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Educational Research Association
The International Journal of Research in Teacher Education
2021, 12(1): 24-32
ISSN: 1308-951X

http://ijrte.eab.org.tr

The Impact of Differentiated Instructions on the Motivation of Gifted Student: A Study about Age and Gender Differences

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Abstract

The purpose of this paper is to find the impact of differentiated instruction on the motivation of gifted students in Mathematics at Kolej PERMATApintar® Negara based on age and gender differences. The differentiated instruction method has been applied in teaching and learning system since the establishment of PERMATApintar National Gifted Center (PpNGC) around year 2011. A survey was conducted on 235 gifted students aged 11 to 17 years old. It consists of 13 questions that examine the level of satisfaction of students towards teaching and learning mathematics at Kolej PERMATApintar® Negara. There were four parts of learning profile that have been studied, namely teacher support, learning activities, sharing ideas and educational environment. All of the data were statistically analyzed using SPSS software to measure student's satisfaction according to age and gender. The result suggests that differentiated instruction method give a positive impact on the motivation of gifted student and male students to be more motivated than female students during mathematics class. Beside that there are significant differences between motivation of male and female students against several elements in learning profile of differentiated instruction method. In addition, the age of the student also has a positive relationship with some elements of the differentiated instruction method. Differentiated instruction is the pedagogical response to what the gifted students need in the classrooms. The elements of differentiated instruction provide great opportunity for gifted students to explore any areas of knowledge especially in mathematics based on their needs. The study summarizes some of the elements in the differentiated instruction method that influence the level of student's motivation in mathematics. Beside that some improvements can be made to all the activities during teaching and learning session in mathematics classes.

Keywords: Differentiated instruction, motivation, age, gender, gifted student.

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Introduction

Differentiated instruction method has increasingly become a part of the daily practices in classrooms across the country. The approach was implemented for students with learning disabilities (Gibson 2013), English learners (Xu 2012), students with emotional and behavioral disorders (Jones Bock et al. 2012), Linguistically Diverse Students in Urban Classrooms (Brady & Paugh 2013) and other. Differentiated instruction is a teaching method that requires teachers to be more proactive response to what the gifted student needs (Tomlinson 2000). There are six general principles of differentiated instruction method which is building community, high quality learning goal, ongoing assessment, flexible grouping, respectful task and teaching up. During the classes, teachers can differentiate through the content, process, product and learning environment according to the student's readiness, interest and learning profile. Jonassen dan Grabowski (2012) stated that student learning process are difference among each other. It depends on thinking process on what the student is trying to learn. Thinking process are varies among students based on the given tasks, learning traits and learning outcomes. Thus, individual student needs for which teachers may differentiate instruction include readiness, interest and learning profile. Gifted students have difference characteristic and tend to compete with the other student to be the best among them (Bekirogullari & Gur 2011). Beside that their learning style are unique and diverse in understanding mathematical concept. This will indirectly affect their achievement in Mathematics (Leu & Chiu 2015). This characteristic has attracted many researchers, especially educators to understand gifted student to meet their needs and willingness. Furthermore, there are no special education systems for the gifted and talented which causes some of these students never get their needed especially in education and eventually their development will be disturbed and retarded. Malaysia have developed a fully residential school with a special education system for gifted and talented student since 2011(Isman et al. 2012). Students who want to enter the school are required to sit for screening tests i.e. UKM1 test, UKM2 test and UKM3 test besides participating in a camp for the gifted and talented that was organized by PERMATApintar National Center (PpNGC).

Students selected will attend college for five years and need to do some research in science and mathematics. Since all the gifted students who participated in this study have various characteristics, the research has to be conducted to ensure that every student gets an education that suits their needs. Student motivation in mathematics is very important as it will influence the effort of students to learn and understand mathematic generally. Mathematics is a subject that requires fast thinking ability in addition to solve problem by number. There are some studies were conducted about motivation of gifted student in mathematics such as a study about relationship between gender and motivation of gifted student (Preckel et al. 2008), goals and emotions (Hannula 2006), Mobile-Assisted Learning Application (Rex et al. 2017), stakes test achievement (Simzar et al. 2015) and other. Beside that there are some studies were conducted about achievement of gifted student in mathematics such as the effect of homogeneous and heterogeneous grouping of gifted students(Hunt 1996), comparison between gender(Heller & Ziegler 1996; Olszewski-Kubilius et al. 1990; Weiner & Robinson 1986), cluster grouping and specific curriculum(Pierce et al. 2011), advanced geometry and measurement curriculum units (Gavin et al. 2013), mentoring mathematical minds (m3) units(Cho et al. 2015), teachers' instructional practices (Firmender et al. 2014) and other.

No researches were conducted to study about differentiated instruction and relationship between motivation and achievement of gifted student in mathematics. Therefore, the objective of this research is to study the impact of differentiated instruction based on learning profile on the motivation and achievement of gifted student.

Methodology

This study was carried out through the survey method using a set of questionnaires consisting of two parts, namely student demography and student's response toward teaching and learning session using differentiated instruction method. The questionnaire was adapted from Mohd Hasrul's (2017) Motivational Orientation of Differentiated Instruction in English Language Teaching (MoDiELT) (See Appendix). The objective of MoDiELT is to examine students' motivation towards the use of differentiated instruction in teaching English language. Thus, the original questionnaire was adapted to suit for students' motivational orientation of differentiated instruction towards Mathematics teaching and learning. For the purpose of this study, the researcher utilized only one section or element of MoDiELT i.e. learning Profile that has 13 items. Items were rated on a 5-points scale (5=Strongly Disagree, 4=Disagree, 3=Neutral, 2=Agree and 1= Strongly Agree). There are four parts of learning profile that have been studied, namely teacher support, learning activities, sharing ideas and educational environment. The participants in this survey consisted of 235 Gifted Students at Kolej PERMATApintarTM Negara aged 11 to 17 year-old of which 124 of them are boys and the rest are girls. Data were collected in July 2016 after mid-term examination result. Descriptive analysis is used to analyze student perceptions. The question of this perception is using the Likert scale to obtain information about the perception of the students on the use of differentiated instruction method.

There are two part of analysis. The first part is to calculate the mean of average scores for each element studied and to get the percentage of students who choose to strongly disagree, disagree, neutral, agree and strongly agree on the Likert scale which is presented in the questionnaire. The second part is to calculate the validity of Data using Cronbach Alpha. It was analyzed by using IBM SPSS statistics 20 software.

Analysis validity of the result

The consistency of the item in the survey was being determined using Cronbach's alpha statistical factor. The condition of the data either it can be accepted or not is depend on the coefficient of Internal Consistency Cronbach's Alpha. Generally, reliability coefficients of Cronbach's alpha of 0.70 or more are considered acceptable and indicate that the survey element is consistent and acceptable. Table 1 show that the coefficient of the Cronbach's Alpha of two categories items for the survey elements is 0.907. Therefore, data obtained are very reliable in yielding the result for the purpose of the study.

Table 1. Internal Consistency Cronbach's Alpha Coefficient for the survey elements.

Reliability Statistics	
Cronbach's Alpha	N of Items
.907	13

Results and Discussion

The impact of differentiated instruction based on learning profile on the motivation of gifted student based on gender differences

Table 1 shows the score for each element of motivation in learning profile of differentiated instruction method based on gender differences. Based on the table, it shows that most of gifted students were motivated by differentiated instruction approach. They were motivated by the encouragement and support by their teachers. Teachers play an important rule in teaching and learning in the classroom.

Besides that, they were also interested with the learning activities to understand the theory as in differentiated instruction method. They were given the opportunity to share the ideas and opinions to each other during the group discussion that helps them in assessing the theory more deeply and increase their confident in delivering a speech. In addition, it has been encouraging for the students to do the research and be creative in solving mathematical problems. Besides that, they preferred an unobstructed educational environment such as a long period of time for mathematical subjects and adjustable classroom. They were also very interested with the activities during the classes. Most students like to learn lessons through activities. They will not be tired of learning the lessons through activities otherwise it will improve their understanding of what they are learned. Therefore, all of these elements in differentiated instruction such as giving the chance and opportunity for the students to explore the knowledge in open to discussion, adjustable classroom, effective activities and supportive teachers will increase the interest of gifted student toward mathematics. Motivation of male students is always higher than female students. Almost elements of motivations show the motivation of male students is always at a good level of 3 and above. This shows that male students are more motivated with differentiated instruction method.

Elements of motivation	Gender	Mean	Std. Deviation	Std. Error Mean
I do a lot of interesting activities during Mathematics lesson.	Male	3.77	0.844	0.076
	Female	3.56	0.901	0.086
Mathematics activities in the classroom are fun	Male	3.86	0.82	0.074
	Female	3.82	0.865	0.082
In my Mathematics lesson, I always have the chance to give my ideas.	Male	3.89	0.848	0.076
	Female	3.55	0.806	0.077
My teacher is encouraging/supportive	Male	4.57	0.614	0.055
	Female	4.31	0.748	0.071
By the end of the semester, I think my Mathematics will be better.	Male	4.32	0.657	0.059
	Female	4.08	0.788	0.075
I think I have started to use Mathematics language with other people more often.	Male	3.6	0.901	0.081
	Female	3.41	0.878	0.083
I feel I am more inquisitive and talkative now.	Male	3.65	0.797	0.072
	Female	3.68	0.874	0.083
I often wish that the Mathematics period to be longer.	Male	3.57	1.005	0.09
	Female	3.42	0.949	0.09
I often volunteer to do speaking presentations in Mathematics lessons.	Male	3.18	0.929	0.083
	Female	3.01	0.91	0.086
I like Mathematics lesson because I can do whatever I want.	Male	3.48	0.897	0.081
	Female	3.35	0.911	0.086
I like Mathematics lesson because I can suggest	Male	3.32	0.879	0.079

tasks or activities.	Female	3.4	0.887	0.084
I have sample resources to refer to during the Mathematics lesson.	Male	3.9	0.784	0.07
	Female	3.81	0.707	0.067
I always get to work outside of the classroom with my group members.	Male	3.32	0.984	0.088
	Female	3.25	0.939	0.089

Table 1. the score for each element of motivation in learning profile of differentiated instruction method based on gender differences

Table 2 shows that the differences for male and female students on the implementation of differentiated instruction method in mathematics class i.e. sharing ideas and teacher support. There are some questions about the sharing ideas and teacher support such that "In my Mathematics lesson, I always have the chance to give my ideas" and "my teacher is encouraging /supportive". Based on the table, it indicates that the mean score of sharing ideas for male is 3.89 and female is 3.55. When examine the independent sample t-test table, $t(235) = 0.002$, $p < 0.05$. This means that there is a significance difference for the mean score of sharing ideas between male and female students. Beside that the mean score of teacher support for male is 4.57 and female is 4.31. When examine the independent sample t-test table, $t(235) = 0.002$, $p < 0.05$. This means that there is a significance difference for the mean score of teacher support between male and female students. Both of these elements reflect the motivation of gifted students. Thus, it can be concluded that the male students are always motivated rather than female students. They like to share the ideas and very interested in teacher guidance. Female students also motivated to share the ideas and getting guidance from the teachers. However, it is still low compared to the male students' motivation.

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
I do a lot of interesting activities during Mathematics lesson.	Equal variances assumed	1.485	.224	1.893	233	.060	.216	.114	-.009	.440
	Equal variances not assumed			1.886	225.979	.061	.216	.114	-.010	.441
Mathematics activities in the classroom are fun	Equal variances assumed	1.468	.227	.392	233	.696	.043	.110	-.174	.260
	Equal variances not assumed			.391	226.811	.696	.043	.110	-.174	.260
In my Mathematics lesson, I always have the chance to give my ideas.	Equal variances assumed	.121	.728	3.118	233	.002	.338	.108	.124	.551
	Equal variances not assumed			3.127	232.143	.002	.338	.108	.125	.550
My teacher is encouraging/supportive	Equal variances assumed	4.515	.035	2.994	233	.003	.266	.089	.091	.441
	Equal variances not assumed			2.962	213.247	.003	.266	.090	.089	.443
By the end of the semester, I think my Mathematics will be better.	Equal variances assumed	.474	.492	2.561	233	.011	.241	.094	.056	.427
	Equal variances not assumed			2.535	215.061	.012	.241	.095	.054	.429
I think I have started to use Mathematics language with other people more often.	Equal variances assumed	.252	.616	1.645	233	.101	.191	.116	-.038	.421
	Equal variances not assumed			1.648	231.318	.101	.191	.116	-.037	.420
I feel I am more inquisitive and talkative now.	Equal variances assumed	.342	.559	-.289	233	.773	-.031	.109	-.246	.183

Table 2. the differences among male and female students on the implementation of differentiated instruction method in mathematics class.

Age Different

		AGE		
		Pearson Correlation	Sig. (2-tailed)	N
Correlations	I do a lot of interesting activities during Mathematics lesson.	-.250**	.000	235
	Mathematics activities in the classroom are fun	-.244**	.000	235
	In my Mathematics lesson, I always have the chance to give my ideas.	-.058	.374	235
	My teacher is encouraging/supportive	-.137*	.036	235
	By the end of the semester, I think my Mathematics will be better.	-.110	.092	235
	I think I have started to use Mathematics language with other people more often.	-.124	.058	235
	I feel I am more inquisitive and talkative now.	-.138*	.035	235
	I often wish that the Mathematics period to be longer.	-.170**	.009	235
	I often volunteer to do speaking presentations in Mathematics lessons.	-.133*	.042	235
	I like Mathematics lesson because I can do whatever I want.	-.113	.085	235
	I like Mathematics lesson because I can suggest tasks or activities.	-.212**	.001	235
	I have sample resources to refer to during the Mathematics lesson.	-.013	.848	235
	I always get to work outside of the classroom with my group members.	-.089	.175	235

Conclusion

Motivation and achievement of student in mathematics should be given more attention by the teachers at school. Lack of student's motivation can affect the attention of students and finally reduce their performance and achievement in the examination. The right teaching approach should be implemented in order to encourage students exploring the knowledge and built self-confidence in solving the problems. In overall, Differentiated Instruction approach has positive impact on gifted and talented students. The results showed that the gifted student's motivation improved with differentiated instruction. Students have the rights to explore the knowledge and sharing the idea with the facts. As a result, the motivation and achievement of student in mathematics increased. In addition, the activity is one of the elements in differentiated instruction approach. Gifted students tend to learn something through activities. Student motivation increases when the teacher provides appropriate activity in the classroom. However, teachers need to design appropriate activities so that this not only increases student motivation, but also improves student's achievement in examinations.

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