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Ph.D. program in Education Sciences

The Impact of Goal Theory Application on the Classroom Management and Efficiency of Teaching Mathematics at University

Extended abstract of doctoral dissertation in Education Sciences

Gulseren Sekreter

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Scientific Supervisor: Natela Doghonadze,
Professor, Doctor, at International Black Sea University

I confirm that the work corresponds to the field, is characterized by novelty, scientific and practical value and is presented by the format defined by International Black Sea University.

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(supervisor's signature)

Experts (full name & academic title):

1. **Ekaterine Pipia Professor, Doctor**
   signature
2. **Diana Mtchedlishvili Assoc. Prof. Doctor**
   signature

Opponents (full name & academic title):

1. **Nino Nakhutsrishvili Professor, Doctor**
   signature
2. **Rusudan Gotsitidze Professor, Doctor**
   signature
3. **Jan Boehm Professor, Doctor**

INTRODUCTION

Significance

Motivation is an important factor for all educators to evoke energy and persistence among students. As current achievement motivation theories focus on students' beliefs, values, attributions and goals as prominent influences on motivation, this study is also based on modern theories of motivation which are focused more specifically on the relation of beliefs, values, attributions and goals with learning mathematics.

It is reasonably accepted that motivation and achievement affect each other. According to definition of motivation theorists, it is a kind of "psychological forces that determine the direction of a person's behaviour, a person's level of effort, and a person's level of persistence in the face of obstacles" (Jones, Jennifer & Hill 2000, p. 427).

The first chapter of the dissertation, correspondingly, deals with modern motivation theories and research around three broad motivation-related questions that learners can ask themselves during the mathematics class. "Can I do this task?", "Do I want to do this task?" and "Why do I want to do this task?"

When a learner faces a task which s/he wants to accomplish that is the first question they ask themselves: "Can I do this task?" This question focused on expectancies for success and beliefs about ability and intelligence. Competence-related beliefs include: self-efficacy theory, self-worth theory and attribution theory. All these theories relate directly to the question "Can I do this task?" and remain prominent in theory and research on achievement motivation. Students have to answer this question. If they answer it affirmatively, they show a better performance, persist longer in the face of difficulties, and they are also motivated to select more challenging tasks. Students not only need to have the ability and acquire the skills to perform successfully on academic tasks, they also need to develop a strong belief that they are capable of completing tasks successfully.

During the inquiry process motivation theorists try to understand how motivation affects choice, persistence, and effort. Some of them argue that individuals' activity choice, persistence, and effort can be explained by their judgments about their ability to complete the activity and the extent to which they value the activity (Wigfield, 1994). Bandura and his colleagues (Bandura et al., 2001) indicate two kinds of expectancy beliefs (efficacy expectations and outcome

expectations) which are completely different from each other, because individuals can believe that a certain behaviour will produce a certain outcome (outcome expectation), but may not believe that they can perform that behaviour (efficacy expectation). These two kinds of expectancy beliefs are necessary and inseparable in terms of success. Based on this, Bandura and his colleagues state that "unless people believe they can produce desired outcomes (outcome expectations) by their actions (efficacy expectations), they have little incentive to act or to persevere in the face of difficulties" (Bandura et al., 2001, p. 187). Bandura proposed that individuals' efficacy expectations are the major determinants of students' goal orientation, activity choice, willingness to expend effort, and persistence.

Students' self-worth and their attributions for success and failure can also help to answer the question "Can I do this task?" The need to protect self-worth arises primarily from a fear of failure. This failure-avoiding strategy model may also be considered from a performance-avoidance goal perspective (a student does not do something in order not to look bad or receive unfavourable judgments from others to protect their self-worth). Therefore, if failure seems likely, some students will not try, precisely because trying and failing threatens their self-worth. Covington and Omelich (1979) have written about ways in which school environments can be changed to lessen the emphasis on relative competence of children, thereby allowing more children to maintain a sense of self-worth in school. As for the attribution theory perspective, a failure in a mathematics exam may be attributed by the student to bad luck, difficult questions, low ability, or his/her insufficient effort. All those attributions have an impact on the way they cognitively, affectively, and behaviourally respond to future occasions. Especially ego-involved (performance-approach goal) students believe that success depends on luck and ability more than on effort. As a matter of fact, this belief has little positive impact (if any) on students' long-term engagement and achievement.

For the second motivation-related question that learners can ask themselves during the mathematic class is "Do I want to do this task?" which is dealing with the modern expectancy-value theory. If students are confident in achieving an academic task (self-efficacy) and they believe that the academic task is worth pursuing (task-value), they are more likely to engage in an activity and learn things that have a value for them.

Theories dealing with efficacy, self-worth, attribution and expectancy-value provide powerful explanations of individuals' performance on mathematical achievement tasks. However,

these theories do not systematically address another important motivational question: 'Why do I want to do tasks in mathematics?" This motivation-related question deals with Achievement Goal Theory, which is focused on the reasons for engagement. Researchers have articulated three types of achievement goal orientations: mastery goals, where students pursue their competence by developing and improving their ability; performance-approach goals, where learners are concerned about demonstrating their ability; and performance-avoidance goals, where students' main concern is hiding their lack of ability (Elliot, 1999).

Weakness in learning mathematics is a common and widespread issue among students. Educators and researchers have to ask why it is so?

Although there are so many reasons these are the most influential ones:

- Students' beliefs about their intelligence and capabilities in studying mathematics are additional factors that need to be taken into consideration
- Most students state and believe that they are not skillful in this area and are weak. Dweck and her colleagues (e.g., Dweck, 2002; Dweck & Leggett, 1988) posited that learners can hold one of two views of intelligence or ability.
    - incremental view of intelligence: belief that competence increases due to hard work (positively correlated with mastery-learning goals)
    - entity view of intelligence: belief that achievement depends on gifts and does not increase due to hard work (positively correlated with performance-approach goals)
- Students also believe that mathematics is one of the most difficult courses and a small number of them can perform well in it.
- If someone performs well in mathematics, s/he is genetically talented in mathematics, which means that all efforts in learning mathematics, unless you are talented, are in vain..

Before children go to school, they seem primarily on mastery goals, but when they go to school where they are surrounded by peers, they start comparing themselves with others and to view their success better than, worse than or doing as well as others'. From that time they start to compare their abilities, capabilities which is not desirable in terms of students' self-efficacy beliefs. This comparison even increases at university.

Learners with performance approach can easily give up, when they face difficulties, because they accept their limits and competencies and believe that it is not possible to change the situation. Students who adopt ego-involved (performance-approach) goals desire to maximize favourable evaluations of their competence in order to outperform others.

Correspondingly, the second chapter of the dissertation aims to:

- examine the interaction between students' mathematics self-concept, ability beliefs, self-worth and achievement goal orientations as motivational variables;
- identify learning strategies in mathematics achievement in terms of these motivational variables study.

As for the last chapter, it presents the research which comprises very detailed information about its design, goals, procedure, methods, participants and results.

Theoretical Value and Background

The continuous problem of poor achievement of students in mathematics has remained a matter of great concern to all researchers and educators. Three types of goal orientation were specified in this study, which are mastery-learning goal orientation (MG), performance-approach goal orientation (PAG), and performance-avoidance goal orientation (PAvG). Previous studies consistently reveal that mastery goal orientation is related to positive patterns of learning, preference for challenge, task achievement, self-efficacy, self-regulation of learning, positive emotions and strategy use (such as Ames, 1992; Dweck and Leggett, 1988; Elliot & McGregor, 1999; Mirzaei et al., 1997; Pajares, Britner, & Valiante, 2000). Moreover, some researchers (e.g., Anderman & Walters, 2006; Harackiewicz et al. 2002; Meece, Blumenfeld, & Hoyle, 1988; Wolters, 2003) also assert that mastery goals are associated with adaptive behavioral and cognitive outcomes, whereas performance-avoidance goals are associated with less adaptive outcomes (Kaplan & Maehr, 2007; Midgley et al, 1998; Skaalvik, 1997). Studies of performance-approach goals report more inconsistent findings. Several researchers report that it is related to a number of positive outcomes, for instance effort, persistence, and performance (Elliot, & Church, 1997; Harackiewicz et al., 2002; Law, Elliot, & Murayama, 2012, Hulleman, & Harackiewicz, 2011). Also some researchers identified correlations between performance goals and maladaptive thoughts, emotions and behaviors (Ames, 1992; Dweck and Leggett, 1988). In contrast, other

researchers have found weak or moderate correlations between performance goals and self-efficacy, the use of effective learning strategies, grades, attitudes and positive emotions (such as Elliot, 1999; Urdan, 2004; Kaplan & Maehr, 2007). Also some other studies report performance goals to be unrelated to self-efficacy, CGPA (Cumulative Grade Point Average) as well as to correlate less on the beneficial strategy using and the deep learning (such as Mirzaei et al., 2012; Middleton & Midgley, 1997). Thus, inconsistencies have been found about the consequences of adopting performance goals orientation in achievement situations. Therefore, the literature concerning performance-approach goals is not conclusive enough and performance-approach goals are controversial. For instance, an important issue is whether a performance-approach goal may turn into a performance-avoidance goal when the student encounters greater challenges. Exploring this prediction requires longitudinal studies. Correspondingly, this study will try to reveal that students majoring in mathematics are more likely to be active and willing to pursue challenging tasks, have positive feelings toward learning mathematics, and invest greater effort into the learning when they adopt a mastery goal orientation rather than performance-approach or performance-avoidance goal orientation.

The dissertation, hopefully, has contributed to the development of goal theories of learning, in particular, in the relation of these theories to teaching mathematics at university. The approached to changing students goals to optimal ones have been viewed in the dissertation.

Practical Value

This study will enhance teachers' awareness in math teaching-learning process. They will realize that their major job in mathematics is to inspire belief which competence increases due to hard work. Teachers also will understand that reducing stressful situations and minimizing negative evaluations of students' genetic capacity to learn mathematics more affective factor on the way of math success.

This study may be useful for students, teachers and administrators in the identification of university students who are considered at risk for math failure or are on the verge of dropping out of college.

From math learner's perspective this study will also enhance students' awareness in math learning and success. They will also realize that effort is the key to success and competence increases due to hard work when they face obstacles.

Therefore, from many perspectives this study has implications for both researchers and practitioners.

Novelty

This study differs from previous studies on achievement goal theory in several ways. First, it has attempted to influence students' goal orientations in mathematics through experimental teaching-learning activities. Second, an attempt was made to increase students' mathematics efficacy beliefs through mastery-learning activities and subsequently, student achievements in mathematics. Therefore, the problem addressed in this study was whether experimental mastery-goal instruction would affect students' goal orientations that they would adopt during the experiment. Third, mastery learning in mathematics as an instructional philosophy has been identified specifically. This instructional modification suggested for mathematics instruction was implemented in the experimental group to influence students' goal orientations which is based on the idea that effort is the key to success and competence increases due to hard work when students face difficulties. Finally, modern theories of motivation which is focused more specifically on the relation of beliefs, values, attributions and goals with action and achievement in mathematics were provided a theoretical framework for this study.

Goals of the Study

- This study will try to indicate that in educational context in most cases the applications of mastery goals are the optimal ones for students' math success.
- The study, based on literature analysis, aims to develop a model of development in students of mastery goals in learning mathematics and to test the developed model.
- The purpose of this study is to determine whether students' mean results in mathematics will improve with the development of classroom mastery goal strategies and students' goal adaptation.
- This research will also indicate that adopting not only achievement-avoidance goals, but also performance-approach goals are one cause of low achievement in mathematics.

Hypothesis

The hypothesis of this study is that the implementation of mastery-learning goal instruction will enhance students' math achievement level whose goal adaptation is non-mastery.

This research hypothesizes that:

- The students will become mastery-learning goal oriented by the implementations of mastery-learning goal oriented classroom management technics and instructions.
- Applications of mastery-learning goal orientation will increase students' testing results in mathematics whose goal adaptations were initially non-mastery.

Research Questions

1. How and why the applications of Achievement Goal Theory affect students' success in mathematics at university?
2. Do successful students in good academic standing (with an average point of 2.0 or above) and unsuccessful students in low academic standing (with an average level below 2.0) differ in terms of their goal adaptations?
3. How the applications of Achievement Goal Theory affect students' expectancies for success, beliefs about ability, usefulness, importance and interest for mathematics?

Research Objectives

- To examine deeply how students' goal adaptation in achievement situation affect their achievements in mathematics at university.
- To understand why some students complete tasks despite enormous difficulty, while others give up easily.
- To understand the role of students' academic self-worth, self-efficacy, attributions, and expectancies for success in mathematics.
- To understand how mathematics learners differ in terms of beliefs, values, attributions and feelings in terms of their goal adaptation in achievement activity.
- To examine the relations of students' beliefs, attributions, expectations, subjective task values, and goals with their actions in math subject.

- To find out how students' goal adaptations in achievement situation affect their expectancies for success, beliefs about ability, usefulness, importance and interest in mathematics.
- To reveal whether possessing mastery-learning-oriented motivation of students who seek knowledge for the sake of knowledge has a more positive impact on students' achievement in mathematics compared to other kinds of learning goals.

Research Methods

To answer the research questions and to test the hypothesis, the following research methods were applied:

- analysis of research literature on the investigated issue;
- questionnaire results' survey to find out students' views on the goals they pose in front of themselves while learning mathematics;
- experiment with the control group taught mathematics without trying to impact the goals that they pose for themselves while learning mathematics and the experimental group taught the same contents with the same course books, but with teacher effort to change students' learning goals for mastery goals;
- statistical treatment of the results obtained in the survey and experiment

Basically, the research methods were quantitative, as the goal of the study was to prove the hypothesis; however, the questionnaire involved some open-ended questions, so to some degree qualitative methods were also applied.

Dissertation Structure

Dissertation comprises an introduction, three chapters, conclusions and recommendations, as well as 4 appendices. The are 18 tables, and 11 figures in the dissertation.

CHAPTER 1. LITERATURE REVIEW

Chapter one overviews such issues as the role of motivation for learning outcomes and classroom management, contemporary theories of motivation (much attention is paid to attribution

and expectancy x value, and goal theories). Three types of learning goals are emphasized: mastery, performance-approach and performance-avoidance goals. It is emphasized that most of contemporary research (Lin, Hung and Lin, 2006; Saxena and Singh, 2014; Wolters, 2003; Zimmerman, 2004) shows mastery goals as the most effective ones. To sum up the learning goal analysis in chapter one, Table 1.1 was made up by the researcher. It was used for organizing the research described in chapter 3.

Table 1.1. Comparison of performance-avoidance, performance-approach and mastery goals

	Performance-avoidance goals	**Performance-approach goals**	**Mastery goals**
main features	fear of failure (decreasing self-efficacy; believing that, if a student has low ability, s/he cannot be efficient) → avoiding participation in activities	desire to be as good as or better than other peers (extrinsic motivation)	interest in the subject, development of curiosity, insistence and skills
advantages	student feels safe, but this feeling does not correspond to reality, so, in fact, there are no advantages	students are involved in activities, they believe in the effects of working hard	lowest of the three approaches anxiety levels; students mostly use high-level cognitive strategies; helpful for continuous education
disadvantages	very high anxiety levels; little practice decreases anyway low skill level; pushes students to cheat; students use only avoidance strategies	rather high anxiety levels; students believe that their success depends on luck rather than effort; students use both low-level and high-level cognitive strategies; when faced with difficulties, students easily give up; not helpful for continuous education	not easy to maintain mastery goals all the time

(made up by the researcher)

It is easy to see that all approaches have advantages, however, the 'advantages' of performance-avoidance approach are eventually rather harmful, so the approach itself harms knowledge and skills acquisition by students. On the other hand, all approaches have drawbacks, but both performance-avoidance and performance-approach goals have grave disadvantages, which are practically impossible to overcome; compared to them, the disadvantages of mastery goals are manageable. This is why in this dissertation only this approach is recommended as a really effective one. Performance-approach goals may be to some degree effective, but in the long term they are ineffective, while performance-avoidance goals might lead to obtaining a diploma, but definitely do not contribute to knowledge and skill development.

CHAPTER 2. MODEL OF EFFECTIVE APPLICATION OF GOAL THEORY TO TEACHING MATHEMATICS

The purpose of this chapter is to explore the directions and recent progress in understanding of the motivational dynamics of mathematics achievement. The chapter presents information concerning the impact of students' self-concept on their goal orientation. There is considerable evidence to support the assertion that positive academic self-concept contributes to academic achievement by enhancing the motivation (Awan, Noureen, & Naz, 2011). Bayrami, Yari, Khani, & Mohammadi (2014) conducted a research to evaluate the relationship between mathematics self-concept and achievement goal orientation for predicting test anxiety of high school students. Their results of research showed that there is a significant relationship between predictive variables (mathematics self-concept, achievement goal orientation) and test anxiety in student. According to their analysis they indicated among the studied variables, mathematics self-concept and mastery approach might predict test anxiety in students (Bayrami, Yari, Khani, & Mohammadi, 2014), because mathematics self-concept, cognitive aspect and non-cognitive aspects can affect areas of student's mathematics learning. Among important cognitive factors in mathematics, reasoning and problem-solving performance and among its emotional aspects self-concept of students who enjoy learning (mastery orientation) rather than compete with (outperform) others (performance

approach), shows more interest and better performance in class (Bayrami, Yari, Khani, & Mohammadi, 2014).

The factors, having an impact on mathematics self-concept are:

- The complexity of the subject (its abstract character; manipulations with numbers requiring great concentration and accuracy; the need to apply the learned formulae for problem-solving, which requires to select the right formula in each case; the subject requires a high enough IQ).
- Task difficulty (although the subject on the whole is difficult, which has an impact on the difficulty of all tasks, still some tasks may be more or less difficult; if the task is easy, such as the algorithm is given, and just has to be followed, all students can normally do it;
- The challenging tasks also become doable for the majority of students; some creative tasks are undoable for the majority of students, this does not mean they should not be used, this only means that they should not be abused, so that students do not experience 'learned helplessness').
- Naturally, students, assessing mathematics as a difficult subject and the test tasks as challenging / undoable will have a debilitating level of test anxiety. To avoid it, students need enough practice in the test tasks that cause most problems.
- Depending on students' increment or entity view on intelligence, students may develop a low mathematics self-concept, whatever the teaching/learning methods are. Thus, it is the teacher's task to explain to students and to persuade them (by practical examples) that intelligence (and, correspondingly, the ability to learn mathematics) largely depends on hard work.
- Positive experiences in class will, of course, increase student's level of mathematics self-concepts. It means that teachers should provide enough explanations, guidance and moral support, for their students to experience positive feelings in connection with mathematics class. And vice versa, repeated negative experiences will develop in students a low mathematics self-concept. This means that students need immediate help with the tsk types or topics they fail at.
- Parents', teachers' and peers' reaction to student's success and failure has to be supportive, it is important that they do not 'diagnose' the student's inability to learn mathematics.

Students' self-worth influences their goal orientation in achievement in mathematics. According to self-worth theory, as stated by Martin Covington (2000), students naturally have the tendency to establish and maintain a positive self-image, sense of self-worth, or an appraisal of their own value as an individual. Self-worth theory allows us to understand the how much each

student is driven to “approach success” and to “avoid failure” (Covington & Beery, 1976; Covington, 2009).

Students’ ability beliefs also influence their goal orientation in achievement in mathematics. Students who believe that genetically they do not possess mathematical inclinations will not make efforts to learn it, as they view the course as unlearnable for them. This leads to performance-avoidance goals, which are extremely harmful for learning mathematics.

Table 2.1 helps to understand which type of goals should be used in the classroom. As no good teacher consciously holds classes based on avoidance goals, these goals are not included in the table.

Table 2.1. Mastery and performance-oriented classroom management compared

Mastery goal oriented classroom management:	**Performance goal oriented classroom management:**
Teacher emphasizes success / competence as a result of hard work and effort.	Teacher emphasizes success / competence as a result of ability and intellectual capacity.
Teacher focuses on students’ effort and strategy use (when a student fails, s/he gives constructive feedback about student’s effort and strategy use).	Teacher focuses attention on comparing students’ performance and capacity to each other.
Teacher gives tasks from easy to difficult, increasing difficulty step by step.	Teacher avoids challenging tasks to let students succeed.
Teacher is a modelling problem-solving and assessment, then a student who is often successful fulfils the task, then weaker students are guided by the teacher (or peers)	Teacher simply uses problem-solving and assessment, without explaining their logic (e.g., does not present rubrics to students).
Teacher’s main belief is that students’ mathematics-efficacy can be increased with mastery goal oriented behaviors.	Teacher’s main belief is that competitive lesson activities make students more confident and so mathematics-efficacy will be higher.
Students’ desire for developing skills is higher than their fear of failure. Formative assessment is emphasized.	Students’ desire to pass / get a high grade is emphasized. Summative assessment is emphasized.
Pair and group work is used, to let students share problem-solving strategies.	Whole-class and individual work is used, to boost competition.
Students give importance to self-improvement and mastering tasks, because teacher wants students to work for the sake of learning.	Students give importance to outperforming others and getting the highest grades, because

	teacher wants students to work for the sake of a grade.
When competition is organized, it is between groups, not between individual students.	Competition (who finishes the task first and correctly is rewarded) is often applied.
There is no limit in the way of success.	Students determine their level of success and put limit to it, comparing themselves to their peers.

(developed by the researcher)

From the table it is reasonable to see that mastery goals are more beneficial to students in terms of mathematics achievement. However, it does not mean that performance approach are completely useless. When they are used as a supplement to mastery goals such as checking that specific steps are being accomplished toward a mastery goal, performance goals might also be useful in the classroom as long as mastery goals are the main focus. Supporting ideas are given by some researchers (Harackiewicz et al., 2002) that endorsing the performance-approach goals is beneficial, especially when mastery goals are also endorsed. However, very little research has been conducted on the relation of multiple goal contexts (with mastery and performance-approach goal structures) to student learning.

Thus, the model of teaching mathematics at university which supports the development of mastery goals in students is schematically presented in Table 2.2.

Table 2.2. The model of mathematics teaching supporting the development of mastery goals in students

Teacher →	**Activities →**	**Assessment →**	**Students**
Develops **positive views** in him/herself, concerning students' abilities to learn mathematics in general and do the particular task.	Are doable (follow the path from easy to difficult), some of them – used as bonus - also challenging, They are numerous and various enough, many of them are authentic.	Formative assessment is emphasized. The feedback provided is constructive (underlining success and the ways to overcome failures) and leaves the student a chance to improve one's skills.	Under teacher's impact **develop positive views** on the course as a whole, as well as on particular tasks. They develop a view that their efforts will be rewarded – a positive view on themselves as learners of mathematics.
Serves as an **effective model** of problem-solving, also chooses	Among activities there are whole-class, individual, pair and	Peer and self-assessment is employed, so that	Due to sufficient number of effective tasks, teacher and peer-

effective models / experts among students to help him/her teach	small group ones, which provides involvement of all students and sharing knowledge, skills and strategies.	students form their self-efficacy and self-motivation.	support **increase their self-efficacy** and motivation to learn mathematics (to do a particular task), realizing its value.
Teacher **clearly presents** the materials, doing his/her best to make them learnable.	Among activities are finding examples to illustrate the theoretical materials learned, problem-solving	Typical errors are discussed, but their discussion is not linked with a particular student. When individual comments are needed, this happens between teacher and student, not publicly.	Teacher is not the only material presenter in the class, **all students are involved in material presentation.**
Creates a safe, friendly, supportive **classroom atmosphere**	Some activities are funny and for entertainment;	Not all activities are assessed. A chance is left to improve the results and to overcome the failure.	Feel relaxed, **debilitating anxiety is avoided**, which contributes to **higher motivation**.

CHAPTER III. RESEARCH HELD TO TEST THE HYPOTHESIS OF THE STUDY

The research included a case study conducted at Suleyman Sah University (Turkey) with 53 freshman students of mathematics and an experiment. According to the results of the case study, students with mastery goal orientation turned out to be more successful than students with performance goal orientation. It was judged that there were quite many students with mastery goals among the respondents, however, non-mastery goal students constituted about 40%, which is undesirable. It was concluded that there is a strong positive correlation between mastery-learning goal and students' academic success (average grades in mathematics are positively correlated with mastery goal orientation: $r = .60$, $p < 0.01$). Performance-approach goal also yielded a positive, however, weak correlation with average grades in mathematics ($r = .25$, $p < 0.10$). On the other hand, performance-avoidance orientation correlation is negative ($r = -.24$, $p < 0.10$). The study also indicated that the best way to change students' academic achievement level in mathematics as well as to reduce or eliminate their mathematics test anxiety is to take measures to change students' performance-approach and especially performance-avoidance goals into mastery-learning goals.

In their research the students with mastery approach did really well (average grade 2.0), with performance-approach goals - relatively well (average grade 1.0), but not well enough, while the students with performance-avoidance goals did the worst (average grade 0.0) (Sekreter & Doghonadze, 2015). In the light of the findings it is reasonable to say that mastery-learning goal orientation is best fit for achievement in mathematics.

The experiment involved two studies:

1. Finding out the correlation between students' tests results and the goals adopted by students while learning mathematics
2. Finding out how applications of achievement goal theory affect students' expectancies for success, beliefs about ability, usefulness, importance and interest for the math subject.

According to students' first AGQ results from the table 3.1 it can be seen that among 39 students 16 have performance – avoidance goals, 15 have mastery goals, and 8 - performance approach goals. The average achievement of students whose goal adoptions are mastery learning is 75 (out of 100 possible), while for performance approach it is 71 and for performance-avoidance - 58. Therefore, the null hypothesis was not confirmed and it is possible to say that the mean results of mastery-goal-oriented students is higher than that of students with performance-avoidance and performance approach goals. Mastery-oriented students showed the highest success.

Table 3.1. Average grades in mathematics of MG, PAG and PAvG-oriented students according to the pre-test exam results

GPA/ goals types	Number of students (out of 39)	Mean result (out of 100)	Standard deviation	Standard error of measurement
Mastery goals	15	75.33	13.819	0.09
Performance-Approach Goals	8	71.88	10.999	0.10
Performance-Avoidance goals	16	58.75	17.275	0.08

According to the standard deviation from table 3.1 it is seen that the variability of mean value (mean grades) is the highest for the students with performance-avoidance goals, middle – for the students with mastery goals and the lowest – for the students with performance-approach goals.

Table 3.2. ANOVA left-tail test shows significant difference between MG, PAG and PAvG oriented students' mean of grades

	Sum of squares	Df	Mean square	F	P
Between groups (combined)	2294.535	2	1147.268	4.566	0.017
Within groups	9045.208	36	251.256		
Total	11339.744	38			

According to table 3.2, it is possible to say that MG, PAG and PAvG-oriented students' mean grades are significantly different from each other, since $p < 0.05$.

After the experiment among the 20 students who used to be non-mastery initially, 13 became mastery goal oriented and 7 of them still remained non-mastery.

If in the beginning of the experiment there were 8 students with PAG, at the end, according to questionnaire results, there were only 2, and even they received lower average results in the PAG category than before. Also, if in the beginning of the experiment there were 12 students with PAG, at the end, according to questionnaire results, there were only 5, and even they received lower average results in the PAvG category than before. The experiment has been reached 65% success, which is a very good result for a one-semester period.

Table 3.3. Students' mean of pre-test and post-test results

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	pre-test&	67.82	13	8.567	2.376
	post-test	83.85	13	10.439	2.895

Table 3.3 reveals that students' post-test mean results (83.85) are higher than pre-test results (67.82). To check whether the difference between students' mean pre-test and post-test results was statistically significant, Paired Sample t-test was applied.

According to table 3.4 pre-test exam result does not affect post-test result. Negative correlation has been found between pre-test and post-test results. Therefore it can be sad that pre-test and final grades are not dependent each other. They show variability. While one of them can get high in pre-test in the final can get lower or vice versa.

Table 3.7. Paired Sample t-test for mean pre-test and post-test results

	Paired Differences					t	Df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
pre-test & post-test	-21.154	14.456	4.009	-29.889	-12.418	-5.276	12	.000

The results have been found at % 95 confidence level. The difference between mean pre-test exam and post-test results have been found statistically different since the calculated value of *t* falls into rejection region for degree of freedom (df)=12 and 5% significance level (t-table value is 2.179). So we it is possible to reject the null hypothesis that there is no difference between mean of the pre-test and mean of the post-test results and accept the alternative hypothesis that students' mean post-test results are statistically significantly higher than the pre-test results. Thus, the hypothesis can be viewed as proved, at least for the given group of students.

According to the findings it is possible to indicate that non-mastery students who do not possess mastery-learning goal motivation demonstrated a better academic success after they became mastery-learning-oriented. Their mean post-test result is 24% higher than their mean pre-test result and it is positively related to a good academic standing (mathematics GPA is B= 3.0= 83-86%). On the other hand, students who resisted to become mastery-learning oriented and only partially developed the views showed less improvement in their academic success. Their mean post-test result was only 14% better than their mean pre-test result, however, not good enough and negatively related to good academic standing (math GPA is D= 1.0=60-66%). This result in the experiment shows that the quality of student learning as well as the will to continue learning largely depends on mastery-learning goals students bring to the classroom.

Although this research was carefully prepared and reached its aim, it had some limitations. First of all, because of the time limit, this research was conducted only a small size of population in a single university. Thus, the generalizability of these findings for university students at other institutions is limited. It is expected that the limitations of this study may be addressed through replications and additional larger-scale and longer period investigations.

CONCLUSIONS AND RECOMMENDATIONS

In accordance with literature analysis and the experimental findings the following fundamental conclusions emerged from the research:

1. Learning begins with goals. If the posed goals are fruit-bearing, students will be engaged in the educational process, persist irrespective the challenges, believe in their ability to learn the subject and eventually succeed in learning. Educational psychology has shown that there are mastery, performance-approach and performance-avoidance type of goals (Ames, 1992; Anderman & Anderman, 1999; Dweck & Leggett, 1988; Elliot & McGregor, 1999; Eccles & Wigfield, 2002; Meece et al, 1988; Midgley et al., 1998; Nicholls, 1990). Literature analysis (Anderman & Anderman, 1999; Elliot & Church, 1997; Midgley et a., 1998; Skaalvik, 1997) basically supports the idea that mastery goals are the most productive, performance approach is productive to some degree, while performance-avoidance is completely ineffective, even harmful. This dissertation confirms the idea for the university students of mathematics.

2. Mastery goals are those goals which underline the ability perform certain actions over comparison between students, passing the course or getting high grades in it. Mastery goals are based on intrinsic motivation and they are the bases life-long professional development. Performance-approach may help students to somehow pass the exams, but they seldom support the development of skills. Performance-avoidance goals, although they seem to students to be face-saving, eventually damage students' sle-efficacy and do not lead to fulfilling the course requirements.
3. If students believe that the task and the academic course in general is useful and doable for them (expectancy-value theory), if they have mathematical efficacy, they more likely work hard, pursue challenging goals, spend much effort toward fulfilling the identified goals, and persist longer in the face of difficulty. This is especially important for teaching and learning mathematics which is generally viewed as a difficult course requiring special abilities.
4. Students' achievement goal orientations affect their achievement-related beliefs, values, attitudes, and behaviours in learning mathematics. The present study indicated that possessing mastery-learning goal orientation is the central determination of students' achievements in mathematics, expectancy for success, usefulness, importance, and interest.
5. The result of the study showed that mastery goal orientation produces higher self-efficacy beliefs among participants as compared to the performance-approach and performance-avoidance goal condition.
6. Mastery goals are important during the process of development of mathematical skills. Teachers should organize classroom management strategies based on the mastery-learning goal orientations. For this, teachers themselves should have positive views on the utility of the subject its relatedness with various life problems and spheres of human activity. Teachers cannot help students develop mastery goals unless they believe in the ability of all their students to tackle with the challenges of the course.
7. Teachers need to inspire students' curiosity about mathematics and its applications to solve authentic (i.e., real-life) problems. Teachers should stimulate students' cooperation versus competition. Pair and group work both in class and as homework (preparing projects) helps them share knowledge, skills and strategies and thus raise students' self-efficacy in mathematics. The experience of successfully done tasks motivates students, while often

experienced failure may lead students to learned helplessness, which has a strong demotivating effect.

8. Mathematics teachers, to stimulate the development of his/her students' mastery goals should provide students with:

- a safe, student-friendly learning environment, applying a smile and humour, entertaining activities alongside the serious ones;
- clear explanations;
- abundant, doable (from the easy to the difficult) and variable activities, sufficient practice, supplementary work for the skills that students are having difficulty acquiring;
- direct support and additional instruction in mathematics, especially for the students who are struggling;
- constructive feedback: emphasize success against failure and recommend the ways to overcome weaknesses and challenges;
- positive views on their ability to learn mathematics;
- whole-class, pair, small group and individual work, to take into consideration learners' individual peculiarities and to enable the share the knowledge and strategies;
- authentic activities, which link mathematics with real-life problems and increase students' feeling of the usefulness of the academic course.

Teachers should serve as problem-solving models, by thinking-aloud techniques revealing their strategies, and choose effective models among students. However, weaker students should often represent the work fulfilled by the group, to motivate the stronger students help them, also to let weaker students experience the pleasure of being successful.

9. Mastery learning model for math proposes that all students can acquire basic mathematical skills when provided with appropriate learning strategies in the classroom. Therefore choosing mastery-oriented classroom management strategies influence the amount and the quality of student learning, as well as the students' persistence to continue learning.
10. If students' success-oriented attributions (explanations of successes and failures) depend on effort and persistence (beliefs of mastery-learning goal-oriented students) more than on luck or genetic ability (beliefs of performance-approach goal-oriented students), they will have more chances to be better learners and to achieve their goals successfully in learning mathematics.

11. As it is frequently asserted by researchers (Elliot & McGregor, 1999; Kaplan & Maehr, 2007; Middleton & Midgley, 1997; Midgley et al, 1998; Pajares, Britner, & Valiante, 2000; Skaalvik, 1997), this research also found that performance- avoidance goal orientation in learning mathematics is negatively correlated with students' academic success. These students experience a relatively low performance and they more tend to lack efficacy expectation for success. These students often turn to cheating as a strategy of passing the exam, as they do not believe they can do it otherwise. As Covington (1992) indicated, the need to protect self-worth arises primarily from a fear of failure. Therefore, if failure seems likely, some students will not try, because trying and failing threatens their ability self-concepts. Covington (1992) called such strategies failure-avoiding strategies. If this fear of failure is strong, then a student does not do something in order not to look bad or receive unfavourable judgments from others to protect his/her self-worth. It is important to make sure that the performance goals do not promote failure-avoidance (performance-avoidance-oriented) behaviour, such as avoiding unfavourable judgments of capabilities and looking incompetent when the student encounters greater challenges. If these goals develop, it is difficult to persuade a student change them, even though they know these goals eventually lead to complete failure.
12. As Covington (1992) indicated, a key way to maintain one's self-worth is to protect one's sense of academic competence. Even high-achieving students can be failure-avoidant because of the question that they ask themselves: If I try my best and then fail? Rather than responding to a challenging task with a greater effort, these students may try to avoid the task in order to maintain both their own sense of competence, and others' conclusions regarding their competence. Focusing on the demonstration of competence may cause avoiding strategies. Thus, developing competence is the best choice in goal adaptation. Besides the pedagogical (clear presentation, effective activities) and managerial (effective planning, student engagement, pair and small group work) ways to support students' learning and positive views on it, the psychological ways (positive atmosphere in the class, explanation of the role of mathematics, of students ability to perform the tasks, of teacher's belief in their abilities) are also very important.
13. Students need to believe they are academically competent in order to think they have personal worth in the educational context. However, (summative) assessment, competition,

and social comparison make it difficult for many students to maintain the belief that they are competent academically. If teachers reduce stressful situations and minimize negative evaluations of competence during the teaching-learning process, they may help students overcome these undesirable consequences.

14. Based on the quantitative findings, this research also concludes that mastery-learning goal to instruction can be developed in students by the offered in the dissertation approach. If/when reached, mastery goal is capable of enhancing achievement in mathematics of average level mathematics learners by inspiring the belief that they can produce the desired outcomes by their actions. This finding no doubt will inform the teacher of the need to make their students more enthusiastic and inspire students' curiosity about mathematics and its possible practical applications which help students to develop their mathematical competence through practice and effort. These findings will also inform the teacher of the need to accommodate individual differences in learners of mathematics, based on the different types of goal orientations. Thus, teachers should tailor instruction to individual needs of the learners of mathematics and wait patiently to insure mastery goal-oriented behaviour. By so doing, students will be persistent in the face of difficulties and obstacles on their way to achievement. The dissertation recommends that mathematics teachers should be encouraged to integrate mastery-learning oriented strategies in their instructions.
15. Based on quantitative data analysis, considerable evidence presented in the literature review as well as in the given dissertation suggests that university students show the most positive interest and learning patterns, higher efficacy expectations for success in learning and using mathematics and willingness when their classroom settings emphasize mastery, understanding, and improving knowledge, skills and strategies. Whereas classroom environments that are focused on demonstrating high ability and competing for grades can increase the academic performance of some students to some degree, research suggests that mastery-learning orientation is the best fit for mathematic achievement at university, as only this goal orientation has long-term efficacy.
16. It is important with regard to academic cheating that students' goal orientations will affect the types of strategies that students use to complete tasks. Unfortunately, cheating can be used as one of strategies. If a student's main concern is demonstration of high ability and outperforming others (performance-approach goals) or the avoidance of appearing

incompetent (performance-avoidance goals), then cheating can be used as a strategy to achieve these goals. In contrast, if a student is mastery-goal-oriented, cheating will not provide any advantages and facilitate the type of learning that will lead to task-mastery (Anderman, Griessinger, & Westerfield, 1998). Since mastery-learning oriented students have the desire to improve their competence and it is associated with deeper engagement with the task, they will not use cheating as their learning (more exatly, grade-getting) strategy. Moreover, these students' sense of satisfaction with the work is not tied up with external performance indicators such as earning high grades. As a result, if one's goal is to learn and to become proficient for the sake of knowledge intentionally, there is no reason to cheat.

17. Achievement motivation researchers should investigate the changes in students' goal-orientation types, ability beliefs, expectancies for success, and subjective values, as well as the relations of them during the education years to give more valid explanation for math learners' performance, choice of achievement tasks and persistence on those tasks.
18. A strong positive relationship was found between the mastery goals and students' self-efficacy, beliefs in usefulness of the course (mathematics) and …. However, a weak, but still positive relationship was found between the beliefs in mathematical abilities and students desire to learn the course. This view is dangerous only if students get much negative experience and feel teacher's negative views on their ability to learn mathematics. If teacher provides a positive regard on their mathematical abilities and explain that success will come, it is just the question of effort, patience, persistence and time, this view does not create large problems for the development of mastery goals.
19. The model, developed in the dissertation and tested experimentally, can be recommended for further application and investigation.

List of publications related to the doctoral dissertation:

1. Sekreter, G. (2015). Overview of Modern Theories of Motivation". *The 5th International Research Conference on Education, English Language Teaching, English Language and Literatures in English (IRCEELT).* Proceedings. International Black Sea University. Tbilisi / Georgia, p.376-384

2. Sekreter, G. & Doghonadze, N. (2015). Applications of Goal Theory to Teaching Mathematics. *Journal of Education in Black Sea Region,* vol. 1, iss. 1, p. 65-73
3. Sekreter, G. (2016). The Way Students' Self-Concept Influences Their Goals in Mathematics Achievements. *The 6th International Research Conference on Education, Language and Literatures.* International Black Sea University. Tbilisi / Georgia, p. 123-127.
4. Sekreter, G. (2016). Mastery Goal Orientation Promoting Students' Expectancies for Success and Self-Efficacy, *Journal of Education in Black Sea Region,* vol. 2, iss. 1, p. 93-96