The impact of self-regulation instruction on mathematics achievements and attitudes of elementary school students

Öz Düzenleme Öğretiminin İlköğretim Öğrencilerinin Matematik Başarısına ve Tutumuna Etkisi

Zeki Arsal[1]
Abant Izzet Baysal University

Abstract
The purpose of this study is to find out the impact of self-regulation instruction on fractions and decimal numbers on academic achievement and attitude towards mathematics in elementary school program in Turkey. The subjects of the study were fourth year elementary school students (N=60). Zimmerman, Bonner and Kovach's (1996) model related to self-regulation instruction was adapted to fraction and decimal numbers teaching activities and carried out for six weeks during the academic year. Self-regulated learning instruction was implemented in the experimental group. The results in the study suggested that the students in the experimental group had higher academic achievement on fraction and decimal numbers, and attitude scores in mathematics than the control group.
Key Words: Self-regulation; academic achievement; attitude; elementary school mathematics; fractions and decimal numbers

Öz
Bu çalışmanın amacı, öz düzenleme öğretiminin ilköğretim matematik programında yer alan kesirler ve ondalık sayılar ünitelerindeki akademik başarıya ve matematiğe karşı tutuma etkisini belirlemektir. Araştırma, ilköğretim 4. sınıfa devam eden 60 öğrenci ile yapılmıştır. Araştırmada Zimmerman, Bonner ve Kovach (1996) tarafından geliştirilen öz düzenleyici öğretim modeli kesirler ve ondalık sayılar öğretim etkinliklerine uyarlanmış ve 6 hafta uygulanmıştır. Öz düzenleyici öğretim etkinlikleri deney grubu öğrencilerine uygulanmıştır. Araştırma sonunda, deney grubunda yer alan öğrencilerin hem kesirler, ondalık sayılar ünitesindeki academik başarılarının hem de matematiğe karşı tutum puanlarının kontrol grubu öğrencilerine göre daha yüksek olduğu bulunmuştur.
Anahtar Kelimeler: Öz düzenleme, akademik başarı, tutum, ilköğretim programı, kesirler ve ondalık sayılar

Introduction

Mathematics improves critical thinking skills; helps solving real life problems and understanding the facts of the life. Most students, during their elementary school education, think that mathematics is very complex. As a result, they can not benefit from the advantages of the learning of mathematics throughout and long after their education. One of the reasons

[1] Assist. Prof. Dr. Zeki Arsal, Abant Izzet Baysal University, Department of Educational Sciences. arsal_z@ibu.edu.tr

of this might be ineffective teaching methods, materials and activities. Mathematics teaching should include three purposes. First, students should have conceptual knowledge of mathematics. Second, they should have procedural knowledge of mathematics. Finally, they should understand the relationships between conceptual and procedural knowledge. These three purposes may serve relational understanding. The relational understanding means understanding the concepts and connections of mathematics, using the symbols of mathematics and knowing the relationships between concepts, symbols and methods (Baykul, 2002). Relational understanding enhances memory strategies, helps students to learn new mathematics concepts and procedures, and improves problem solving abilities of the students. (Van de Walle, 1998). Students should examine their mathematics thinking, analyze mathematics situations, explain and justify their mathematics reasoning so that they can develop deep mathematics understanding (Pape & Smith, 2002). Relational understanding also helps students become autonomous learners. Students can learn more deeply when they take control of their own learning. Mathematics teachers should not only improve relational understanding but also self-regulated learning skills of their students. Knowing cognitive processes and using self-regulated learning strategies may have an important role in that student can see the relational understanding in mathematics.

Educational psychologists have provided rich descriptions of self-regulated learning. Winne (1995) described self-regulated learning as an inherently constructive and self-directed process. According to Pintrich (2000:453) self-regulation or self-regulated learning is "an active constructive process whereby learners set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behavior, guided and constrained by their goals and the contextual features in the environment." Pintrich (1999) described the model of self regulated learning that includes three general categories of strategies; (1) cognitive learning strategies (rehearsal, elaboration and organization strategies). (2) self-regulated learning strategies to control (planning, monitoring and regulating strategies). (3) resource management strategies (managing and controlling time, effort and their environment). Wolters (1999) supported Pintrich's definition and he pointed that one of the most important issues in self-regulated learning is that students can select, combine and use cognitive strategies effectively.

Zimmerman (1989) defined comprehensively the characteristics of self-regulated learners as follows: They are metacognitively motivationally and behaviorally active in their own learning process. In this sense, self-regulation refers to different students' thoughts and behaviors to reach their learning goals. Self-regulated learners follow activities such as attending to instruction, processing information, relating new knowledge to prior knowledge, making rehearsal, improving social relations and arranging environment in order to reach learning goals. These aspects of self-regulation can be observed in the model suggested by Zimmerman, Bonner and Kovach (1996). This model involves four interrelated processes that are defined below:

1. Self-evaluation and monitoring occur when students judge their personal effectiveness through observations and recordings of prior performances against to outcomes.
2. Goal setting and strategic planning occur when students analyze the learning task, set specific learning goals, and plan or refine the strategy to attain the goal.
3. Strategy-implementation monitoring occurs when students try to execute a strategy in structured contexts and to monitor their accuracy in implementing it.

4. Strategic-outcome monitoring occurs when students focus their attention on links between learning outcomes and strategic processes to determine effectiveness.

In the model, students monitor and evaluate their learning performance on a task. Self-evaluation improves and includes keeping performance records. Secondly, students analyze the learning task, set goals, plan and refine a learning strategy. If students have little knowledge about a task and they can not set goals or use effective learning strategies. Thirdly, students implement the strategies they select and take feedback from peers, teachers and themselves. Students use new strategies when their strategies are ineffective. Finally, students evaluate their performance outcomes and effectiveness of their strategies. They change their strategies if they are ineffective.

The model of self-regulation including self-evaluation and monitoring, goal setting and strategic planning, strategy implementation, strategy outcome monitoring can be embedded within mathematics instruction in elementary schools in order to increase children's achievement in and attitudes towards mathematics. In the social cognitive theoretical framework, learners do not use self-regulation strategies equally in all domains. Although self-regulation processes (e.g. monitoring, planning and goal setting) are general, learners must adapt these processes to specific domains such as mathematics and use them effectively. Moreover, self-regulation is related to context of the learning materials (Schunk, 2001). This situational specificity is pointed in Zimmerman's (1998) conceptual framework comprising six areas in which one can use self-regulatory processes; motives, methods, time, outcomes, physical environment, and social environment. Self-regulated learners can choose one or more of these areas. Students can learn a task when they use this process. Also, they benefit from some external factors (i.e. teachers, parents, and computers).

Most self-regulated learning definitions and models include strategies, processes, responses used by students to improve their academic achievement. Self-regulated learning is defined as a covert process in cognitive issues of self-regulated learning and as overt responses in behaviorist view of self-regulated learning. In all definitions, all of the students aim to improve their academic achievement by using self-regulated processes (Zimmerman, 2001).

In the literature, there are relationships among self-regulated learning behaviors and academic achievement in and attitude towards mathematics. Stoeger and Ziegler (2005) examined a self-regulated training program for gifted students who are under achieving in mathematics. In the study, the training program developed by Zimmerman et. al., (1996) was conducted within the framework of regular classroom instruction on the subject of mathematics over a six-week period. The results showed that the training was effective for increasing mathematics achievement. Nota, Soresi and Zimmerman (2004) examined self-regulation and academic achievement of high school students. They found that the cognitive self-regulation strategies of organizing and transforming proved to be significant predictor of the students' course grades in mathematics. Esler and Kohavi (2003) investigated the relations between classroom control, self-regulation strategies and academic achievement. In this study, they found that the achievement of the students was positively associated with self-efficacy in self-regulated learning, self-efficacy in mathematics and other academic domains, as well as with intrinsic motivation and cognitive strategies. Scmitz and Wiese (2006) investigated a standardized diary approach with time-series analysis methods to investigate the process of self-regulated learning by adaptation of Zimmerman's self-regulated learning model (consisting of four weekly training sessions). The results indicated

that interrupted time series analyses and control group comparisons confirmed the essential treatment effects and a significant improvement in self-regulatory behavior. The study revealed that the students in the experimental group made more improvement in self-efficacy, effort to learn and handling distractions than students in the control group. Furthermore, teaching self-regulated learning strategies can increase not only academic achievement but also self-regulated learning skills of students. Chan and Moore (2006) found that greater strategic knowledge and use are likely to lead subsequent higher achievement. Sundre and Kitsantas (2004) supported the results of the study. They found that self-regulation strategy use yielded a significant coefficient for prediction of consequential multiple-choice test performance. These results contribute to current theories of self-regulation and motivation, because self-regulation was shown to be a strong predictor of achievement when operatinalized by a high demand of task, and essay writing.

Research literature has pointed out that self-regulated learning is correlated to academic achievement of the students in different learning context. Teaching self-regulated learning to elementary school students can lead to an increase in their academic achievement in mathematics. In addition, classroom teachers can solve mathematics learning problems of their students by implementing self-regulated learning activities. All elementary school children can learn mathematics and benefit from advantages of mathematics in their life. In this framework, the purpose of this study was to find out the effects of self-regulation instruction on mathematics achievement in fractional and decimal numbers and their attitudes towards mathematics in the elementary schools. For this purpose, the following research questions were investigated: Is there any significant difference in the post-test between the control and experimental groups in terms of academic achievement? Is there any significant difference in the post-test between the control and experimental groups in terms of attitude towards mathematics?

Method

Participants

The participants of the study were fourth-year students (n=60) enrolled in the two elementary schools in a city with the population of one hundred thousand in the north of Turkey. The schools involved in the present study were public schools. There were thirty students in the control group and thirty students in the experimental group. All of the students in the study were about ten years old. There were 13 (43.3%) female, 17 (56.7%) male students in the experimental group and 16 (53.3%) female, 14 (46.7%) male students in the control group. The families of the students in both groups had similar socio-economic backgrounds.

Instruments

In order to collect the data related to mathematics academic achievement of the students, the Mathematics Achievement Test developed by the researcher was conducted. The pre-test and post-test were the one and same instrument which was administered at two different times throughout the study. The test includes thirty items which measure the objectives of fractional and decimal numbers in the mathematics course in the elementary school program in Turkey. The test consists of two subtests, fractional numbers subtest which has 13 items and decimal numbers subtest which consists of 17 items. In the first place, the item and test statistics of the achievement test were computed for reliability and validity. According to the validity and reliability results, thirty items whose item discriminatory scores were higher than 0.30 were included in the test. The Kuder-Richardson (KR-20) reliability value of the

Fractional Numbers subtest is 0.63 and the test difficulty (P) is 0.57. The KR-20 reliability value of the Decimal Numbers subtest is 0.83 and the test difficulty (P) is 0.68.

The data related to the attitudes of the students towards mathematics were collected by The Mathematics Attitude Scale developed by Baykul (1990). The scale was commonly used by the researchers and teachers in order to measure attitude towards mathematics in elementary schools in Turkey. The scale included thirty items, fifteen of which are positive and the remaining fifteen of which are negative statements. According to factor analysis, the items whose factor value is higher than .40 were selected. The instrument employed a 5-point Lickert-type response formatted scale (1=strongly disagree and 5= strongly agree). The Cronbach Alpha reliability value of the scale is 0.96. The pre-test and post-test was the same instrument which was administered at two different times, at the beginning and end of the study.

Procedures

The design of the research was based on a pre-test and post-test model. The study lasted for six weeks during the 2006-2007 academic years. The study was conducted on fractional and decimal numbers in mathematics course in the elementary school program in Turkey.

Factors that may affect the results of the study was controlled by the researcher in the beginning of the study. Firstly, the mathematics achievement and attitude towards mathematics of all the children in the school were measured in the beginning of the study in order to select experimental and control groups. The results indicated that there was not any significant difference between the experimental and control groups in academic achievement ($t(58) = 0.78$, $p = .08$) and attitude towards mathematics ($t(58) = 0.80$, $p = .42$) according to the pre-test t test results (See Table 1). Secondly the teaching activities, materials, homework related to fractional and decimal numbers planned by researcher were conducted in the experimental group just as in the control group. Thirdly, the factors such as prior mathematics achievement, social and cultural background of the students were taken into account in order to compose experimental and control groups. Fourth, neither the students in the control group nor the students in the experimental group did take any self-regulated learning instruction in their prior school life. Finally, the teachers of experimental and control groups were selected to have similar characteristics of age, years of experience and education level.

In order to find the effectiveness of self-regulation instruction on academic achievement and attitudes towards mathematics, the self-regulation instruction program (i.e., planning, monitoring, goal setting) was implemented in the experimental group.

The theoretical background of the instruction program used is founded upon self-regulated learning model developed by Zimmerman et. al., (1996). This model, involving explicit training in goal setting, strategy use, self-monitoring, and systematic practice, could also be used in classroom situations. In the model, Zimmerman et. al., (1996) pointed out four interrelated processes. The relationships between the model and self-regulation instruction program in this study were given as following:

1. Self-evaluation and monitoring: The students in the experimental group monitored and evaluated their learning experiences, study time, study environment, task value and their interest to the task, distracters, parents help, self-efficacy and study strategies (i.e., cognitive and metacognitive), and their learning performance by filling the Self-Report Form.
2. Goal setting and strategic planning: The students in the experimental group set learning goals related to their homework and tasks and planned learning experiences and their study strategies.

3. Strategy implementation and monitoring: The students in the experiment group implemented their learning experiences and study strategies and monitored their learning performance.
4. Strategic outcome monitoring: The students in the experiment group evaluated effectiveness of their study strategies and learning activities by considering the test results at the end of each week of study for six weeks. And either changed their study strategies or countinued to use them.

In the study, students in the experimental group reported their homework activities and learning experiences for self-regulated learning by filling in the Self Report Form. According to Scmitz and Wiese (2006) self-regulated learning researchers and teachers generally use homework activities in order to improve self-regulation skills and achievement of their students. The Self-Report Form is formed to develop the students' self-regulation strategies such as planning, monitoring, goal setting and self-evaluation. The Self Report Form includes learning experiences such as time management, goal setting, task value, interest in the subject, distractions, study strategies, parents help, self-efficacy. Students set learning goals (for example; I must learn fractions, decimals, I must solve fraction and decimal problems) and performance goals (for example; I must take nine points over ten in the exam, I must be the best in the classroom), time management (I studied two hours, I need more study hours to be successful), task value (This homework or learning material are important for me or not), interest in the subject (I am interested in this homework or learning material, The learning materials are interesting for me), distracters (I do not study in a place where there is a TV set, I study in my study), study strategies (I highlight important concepts in my notes, I summary my notes), parents' help (I seek help, I ask my parents and peers when I need help), self-efficacy (I study hard, I give points myself for the homework).
The process related to self-regulation instruction in the experimental group were given as following:

1. The researcher planned teaching activities, homework, materials related to fractions and decimal numbers units in the elementary school fourth grade mathematics program in Turkey.
2. The researcher developed The Self-Report Form for the self-regulation instruction.
3. The four-hour theoretical instruction on the role of teacher and students, self-regulation concept, self-regulation teaching model, completing the Self-Report Form, was given to the teacher of the experiment group by the researcher.
4. The teacher implemented planned teaching activities related to fractional and decimal numbers and gave homework on a daily basis.
5. The teacher instructed students about how they fill The Self-Report Form, monitor and evaluate their learning process.
6. Students reported self-regulation strategies they use while doing their homework and other learning activities they engaged at home by filling Self-Report Form.
7. Teacher conducted quizzes and gave feedbacks every week so that the students can evaluate their learning performance and effectiveness of their study strategies.
8. The teacher controled the Self-Report Forms every week and gave feedback and suggestions about their study stratagies such as cognitive and metacognitive learning strategies, learning goals, study time, distractors (for example; you should study more, your study time is not enough to achieve your goals, you should change your study strategies and you should seek help from parents or peers), and helped solve the problems about their homework.

9. According to the test results and teacher's feedback, students evaluated the reasons of success and failure, planned new learning experiences and changed their study strategies if they needed to. Also, they gave suggestions to their peers about their study strategies.
10. The students evaluated and reported their self-efficacy beliefs by giving themselves a point over ten. In addition, the teacher encouraged students about giving reinforcements to themselves.
11. At the end of the six weeks, the post-test and the attitude scale were conducted over the students in the experimental group.

The process in the control group were given as following:

The teacher in the control group implemented the same teaching activities related to fractional and decimal numbers given to the experimental group. However, self-regulation instruction activities such as planning, monitoring, goal setting were not implemented for students in the control group. Students in the control group did not fill in any form in order to monitor their learning process. The instruction about self-regulation was not given to the teacher in the control group. Moreover, the teacher did not give any feedback to the students to evaluate their learning processes. At the end of the six weeks, the post-test and the attitude scale were conducted over the students in the control group.

Results

The data related to the first research question (Is there any significant difference in the post-test results between control and experimental groups in terms of academic achievement?) was given below:

Table 1.

Means, Standard Deviations and t-test Results for Academic Achievement in The Pre-test and Post-test

		Pre-test				Post-test			
Groups	N	M	S.D.	t value	p	M	S.D.	t value	p
Experimental	30	9.70	2.45	.78	.08	19.86	3.71	3.84*	.000
Control	30	9.10	3.12			15.56	4.87		

*P<.05

The results in Table 1 show that there was no significant difference between the experimental and control groups in terms of academic achievement in the fractional and decimal numbers in the mathematics course in the beginning of the semester ($t(58) = 0.78$ $p<.05$). However, there was a significant difference between the experimental and control group in terms of academic achievement at the end of the semester ($t(58) = 3.84$, $P<.05$). The results indicated that the academic achievement of the experimental group in the post-test was higher than that of the control group. Self-regulated learning activities may have positively effected academic achievement of students in the experimental group.

The data related to the second research question (Is there any significant difference in the post-test results between control and experimental groups in terms of attitudes towards mathematics?) was given below:

Table 2.

Means, Standard Deviations and t-test Results for Attitude towards Mathematics in The Pre-test and Post-test

Groups	N	Pre-test M.	S.D.	t value	p	Post-test M	S.D.	t value	p
Experimental	30	103.46	12.56	.80	.42	111.26	18.81	2.02*	.04
Control	30	99.43	24.24			99	27.33		

*P<.05

The results indicated no significant difference between the experimental and control groups in terms of attitude towards mathematics at the beginning of the semester (t (58) = 0.80 P<.05). However there was a significant difference between the experimental and control groups in terms of attitude towards mathematics at the end of the semester (t (58) =2.02, p<.05). The results indicated that attitude scores of the students in the experimental group were higher than those of the students in the control group. Self-regulated learning activities may have increased not only academic achievement in fractional and decimal numbers but also students' attitude towards mathematics in the experimental group.

Discussion

The aim of this study was to find out the impact of self-regulation instruction on fractions and decimal numbers on academic achievement and attitude towards mathematics. According to the pre-test results, there was no significant difference between the experimental and control group in terms of academic achievement. However, the post-test results indicated that there was a significant difference between the experimental and control group in terms of academic achievement; the post-test scores regarding academic achievement of students in the experimental group were higher than those of students in the control group. Self-regulated learning activities by means of diaries that had been carried out in the experimental groups such as self-evaluation, monitoring, planning, goal setting, strategy implementing might have been the reasons for higher academic achievement of the students in the experimental group. These results were supported by the literature related to self-regulated learning. For example, Camahalan (2006) examined the effects of self-regulated learning on mathematics achievement of sixty elementary school students with low mathematics achievement. Zimmerman's self-regulated learning strategies were applied conducted in the study. The results showed that there was significant improvement in the mathematics achievement and use of self-regulation strategies of the students in the experimental group after thirty sessions of training on the use of self-regulated learning strategies. This study supports Zimmerman's theory that when students are given opportunities to self-regulate and explicitly taught self-regulated learning strategies, academic achievement is more likely to be positively affected. These results supported the findings of this study. Moreover, the results in this study confirm the study of Eshel and Kohavi (2003). They investigated relations between self-regulation strategies and academic achievement. The results indicated that perceived student and teacher control are likely to have an additive effect on the academic attainment of students. The mathematics achievement of the experimental group students was consistently higher than that of the control group students.

In the study, students in the experimental group selected and implemented study strategies such as cognitive and metacognitive according to the context of the homework. Selecting and implementing cognitive and metacognitive learning strategies can be considered as the reasons for the academic achievement of those in the experimental group.

Ross, Glennon, Guarino, Reed and Marshall (2003) indicated that the learners' use of cognitive learning strategies was significantly related to their academic performance in the course. Study strategies were related to course performance of the students. It seems that self-regulated learning training activities may positively affect not only academic achievement but also cognitive and metacognitive learning strategies.

In the study, students reported their learning process, study strategies in the homework activities by filling in the Self Report Form. Students in the experimental group monitored their own progress for learning through keeping records. Self-reporting activities may increase academic achievement of students in the experimental group. Zimmerman and Martinez-Pons (1986) examined self-report strategies used in different learning contexts by interviews with high school students. They found that students' use of these strategies was highly correlated with their achievement and self-regulation in the class.

The results in this study suggested that diary activities related to self-regulated learning may have affected academic achievement and self-regulatory behaviors of students in the experimental group. These diary activities can be the reason of higher academic achievement of students in the experimental group. Scmitz and Wiese (2006) investigated a standardized diary approach through time series analysis method on self-regulated learning by using Zimmerman's model of self-regulated learning (consisting of few-week-long training sessions). The students in the experimental group answered the questions in standardized diaries over a five-week period. The results showed that standardized diary activities affected self-regulatory behaviors of students in the experimental group.

In the current study, students evaluated the effects of study strategies on their academic performance through teacher's feedback. The results suggested that self-evaluation for their learning process may increase the academic achievement. Strategic planning and feedbacks given by the teacher of the experimental group guided students' efforts to control learning performance. The feedback given by teacher may have affected the academic achievement of students in the experimental group. Furthermore, the feedback may have been useful for students to monitor their self-regulation strategies and change them when they did not enhance achievement. According to Nicol and Dick (2006) self-generated feedback might lead to internally set goals and use of different study strategies. Schunk (1984) found that ability to give feedback to themselves leads to higher academic achievement.

The results in the study indicated that students' positive attitude towards mathematics in the experimental group increased, whereas there was no change in the attitudes of the control group. Self-regulation instruction activities by means of the diaries may have positively affected elementary school students' attitude towards mathematics. High attitude towards mathematics may have led to an increase in the academic achievement of the students in the experimental group. In addition, self-regulated learning instruction may have increased not only attitude towards mathematic but also mathematics self-efficacy beliefs and volition of students. The students in the experiment group evaluated and reported their self-efficacy beliefs towards their homework and given tasks. Social cognitive theorists such as Bandura (1986), assume that self-efficacy is a key variable affecting self-regulated learning. Also, self-efficacy is one of the most important factors affecting academic achievement and attitude towards mathematics. Students' positive attitude towards mathematics may be related to academic achievement and self-efficacy beliefs. Chen (2003) found that self-efficacy played a direct role in predicting students' mathematics performance. Furthermore, Zimmerman and Kitsantas (2005) investigated the role of students' homework practice in their self-efficacy beliefs with respect to learning strategies and academic achievement. The

results showed that there was a significant relationship between self-efficacy beliefs of the students related to homework experiences and academic outcomes at the end of the school term. Also, students who have positive attitude towards mathematics may be interested in mathematics activities and see as a value of learning materials for their achievement. The feedback given by teacher might increase self-efficacy beliefs of student (Nicol &Dick, 2006; Schunk, 1984). Zusho and Pintrich (2003) found that the motivational components of self-efficacy and task value were found to be the best predictors of final course performance. Moreover, they found that high achievers expressed increasingly higher level of interest over time. Also, interest and task value may lead to an increase in the academic achievement of students. In the study, students in the experimental group reported their interest in the learning task and importance of the task for them. Literature supports these results. Marsh, Trautwein, Lüdtke, Köller, and Baumert (2005) found that mathematics interest was correlated with mathematics achievement. It can be said that self-regulated learning can improve students' interest in mathematics. Schiefele, Krapp, and Winteler (1992) concluded that the overall correlation between interest and academic achievement was about .30 but that this relation was heterogeneous across different school subjects and indicators of achievement. Schiefele (1996) demonstrated that interest was a significant predictor of subsequent achievement (cited in Marsh et al., 2005).

Conclusion

In conclusion, the results in this study indicated that the students in the experimental group over which self-regulated learning activities were conducted have higher academic achievement in fractional and decimal numbers in the mathematics course in the elementary school program. It was found that self-regulated learning activities improved students' attitude towards mathematics at the elementary school level. Moreover, self-regulation instruction positively affected self-efficacy beliefs of the students towards and interest in the mathematic. In order to increase students' mathematics achievement in elementary schools, teachers should conduct effective mathematics teaching activities and provide instruction on self-regulated learning strategies. Classroom teachers and mathematic teachers should instruct their students in such a way as to enable them to monitor, control and evaluate their own learning. Students should become autonomous learners in learning mathematics. Finally, there is no reason why students shouldn't be successful in mathematics in their school life and effectively benefit form mathematics throughout their lives.

References

Bandura, A. (1986). *Social Foundations of Thought and Action: A Social Cognitive Theory.* Englewood Cliffs. Ns. Prentice. Hall.

Baykul, Y. (1990). *İlkokul Beşinci Sınıftan Lise ve Dengi Okulların Son Sınıflarına Kadar Matematik ve Fen Derslerine Karşı Tutumda Görülen Değişmeler ve Öğrenci Seçme Sınavındaki Başarı İle İlişkili Olduğu Düşünülen Bazı Faktörler.* Ankara: ÖSYM Yayınları.

Baykul, Y. (2002). *İlköğretimde Matematik Öğretimi*. Ankara: Pegem A Yayıncılık.

Camahalan, F. M. (2006). Effect of self-regulated learning on mathematics achievement of selected Southeast Asian Children. *Journal of Instructional Psychology*, 33(3), 199-200.

Chan, L. & Moore, P. (2006). Development of attribution beliefs and strategic knowledge in years 5-9: a longitudinal analysis. *Educational Psychology*, 26(2), 161-185.

Chen, P. (2003). Exploring the accuracy and predictability of the self-efficacy beliefs of seventh grade mathematics students. *Learning and Individual* Differences, 14, 79-92.

Eshel, Y. & Kohavi, R. (2003). Perceived classroom control, self-regulated learning strategies and academic achievement. *Educational Psychology,* 23(3), 249-260.

Mars, H., Trautwein U., Lüdtke, O., Köller, O. & Baumert, J. (2005). Academic self-concept, interest, grades and standardized test scores reciprocal effects of causal ordering. *Child Development*, 76(2), 397-416.

Nicol, D. & Dick, D. (2006). Formative assessment and self-regulated learning: a model and seven principles of good feedback practice. *Studies in Higher Education*, 31(2), 199-218.

Nota, L., Soresi, S. & Zimmerman, B. J. (2004). Self-regulation and academic achievement and resilence: A longitudinal study. *International Journal of Educational Research*, 41(3), 198-215.

Pape, S. & Smith, C. (2002). Self-regulating mathematics skills. *Theory into Practice,* 41(2), 93-101.

Pintrich, P. (1999). The role of motivation in promoting and sustaining self-regulated learning. *International Journal of Educational Research,* 31, 459-470.

Pintrich, P. (2000). The role of goal orientation in self-regulated learning. In I. M. Boekaerts, P. Pintrich & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 451-502). San Diego: Academic Press.

Ross, M., Glennon, J.S., Guarino A., Reed, C.J. & Marshall, M. (2003). Situated self-regulation: Modeling the interrelationships among instruction assessment, learning strategies and academic performance. *Educational Research and Evaluation,* 9(2), 189-209.

Schiefele, U., Krapp, A., & Winteler, A. (1992). Interest as predictor of academic achievement: A meta-analysis of research. In K. A. Renninger, S. Hidi, & A. Krapp (Eds.), The role of interest in learning and development (pp.183 – 212). Hillsdale, NJ: Erlbaum.

Schunk, D. H. (1984). The self-efficacy perspective on achievement behavior. *Educational Psychologist*, 19, 199-218.

Schunk, D. H. (2001). Social cognitive theory and self-regulated learning. In B. J. Zimmerman & D. H. Schunk (Eds.), *Self-regulated learning and academic achievement* (pp. 125-189). New Jersey: Lawrence Erlbaum Associates Inc.

Scmitz, B. & Wiese, B. (2006). New perspectives for the evaluation of training session in self-regulated learning: Time-series analyses of diary data. *Contemporary Educational Psychology*, 31, 83-88.

Stoeger, H. & Zeigler, A. (2005). Evaluation of an elementary classroom self-regulated learning program for gifted mathematics under achievers. *International Education Journal,* 6, 267-368.

Sundre, D.& Kitsantas, A. (2004). An exploration of psychology of the examinee: Can examinee self-regulation and test taking motivation predict consequential and non consequential test performance. *Contemporary Educational Psychology*, 29, 17-19.

Van De Walle, J. (1998). *Elementary and Middle School Mathematics. Teaching Development*: New York, Congman Inc.

Winne, H. P. (1995). Self-regulation is ubiquitous but its forms vary with knowledge. *Educational Psychologist,* 30(4), 223-224.

Wolters, A. C. (1999). The relation between high school students' motivational regulation and their use of learning strategies, afford, and classroom performance. *Learning and Individual Differences*, 3(3), 281-299.

Zimmerman, B.J. & Martinez-Pons, M. (1986). Development of a structured interview for assessing student use of self-regulated learning strategies. *American Educational Research Journal*, 23(4), 614-628.

Zimmerman, B. J. (1989). A social cognitive view of self-regulated academic learning. *Journal of Educational Psychology*, 81(3), 329-339.

Zimmerman, B. J., Bonner S. & Kovach, R.(1996) *Developing Self-regulated Learning: Beyond Achievement to Self-efficacy.* American Psychological Association, Washington DC.

Zimmerman, B. J. (1998). Developing self fulfilling cycles of academic regulation: Analysis of exemplary instructional models. In D. H. Schunk & B.J. Zimmerman (Eds.), *Self-regulated learning: from teaching to self-reflective practice* (pp. 1-19). New York: Guilford Press.

Zimmerman, B. J. (2001). Theories of self-regulated learning and academic achievement: An overview and analysis. In B. J. Zimmerman & D. H. Schunk (Eds.), *Self-regulated learning and academic achievement* (pp. 1-33). New Jersey: Lawrence Erlbaum Associates Inc.

Zimmerman, B. J. & Kitsantas, A. (2005). Homework practices and academic achievement: The mediating role of self-efficacy and perceived responsibility beliefs. *Contemporary Educational Psychology*, 30, 397-417.

Zusho, A. & Pintrich, P. (2003.)Skill and will: the role of motivation and cognition in the learning of college chemistry. *International Journal of Science Education*, 25(9), 1086-1091.