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Pre-Service Education on Differentiated Instruction: Elementary Teacher Candidates' Competences and Opinions on the Process

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Abstract
Differentiated instruction is an instructional method complying with the constructivist approach that takes individual differences into consideration. Importance of pre-service education becomes apparent so that the differentiated instruction of which positive contributions such as having positive effects on students' academic achievements and enabling them to develop a positive attitude toward mathematics have been shown in mathematics education research can be applied in an efficient way. In this context, the purpose of this study is to examine elementary mathematics teacher candidates' competence of differentiated instruction and their opinions on the process during a pre-service education which has the components through which they become informed of the differentiated instruction method, develop differentiated instructional activities, these activities are observed by teachers and they discuss the effectiveness of the practices. The study group of the research was composed of 49 pre-service elementary mathematics teachers. Accordingly, competence level of differentiated instruction was found to be a value very close to the high level. It is thought that this study will provide information on the points to be taken into consideration in future studies to be conducted on obstacles and conveniences presented by pre-service teachers regarding the use of differentiated instruction method and the learning environment in the light of the practices.
Keywords: differentiated instruction, elementary mathematics education, pre-service teacher opinions, pre-service education, differentiated instruction activities

1. Introduction

The constructivist approach supports that students become active in the learning process, include their individual differences in their learning and need to take the responsibility for their own learning. It is observed in the learning environments where constructivist approach is applied that students are faced with the problematic situation and it is supported that they produce solutions in cooperation, discuss and evaluate themselves (Bevevino, Dengel & Adams, 1999; Fer, 2008; Gagnon & Collay, 2001; Plourde & Alawiye, 2003). How this approach is to be applied efficiently in a learning environment is decided by instructional methods and the classroom setting. The classroom setting is a social environment composed of individuals with different traits, and teachers should consider these differences and choose their instructional methods in accordance with students' different learning styles, interests, and preparedness levels. Nevertheless, many teachers apply uniform instructional models created for moderate-level students. It cannot be expected that this model complies with the whole classroom even though it is thought to be applying to the majority (Rollins, 2011). When students with lower learning level and rate than their peers cannot receive education in accordance with their levels, rates of failure and dropout increase whereas those with higher learning levels become less and less successful in time as they cannot use their potential (Bender, 2012; Heacox, 2002). Indeed, the uniform instructional model created for the whole classroom falls insufficient for students' development.

Differentiated instruction is an instructional method complying with the constructivist approach that takes individual differences into consideration. It is an instructional method which considers students' differences in preparedness levels, interests and learning styles, develops learning environments suitable for these differences to give a chance to every individual to succeed and supports development of students in acquiring information, interpretation and expressing what they learn (Heacox, 2002; Oliva, 2005). It is the subject of differentiated instruction how teachers reach students with different traits. Differentiation is mostly achieved in the aspects of content, process, and product in the learning environment (Heacox, 2002; Tomlinson & Strickland, 2005). There are several strategies such as stations, centers, agenda, complex instruction, orbitals, and points of entry, learning contracts, and tiered instruction (Gregory & Chapman, 2002; Tomlinson, 1995). Yet, it cannot be expected from teachers and pre-service teachers to apply an instructional method which they have never seen and experienced. In this context, importance of pre-service education becomes apparent so that the differentiated instruction of which positive contributions such as having positive effects on students' academic achievements (Richards & Omdal, 2007; Springer, Pugalee & Algozzine, 2007; Yabaş & Altun, 2009) and enabling them to develop a positive attitude toward mathematics (Boerger, 2005; Stager, 2007; Yabaş & Altun, 2009) have been shown in mathematics education research can be applied in an efficient way. Pre-service teachers' competences and their opinions on the process are of importance because they play a critical role in perceiving and guiding behaviors of students in their classrooms (McNamara & Moreton, 1995, *in* Atıcı, 2001). In this scope, the purpose of this study is to examine pre-service teachers' competence of differentiated

instruction and their opinions on the process during a pre-service education which has the components through which they become informed of the differentiated instruction method, develop differentiated instructional activities, these activities are observed by teachers and they discuss the effectiveness of the practices.

2. Method

Since it was aimed to define, describe, evaluate the situation examined comprehensively and reveal the possible interrelationships of events in this study and due to enabling to study the investigated problem deeply, the case study method was used within the scope of descriptive approach (Çepni, 2007; Yin, 2003).

2.1 Study Group

The study group of the research was composed of 49 third-year students who were attending the Elementary Mathematics Education in the Faculty of Education of a state university in Niğde, Turkey.

2.2 Practical Process and Data Collection Instruments

The pre-service teachers received education on differentiated instruction in the axis of different components within the scope of Special Instructional Methods II for a term. For the first four weeks, basic assumptions of differentiated instruction, educational differences, principles of differentiated instruction, teacher and student roles in differentiated instruction, differentiated instruction process and differentiated instruction techniques were addressed. Next, 10 groups were formed, with 9 of them composed of 5 individuals each and 1 of them composed of 4 individuals, and the they were asked to prepare an activity in which they can differentiate a content, a process or a product in accordance with students' possible preparedness levels, interests or learning styles. Then these activities were presented by the groups to the others and shortcomings identified in group discussions and the evaluations of 3 experts were eliminated by the groups. Following this two-week process, each group interviewed with 10 mathematics teacher who were working in public secondary schools in Niğde and volunteered to apply the differentiated instruction activities, and they observed teachers' four typical class hours to examine the teaching-learning processes. For the preparation of differentiated instruction activities, separate interviews were made before the practice with the teachers on the level of the application classrooms and what attainments they would achieve. The groups prepared template instructional plans in accordance with these interviews. Next, each group performed the interest and learning styles inventory and the preparedness test in the classroom in which the teachers were to apply the activities. The groups prepared the differentiated instruction activities by the tiered instruction technique in which the process is differentiated on the basis of learning styles of each classroom's students to which they applied the inventories and the tests; the centers technique in which the process is differentiated on the basis of students' interests; and the station technique in which the content is differentiated on the basis of students' preparedness levels. These activities prepared for the practice were presented by the groups to the others and the experts for evaluation. Shortcomings identified in the group discussions and with the help of 3 expert opinions after each presentation were addressed by the groups and the experts. It took four weeks for the groups to prepare the activities to be performed by the teachers. In the process, the teachers were explained to by the researchers about basic assumptions of differentiated education, instructional principles, instructional process, and instructional techniques. The activities were performed by the teachers for 6-8 class hours and the activities were observed by the pre-service teachers. At the end of the two-week time, obstacles and conveniences of the activities were discussed by the pre-service teachers. Based on the shortcomings observed in the activities, the groups were asked to revise their activities in accordance with those shortcomings. Pre-service teachers' opinions were obtained in written interviews following this pre-service education. Semi-structured interviews were made with 26 pre-service teachers who had not presented their opinions in a detailed and clear way in the written interviews. At the end of the practical process, the “Scale for Applying the Differentiated Instruction and Competence Level” developed by Çam (2013) was performed on the pre-service teachers. This 28-item and 7-factor scale measures with 7-point Likert type grading. These seven factors are motivation, material, learning environment, activities, individual differences, tasks, and evaluation respectively.

2.3 Data Analysis

The data obtained in the semi-structured interviews and the written interviews were analyzed with the content analysis technique. Answers given to the questions were recorded throughout the interviews and the data obtained were inventoried and checked before the analysis. Similar ones of the data obtained in the semi-structured and written interviews were encoded to be gathered in certain themes, and the parts that were consistent and in coherence in themselves were identified. The raw data obtained from the research were encoded by three experts individually to ensure the reliability of the process and the fit index of the coding reliability was calculated to be 87%. The data obtained in the “Scale for Applying the Differentiated Instruction and Competence Level” were evaluated with averages both in general and in the scope of each sub dimension

(motivation, material, learning environment, activities, individual differences, tasks, and evaluation.)

3. Findings

Pre-service teachers' score averages and standard deviations in the "Scale for Applying the Differentiated Instruction and Competence Level" are given in Table 1.

Table 1. Pre-service teachers' score averages and standard deviations in the scale for applying the differentiated instruction and competence level

Dimensions	N	$\overline{X}$	S
Motivation	49	22.88	1,35
Material	49	19.60	1,91
Learning Environment	49	15.34	1,54
Activities	49	19.63	1,96
Individual Differences	49	19.95	1,38
Tasks	49	19.91	1,48
Evaluation	49	19.57	1,79
General	49	137.28	6,58

According to Table 1, teachers' score average of applying the differentiated instruction was 137.28. In consideration of the minimum and maximum values, this value is very close to the high level. Hence, it can be said that the pre-service teachers regard themselves as competent enough to differentiate their instructions on a high level.

When examining the subdimensions, the average of motivation has a higher value (22.88) than the others. This average can be said to be on a high level in the light of minimum and maximum values of motivation. It can be understood from the finding that the pre-service teachers regard the student motivation as competent enough to differentiate their instructions on a high level. As for the material, activities, and evaluation subdimensions, the averages were 19.60, 19.63, and 19.57 respectively and very close to each other. These three subdimensions had moderate-level scores in consideration of their minimum and maximum values. It can be concluded that the material, activities and evaluation subdimension differentiated on a level closer to each other and above the average. The average of the individual differences subdimension was found to be 19.95. In other words, pre-service teachers' levels of considering the individual differences were found to be on a moderate level. Like the individual differences, it was seen that the tasks subdimension was on a moderate level at 19.91. It can be accordingly said that the level of differentiating the tasks that can be given to the students is on a moderate level.

The learning environment subdimension was found to be the one with the lowest score at 15.34. As for the averages of this subdimension in relation with its items, while it was seen that the average of 3 items were on a high level at 17.80, the average of one item ("creating a quiet, one-person study area in a corner of the classroom" was low at 7.99 and the average of the learning environment subdimension was lowered in total by this item.

At the end of the activities, pre-service teachers' opinions on the process were obtained in the written interviews and the semi-structured interviews. The pre-service teachers stated that active student participation in the course could be ensured because their interests in and motivations on the course increased, student confidences could be enhanced by providing students on lower levels with efficient assistance in activities based on preparedness and students on higher levels could be enabled to improve themselves through different activities without getting bored. As for the obstacles that could be experienced in the activities, it was noted that all of the pre-service teachers stated that the classroom settings need to be reorganized to allow for easier group studies. Within this framework, they argued that it is not that possible to "create a quiet, one-person study area in a corner of the classroom." They also stated that larger classrooms and round tables are needed so that the group study could be applied more comfortably. Pre-service teachers' opinions in this scope are given below:

"Activities surely attracted students' attention. This provided the teacher with great convenience during the practice because active participation was achieved as the students were not distracted thanks to the activity." (PT21)

"[I] think it's a very effective method for low-level students. For instance, in the activities we prepared with the station technique, the teacher found the chance to deal with the first station, or the weaker group, very easily...the fact that students in the weaker group could do something with teacher assistance will be very effective on their confidence. The teacher whom we observed before applying the differentiated instruction during the normal class process didn't have the chance to deal with any weak student personally. But they got this chance during the differentiated instruction. Higher-level students had the opportunity to take their level to the next one while performing the activities on their own levels." (PT8)

"*[B]ut it is important that groups can work comfortably so that differentiated instruction can be applied in a better way. If the classrooms had been bigger and there had been round tables, it'd have been more ideal. There*

is an item in the scale you applied as 'creating a quiet, one-person study area in a corner of the classroom' [the pre-service teacher mentioned the item by looking at the scale.] Something like that isn't possible the present classroom settings. I don't think I'll be able to finding such a classroom setting when I become a teacher." (PT34)

When the pre-service teachers was asked if they would use differentiated instruction in the future, they stated that they could prepare the activities and apply them in their instructions because they had learned it both practically and theoretically (36 participants), they could apply it because it enables students' active participation and meaningful learning (32 participants), and they could apply it if the activities were ready as templates as it is time-consuming to prepare the activities (13 participants).

"[*I] think I can apply it easily because I know what is important and how the procedure is to its smallest detail. I can prepare the activities, too. And I feel I can do it because I saw the activities." (PT15)*

"[*W]hen we start teaching, I'm sure our time will be more limited and we won't have the time to prepare so much activities. That's why I wish there were template activities suitable for attainments: for example in accordance with interest, preparedness, learning styles... If I could organize these activities in respect to my students' needs, it would be nice. Then I could apply it." (PT29)*

"[*I] would apply it when I become a teacher because I think it's an effective method in student learning. Because not only it ensures active participation in the course but also kids learn by having fun and building relations." (PT42)*

When the pre-service teachers were asked to evaluate the pre-service education they had received for the differentiated instruction methods, they reported that it was effective to have both theory and practice together (36 participants), group study and inter-group discussions created an efficient learning environment when preparing the activity (29 participants), it ensured the evaluation of inventories through activities in which content, process, or product is differentiated in accordance with not possible but real preparedness level, interest or learning styles of the student and the implementation of the decisions that may be made in possible conflicts (18 participants), and it presents possible obstacles and conveniences of the observation of the activities in the real classroom setting, allowing for the discussion of how more effective activities can be performed (41 participants). In addition to these components, the pre-service teachers also stated that they could feel more competent because they thought that they could manage the classroom and remedy a possible shortcoming for a more effective instruction if they were to be not only observers but also practitioners in the activities (11 participants).

4. Discussion and Conclusion

It is seen that the scores obtained by the pre-service teachers in the scale for levels of applying differentiated instruction were very close to the high level in the light of the minimum and maximum values. Based on the finding, it can be said that the pre-service teachers regard themselves as competent enough to differentiate their instructions on a high level. When compared with other studies, it is stated that teachers' levels of applying differentiated instruction are on a low and moderate level (Kiley, 2011; Tobin & McInnes, 2008). Among the reasons for the low and moderate level of applying differentiated instruction, teachers act with a uniform instructional model and they cannot perform the differentiated instruction in the real sense because they do not know its actual procedure (Clapper, 2011; Kiley, 2011). Such performance of differentiated instruction by teachers has been associated with the fact that differentiated instruction is introduced only with its general concepts without providing clear examples (Tobin & McInnes, 2008). In this sense, how the pre-service teachers regard themselves as competent enough to differentiate their instructions on a high level can be explained with the components of the pre-service education they had received. These components were described by the pre-service teachers as using theory and practice together, group study and inter-group discussions that create an efficient learning environment, ensuring the evaluation of inventories through activities in which content, process, or product is differentiated in accordance with not possible but real preparedness level, interest or learning styles of the student and the implementation of the decisions that may be made in possible conflicts, presenting possible obstacles and conveniences of the observation of the activities in the real classroom setting, allowing for the discussion of how more effective activities can be performed. It can be said that the pre-service teachers took the education of differentiated instruction beyond the general concepts to learn the actual procedure with its practices and could materialize the method in the axis of the components. In addition to these presented components, it was also intriguing the pre-service teachers stated that they could feel more competent because they could manage the classroom and remedy a possible shortcoming for a more effective instruction if they were to be not only observers but also practitioners in the activities. Within this framework, it is obvious that the performance of the activities by the pre-service teachers in the classroom settings can be considered a component of such a pre-service education.

According to scale's subdimensions, the average of the motivation subdimension was on a high level in terms of its minimum and maximum values. It can be understood from the finding that the pre-service teachers regard the student motivation as competent enough to differentiate their instructions on a high level. According

to Luster (2008), the motivation needs to be achieved first for the differentiation of instruction. In this context, it can be said that student motivation, addressed as a primary step in differentiated instruction can be achieved by pre-service teachers. The pre-service teachers also stated that active participation in the course can be ensured because students' interest and motivations in the course increase when applying the differentiated instruction. These opinions based on in-classroom observations were presented among practical conveniences offered by the differentiated instruction. It has also been shown in different studies in the literature that students are more motivated to participate in the course actively in the classrooms in which the differentiated instruction was applied (Anderson, 2007; Beecher & Sweeny, 2008; Coulter & Groenke, 2008; Dreeszen, 2009; McAdamis, 2001; Suarez, 2007; Tomlinson & McTigne, 2006).

In regard to the minimum and maximum values, the materials, activities and evaluation subdimensions were found to have scores above the average. It can be understood that the pre-service teachers would differentiate materials and activities to be used and performed and the evaluation styles in accordance with students' interests, preparedness levels and learning styles above the average. According to differentiated instruction, it is necessary to use materials, activities and evaluation styles together which address multiple areas of interests, preparedness levels and learning styles in the classroom setting and to create an efficient learning environment for each learner through guidance (Tomlinson, 2001; Clapper, 2011). In this framework, it reflects pre-service teachers' positive cognitive effect on these dimensions. In addition, when the pre-service teachers were asked whether they would use differentiated instruction in future, they reported that they could apply and use the activities in their instructions because they had learned it both theoretically and practically and they would prefer it as it allows for students' active participation and meaningful learning. These opinions presented by the pre-service teachers in accordance with their evaluation and observation during the application process are supported by different studies performed on the differentiated instruction which have found that it makes student learning easier since the process includes a student-centered model and create a learning environment that allows for meaningful learning (Geisler et al., 2009; Nunley, 2004; Theisen, 2002; Sondergeld & Schultz, 2008). The fact that the pre-service teachers felt competent for preparing activities that involve appropriate material use and evaluation style can be interpreted as a positive step in terms of applicability of differentiated instruction in contradiction with the idea in the literature that it is very hard to prepare differentiated instruction activities (Sondergeld & Schultz, 2008). Yet, some of the pre-service teachers who stated that it was very hard to apply differentiated instruction activities because they took time to prepare also reported that they would perform them if they were readily available and recommended that there should be template activities. It is mentioned in other studies, too, that activity preparation stage takes time (Karadağ, 2010; Lange, 2009; Sharabi, 2009; Sondergeld & Schultz, 2008). Nevertheless, the fact that the pre-service teachers stated that the template activities should be readily available in consideration that activities could be changed in regard to the student group is thought to be an important step in embracing the flexibilities in accordance with the groups on which differentiated instruction would be applied on.

It is seen that the subdimensions of individual differences and tasks had a moderate average in terms of minimum and maximum values. In other words, it was determined that pre-service teachers' levels of considering individual differences and differentiating the tasks that can be given to students were on a moderate level. It can be concluded from the finding that the pre-service teachers can differentiate the instruction by taking individual differences into consideration and distribute tasks given to the students both in classroom and after the class on the basis of these individual differences. The requirement that tasks given to students are in accordance with individual differences (Karadağ, 2010) complies with the parallelism between the subdimensions in this study. Among the conveniences that can be offered by differentiated instruction, the pre-service teachers stated that students on lower levels can be provided with effective assistance easily in preparedness-based activities and students on higher levels can be given the chance to improve themselves easily in different activities without getting bored. This opinion of the pre-service teachers is supported by the results obtained in the study by Richards and Omdal (2007) showing that the teachers reported they could assist students on lower levels effectively, such students' participation in the course and their confidence increased because they saw there were activities which they could perform on their own. In this context, it is thought that pre-service teachers can differentiate the tasks given to students in consideration of their individual differences.

The learning environment subdimension was found to be the one with the lowest score. As for the averages of this subdimension in relation with its items, while it was seen that the average of 3 items were on a high level, the average of one item (“creating a quiet, one-person study area in a corner of the classroom” was low and this item lowered the average of the learning environment subdimension in total. The pre-service teachers also emphasized the physical inadequacy in the context of the learning environment. As for the possible obstacles in the practice, the pre-service teachers stated that classroom settings need to be organized so that they allow for group studies. Within this framework, they argued that it is not that possible to “create a quiet, one-person study area in a corner of the classroom.” They also reported that larger classrooms and round tables are needed so that the group study could be applied more comfortably. As addressed by the groups within the scope

of the obstacles that may be faced in the practice, such learning environment coincides with the results achieved by Hellman (2007) that troubles are experienced with the differentiation of instruction as long as appropriate learning environment is not provided.

Teachers' competence levels of differentiated instruction were evaluated as a whole at first and by the subscales and the variables later. Accordingly, competence level of differentiated instruction was found to be a value very close to the high level. Based on the finding, how the pre-service teachers regard themselves as competent enough to differentiate their instructions on a high level can be explained with the efficient learning environment provided by components of the pre-service education they had received. The discussion that addressed positive contributions of the components also puts the shortcomings forth. For example, it is obvious that the performance of the activities by the pre-service teachers in the classroom settings can be considered a component of such a pre-service education. For differentiated instruction to be able to be applied more effectively pre-service teachers should receive efficient education before graduating from the university and teachers should attend in-service trainings. It is thought that this study will provide information on the points to be taken into consideration in future studies to be conducted on obstacles and conveniences presented by pre-service teachers regarding the use of differentiated instruction method and the learning environment in the light of the practices.

References

Anderson, K., M. (2007). Differentiating instruction to include all student. *Preventing School Failure, 51* (3), 49-54.

Atıcı, M. (2001). *Teaching competence. Educational Management in Theory and Practice,* (28), 483-499.

Beecher, M. & Sweeny, S. M. (2008). Closing the achievement gap with curriculum enrichment and differerentiation: one school's story**.** *Journal of Advanced Academics, 19* (3), 502-530.

Bender, W. N. (2012). *Individuals with Learning Disabilities and their Education* (H. Sarı, Transl.). Ankara: Nobel Yayıncılık.

Bevevino, M.M., Dengel, J., & Adams, K. (1999) . Constructivist theory in the classroom: internalizing concepts through inquiry learning. *The Clearing House*, 72 (5),275-278.

Clapper, C. T. (2011). *The effect of differentiated instruction on jrotc leaderhip training* (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses. (UMI No: 3440244).

Coulter, S.E. & Groenke, S. L. (2008). A differentiated vocabulary unit for john knowles'a seperate peace. *English Journal, 97* (4), 26-32.

Çam, Ş.S. (2013). *Teachers' levels of applying differentiated instruction approach and their related competence levels* Unpublished Postgraduate Thesis. Osmangazi University, Eskişehir.

Çepni, S. (2007). *Introduction to research and project studies.* Trabzon: Celepler Matbaacılık.

Dreeszen, J. L. (2009). *The impact of differentiation on the critical thinking of gifted readers and the evolving perspective of the fifth grade classroom teacher*. Unpublished Doctoral Thesis. College of Education Kansas State Universiy.

Fer, S. (2008). *Instructional design.* Ankara: Anı Yayıncılık, 2008

Gagnon,Jr.G.W. & M.Collay.2001.*Designing for learning: Six elements in constructivist classrooms.* Corwin Press, Inc, Thousand Oaks, CA, USA. http://www.prainbow.com/cld/cldp.html [24.06 2016]

Geisler, J., Hessler, R., Gardner, R., & Lovelace, T. (2009). Differentiated writing interventions for high-achieving urban African American elementary students. *Journal of Advanced Academics, 20*, 214-247.

Gregory, G., & Chapman, C. (2007). *Differentiated instructional strategies: One size doesn't fit all.* Thousand Oaks, CA: Corwin Press.

Heacox, D. (2002). *Differentiating instruction in the regular Classroom: How to reach and teach all learners, grades 3-12*. USA: Free Spirit Publishing.

Hellman, D. W. (2007). *Implementing differentiated instruction in urban, title I schools: Efects of facilitiated support groups and program fidelity on student achievement* (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses (UMINo.3306865).

Karadağ, R. (2010). *Applying the differentiated instruction approach in elementary Turkish class: an action research.* Unpublished Postgraduate Thesis. Anadolu University, Eskişehir.

Kiley, D. (2011). *Differentiated instruction in the secondary classroom:Analysis of the level of implementation and factors that influence practice.* (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses. (UMI No. 3455173)

Lange, K. (2009). *Lessons learned in an inclusive classroom: a case study of differentiated instruction.* Unpublished Doctoral Thesis. Colorado State University Fort Collins, CO. (UMI No: 3385161).

Luster, R. (2008). *A quantitative study investigating the effects of whole-class and differentiated instruction on student achievement* (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses. (UMI No. 3320691)

McAdamis, S. (2001). Teachers tailor their instruction to meet a variety of student needs. *Journal of Staff Development, 22* (2), 1-5.

Nunley, K.F. (2004). *Layered curriculum: The practical solution for teachers with more than one student in their classroom* (2nd ed.) Kearney, NE:Morris.

Oliva, Peter F. (2005). *Devoloping The Curriculum*. 6. Basım. ABD: Pearson.

Plourde, L. A. &, Alawiye, O. 2003. Constuctivism and elementary preservice science teacher preparation: Knowledge to application. *College Student Journal*, 37 (3), 334-341.

Richards, M.R.E. &Omdal, S.N. (2007). Effects of tiered instruction on academic performance in a secondary science course. *Journal of Advanced Academics,18* (3), 424-456.

Rollins, R. L. (2011). *Assessing the understanding and use of differentiated instruction: A comparison of novice and experienced technology education teachers* (Unpublished doctoral dissertation). North Carolina State University: Raleigh, NC.

Sharabi, G.G. (2009). *A phenomenological study of teacher perceptions of implementing the differentiated instruction approach.* Unpublished Doctoral Thesis. University of Phoenix. (UMI No: 3393495).

Sondergeld, T.A. & Schultz R. (2008) Science, standards, and differentiation: It realy can be fun!. *Gifted child today. 31*(1), 34-40.

Springer, Robert, David Pugalee, Bob Algozzine. 2007. Improving mathematics skills of high school students. *The Clearing House.* c. 81.s.1: 37-43

Suarez D. (2007). *Differentiation by challange: Using a tiered program of instruction in mathmatics. Making the difference: Differentitation in international schools***.** Eds: William Powel. Ochan Kusuma Powel. Kuala Lumpur.

Thesien, T. (2002). Differentiated instruction in the foreign language classroom: Meeting the diverse needs of all learners. Languages Other Than English Center for Educator Development. http://www.sedl.org/located/communique/n06.pdf adresinden 24.06.2016 tarihinde edinilmiştir.

Tobin, R., & A. McInnes. (2008). Accommodating differences: Variations in differentiated literacy instruction in grade 2/3 classrooms. *Literacy* 42, no. 1: 3–9.

Tomlinson, C. (1995). Deciding to differentiate instruction in middle school: One school's journey . *Gifted Child Quarterly*, 39, 77-87.

Tomlinson, C. A. (2001). *How to differentiate instruction in mixed ability classrooms*. ABD: Association for Supervision and Curriculum Development.

Tomlinson, C. A. & McTighe, J. (2006). *Integrating differentiated instruction and understanding by design.* ABD: Association for Supervision and Curriculum Development.

Tomlinson, C.A. & Strickland, C. A. (2005). *Differentiation in practice: a resource guide for differentiating curriculum, grades 9-12*. Virginia USA: Association for Supervision and Curriculum Development Alexandria.

Yabaş, D. & Altun, S. (2009). *Evaluating the effect of differentiated instruction design on students' perceptions of self-efficacy, metacognitive skills and academic achievements. Hacettepe University Faculty of Education Journal*, 37: 201-204.

Yin, R. K. (2003). *Case study research design and methods* (Third Edition). New Delhi: London.