but was significantly reduced compared to the total effect ($B = 0.47$, $p < .001$), indicating that the mediation is partially complete (partial mediation).

Indirect effect) was calculated at $B = 0.18$, with a 95% CI [0.07, 0.31], not including zero, confirming that the mediation is statistically significant. This means that a significant portion of the impact of expectations on performance occurs through increased perceptions of task value.

Theoretically, these findings are consistent with the model of Eccles and Wigfield (2020), which emphasizes that the value component is a key link between self-confidence and motivated behavior. According to them, belief in success without a sense of task importance is not sufficient to promote long-term involvement. This result is also supported by Hampton (2025) and Luc (2025), who emphasize that the perception of the meaning and purpose of the task is one of the most powerful factors of intrinsic motivation.

In conclusion, the mediation analysis clearly shows that perceived value acts as a linking mechanism between belief in success and actual performance, reinforcing the idea that to achieve sustainable results in mathematics, teachers must foster not only students' self-confidence, but also a sense of meaning and importance of the learning tasks. In this way, the construction of motivation becomes more sustainable, more internal, and more related to the learning process than to the external outcome.

DISCUSSION

This chapter presents a discussion of research results regarding the role of EVT in terms of student motivation when solving linear equations. The findings strongly support the principles of this theory, showing that expectations for success and perceived values are the most powerful factors predicting academic performance in mathematics. The results also showed that perceived effort cost and mathematics anxiety negatively affect student motivation and engagement.

Regression and mediation analyses confirmed that perceived value acts as a bridge between expectations for success and actual performance, indicating that students' self-confidence is strengthened by the understanding of the importance of the task. These results coincide with the models described by Eccles and Wigfield (2020) and Lazarides et al. (2022), which emphasize that motivational components are dynamically interconnected and influence the long-term development of academic persistence.

The findings of this study are consistent with the international literature on EVT. As in the research of Kirkham et al. (2023), this study also found that the perception of "cost" is a significant barrier to mathematical motivation. Students who perceive learning as tedious and stressful are less likely to actively engage in solving linear equations.

On the other hand, the results are consistent with Hampton's (2025) study, which confirms that perceiving effort as a productive investment and reasonable achievement helps build positive attitudes toward learning mathematics. Students who see effort as part of personal development have more self-confidence and emotional resilience when facing mathematical challenges.

Analysis by age group showed that with increasing age, students develop higher expectations for success and perceive lower costs of effort, reflecting the development of cognitive and emotional maturity. This finding is consistent with the results of Vinni-Laakso (2025) and Guo et al. (2017), who emphasize that motivational beliefs evolve gradually and are closely related to the experience of academic success.

Specifically, 14-15-year-old students in this study showed higher self-confidence and greater persistence in solving linear equations. This indicates that developing conceptual competencies and a sense of control over the task are factors that increase intrinsic motivation.

Beyond confirming previous findings, the present study extends the EVT literature in several important ways. Unlike many previous studies that examined students' motivation in mathematics as a general academic domain, this research focuses specifically on solving linear equations, a fundamental topic in algebra learning. Furthermore, the study provides empirical evidence from lower secondary education in Kosovo, an educational context that has received limited attention in previous EVT research. By simultaneously examining expectancy beliefs, perceived task value, perceived cost, and academic performance through multiple statistical analyses, the findings offer a more comprehensive understanding of the motivational processes underlying students' engagement in algebra. These results support the applicability of EVT within a specific mathematical domain and contribute new contextual evidence to the international literature on mathematics motivation.

Pedagogical Implications

The research results suggest a number of important implications for teaching mathematics in lower secondary schools:

- Raising expectations for success – Teachers should create a supportive climate that encourages self-confidence and a positive perception of abilities. The use of constructive feedback and examples of real achievements helps reinforce this motivational component.
- Developing the perceived value of the task – By connecting mathematical concepts to practical situations (such as budgeting, real-world measurements, or simulations), students can understand the importance of mathematics in everyday life. This reinforces utility. Value and intrinsic value.
- Reducing perceived cost – Teaching should aim to reduce the feeling of stress through the use of collaborative methods, group work, and the use of educational technology, which makes the process more interactive and less threatening.
- Differentiation by age – Teaching strategies should be adapted to the cognitive development of students. Younger students need emotional reinforcement and concretization of concepts, while older students can be challenged with more complex tasks that require abstract reasoning.

Theoretical and Practical Importance

This study contributes to the development of the EVT by providing empirical evidence for its validity in the context of basic education in Kosovo. The results show that EVT can be used as a practical framework to structure teaching in order to strengthen intrinsic motivation and academic performance.

At a practical level, this model can serve as a basis for teacher training, the development of motivational curricula, and the creation of instruments for measuring expectations and perceived values in different contexts of mathematics teaching.

CONCLUSIONS

This study was conducted with the aim of better understanding how the components of EVT expectations for success, perceived value, and perceived cost—affect students' motivation and performance when solving linear equations in mathematics. Through various statistical analyses, the study confirmed that the motivational factors that make up this theory are not independent, but interact closely with each other, directly influencing how students engage and achieve academic results.

The results of the research confirmed that expectations for success are the strongest predictor of performance in solving linear equations. Students who believe in their abilities to succeed in mathematics show greater engagement and higher scores. This reinforces the essence of EVT, which states that self-confidence in personal competence is one of the main drivers of intrinsic motivation and long-term engagement in learning. In line with this, perceived task value plays a crucial mediating role between belief in success and performance. Students who see mathematics as useful, important for the future, or related to real life develop a greater interest in learning and are more likely to successfully complete academic tasks.

Another important finding is that perceived cost has a negative impact on motivation and performance. Students who experience fatigue, stress, or fear of failure during the learning process have less confidence and less active involvement in solving mathematical tasks. This shows that negative emotions, if not managed well, can harm not only attitudes towards mathematics but also academic achievement. For this reason, reducing stress and creating a supportive learning environment are key aspects for increasing motivation and performance.

The results also showed that age plays an important role in the development of motivation. As students move from age 12 to 15, they develop higher expectations for success, perceive tasks as more attainable, and experience less stress while learning mathematics. This trend reflects the natural development of self-confidence and emotional stability that comes with maturity and academic experience. Older students, who have had more exposure to mathematical concepts, feel more confident in their abilities and achieve better results in solving linear equations.

One of the most significant findings of this study was the mediating effect of perceived value on the relationship between expectations for success and academic performance. The analysis showed that students with high self-confidence are successful not only because they believe in their abilities, but also because they perceive the task as valuable and meaningful. Perceived value indirectly affects performance by making learning more meaningful and emotionally relevant for students. This finding is consistent with the conclusions of Eccles and Wigfield (2020) and emphasizes the importance of teaching not only focusing on technical knowledge, but also on building meaning and purpose in tasks.

Theoretically, the study confirms that the EVT is a valuable model for explaining academic motivation in the context of mathematics. It shows that motivation is a multidimensional construct, where expectations, values, and emotional perceptions combine to influence how students experience learning and success. In practical terms, the results provide clear guidelines for teachers and educational policymakers. Reinforcing self-confidence through positive feedback, connecting mathematical concepts to real-world experiences, and using collaborative methods to reduce stress can help increase student motivation and performance in a sustainable way.

The study also shows that motivation and academic performance are developmental processes that evolve over time. Younger students need greater emotional support, concrete concepts, and real-life activities, while older students benefit more from challenging tasks that require abstract thinking and logical reflection. This indicates the need for a differentiated teaching approach that considers students' cognitive and emotional development.

In conclusion, this study shows that motivation to learn mathematics and solve linear equations is not only the result of cognitive skills, but also of the emotional experience and perception of meaning that the student gives to the learning process. Students who have high self-confidence, who see value in the tasks they perform, and who experience learning as a positive process, achieve better results and develop stronger attitudes towards mathematics. EVT thus emerges not only as a valuable theoretical framework for academic research, but also as a practical guide for contemporary mathematics teaching, helping teachers build learning environments that increase students' confidence, understanding, and motivation.

Limitations and Suggestions for Future Research

Although the study provided valuable findings, there are some limitations that should be considered. The small sample size (n = 55) limits the generalizability of the results. Also, the use of self-reported questionnaires may contain subjective biases. For future research, it is suggested:

- Expanding the sample to other schools to test the validity of the model in different cultural contexts.
- Using mixed methods that combine quantitative and qualitative analyses to gain a deeper understanding of students' emotional experiences.
- Developing experimental pedagogical interventions to measure the effect of increasing expectations and perceived value on performance.

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