Student's Mathematics Anxiety on the Use of Technology in Mathematics Learning

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Abstract. *This study aim to describe the student's mathematics anxiety on the use of technology in mathematics learning. It is a quantitative descriptive research by involving second year students of Mathematics Education Program in Universitas Islam Riau (UIR) who took Technology-based Mathematics Learning course. They were selected based on saturation sampling. Data were collected through questionnaire, in-depth interview and documentation. The results show the high level of each dimension of mathematics anxiety among students. The average score in each indicator of cognitive, affective, and physiological dimension were high. In addition, interview revealed that most of the students expressed their anxiety in the first lecture and when obtained the task of applying particular software in mathematics learning. It is mainly due to unpreparedness and lack of knowledge about the application of software. Based on the results, it can be concluded that the level of students' mathematics anxiety is relatively high.*

Keywords: *Mathematics anxiety, Technology-based, Mathematics learning,*

Introduction

The students perceive mathematics as a difficult subject. Cockroft (2014) argued that students grew up without enjoying mathematics at all. It is deemed as an unpleasant, incomprehensible with difficult tasks or problems, and not everyone is good at it. Such feelings may trigger certain nervousness or called as anxiety. Mathematics anxiety is an uncomfortable feeling that arises when facing mathematics problems. It is linked to fears and worries in dealing with specific situations related to mathematics (Ma, 2003; D'Ailly & Arth *in* Khatoon & Mahmood, 2010). Moreover, it adversely affects the student achievement (Meece, 1981; Sherman & Wither, 2003; Karimi & Venkatesan, 2009; Khatoon & Mahmood, 2010; Erdogan et al., 2011). It occurs since such an anxiety leads to the complexity in learning and applying the concept of mathematics (Gleason, 2008).

Lyons and Beylock (2012) asserted that mathematics anxiety has similar symptoms with those suffered by the body for other causes. It is because of the posterior insula, a part of the brain that perceives pain in the body becomes an active part of the brain on the subject with mathematics anxiety, particularly subjects with high mathematics anxiety. Khatoon and Mahmood (2010) disclosed that mathematics anxiety is found in students from primary to higher education. Furthermore, the anxiety level increases in line with the increase in educational level (Jackson & Leffingwell, 1999; Renga & Dalla *in* Herman, 2005). The higher level of mathematics anxiety occurs as the complexity of the materials. Consequently, students should be motivated to have higher sense of confidence in order to solve every problem in mathematics learning.

In fact, mathematics anxiety may lead the candidate of mathematics teachers to be passive in developing competence and eluding any activities related with their expertise. Such an anxiety is actually can be examined from the cognitive, affective and physiological

dimension. Olaniyan and Salman (2015) reported that students with mathematics anxiety have a propensity to claim that mathematics is a difficult course, dislike mathematics, refuse to do their tasks, even skip the class. It certainly can affect their success in math exams. Choppin (2011) divulged that teachers with mathematics anxiety mainly rely on textbook-based teaching that emphasizes on basic skills and minimal discussion activities. In addition, they are less skillful in applying various strategies of mathematics instructional learning in the classroom (Swars, Daane, & Giesen, 2007). Alzaber and Amelia (2015) affirmed the significant relationship between student's GPA (learning outcomes) and mathematics anxiety.

The use of technology in learning provides positive contribution for students. Istikomah and Sakinah (2013) suggested that the integration of Software Geometers Sketchpad facilitates students to understand a concept. Nevertheless, the use of technology in higher education inadequately diminished students' mathematics anxiety since they are more worried about not understanding the concept of mathematics, instead of applying such technology. It confirms Irfan (2015), who reported students who are common with gadgets as a learning medium still have high anxiety in learning mathematics. Thus, it can be concluded that gadgets do not significantly contribute to the level of mathematics anxiety. Based on the background, the problem in this study is: how is the student's mathematics anxiety on the use of technology in mathematics learning? Furthermore, the aim of this study is to describe the student's mathematics anxiety on the use of technology in mathematics learning.

Research Methods

This study is a quantitative descriptive study conducted in April 2017 at Mathematics Education Program in Universitas Islam Riau. The subjects of this study were the second year students of Mathematics Education Program who took Technology-based Mathematics course. It involved 40 respondents selected by saturation sampling. Data collection techniques included questionnaire and interview. Questionnaire consisted of statements related to the main sources of mathematics anxiety. It was adopted from Suharyadi (2003) and had been validated and checked for reliability. The examples of statements in questionnaire are presented in Appendix A. The indicators are presented in Table 1 as follows.

Table 1. Indicators of mathematics anxiety

Dimension	Indicator
Cognitive	Self-ability
	Self-confidence
	Difficult in concentration
	Fear of failure
Affective	Nervous
	Unpleasant
	Restless
Physiological	Nausea
	Excessive sweating
	Rapid heartbeat
	Dizziness

In this study, the questionnaire was completed using the Likert-scale (Mardapi, 2008) with four answer choices, namely: Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (DS). Prior the implementation of instrument, a limited test was

conducted to examine the validity of the questionnaire, by employing Product Moment formula. In this study, the use of technology in mathematics learning refers to the use and operation of Geogebra and Goemeters Sketchpad. Furthermore, interview was performed to determine the response of students toward the use of Geogebra and Goemeters Sketchpad. It was conducted with structured interview sheets in order to make the interview more focused.

Data analysis technique was quantitative data analysis. It was done descriptively based on the results of questionnaire and interview. Descriptive statistical analysis was to describe data about mathematics anxiety among students in the technology-based learning. Data analysis was analyzed manually by using SPSS 21 Software. In this study, the levels of mathematics anxiety were classified into high, moderate and low category. The grouping of mathematics anxiety level is determined based on the distribution of respondent' answers (Azwar, 2012: 109). In this study, the criteria of the levels of mathematics anxiety are presented in Table 2.

Table 2. Category of Student's Anxiety

Score	Category
$X \leq (\mu - 2.0\sigma)$	Low
$(\mu - 2.0\sigma) < X \leq (\mu + 2.0\sigma)$	Moderate
$X > (\mu + 2.0\sigma)$	High

Description:
μ = Mean of student's anxiety obtained from research subjects
σ = Standard deviation

Based on previous criteria, derivative criteria were obtained as follows:

Table 3. Category of Student's Anxiety

Score	Category
$X \leq 62.32$	Low
$62.32 < X \leq 99.08$	Moderate
$X > 99.08$	High

Results and Discussion

Research activities were conducted after the completion of learning process, which was by distributing the questionnaires to second year students of Mathematics Education Program, UIR. Questionnaire was intended to determine the anxiety level of students on the use of technology, i.e., Geogebra and Geometers Sketchpad, in mathematics learning. The results are presented in Table 4 below.

Table 4. The Student's Mathematics Anxiety Profile

Category	Total (students)	Percentage (%)
High	37	92,5
Moderate	2	5
Low	1	2,5

Table 4 demonstrates that almost all of the students' mathematics anxiety level is high. It should be a serious concern despite of the students' academic ability. Based on the

results of the interview, most students expressed severe anxiety at the first lecture meeting and when there is software-related task. They stated that their anxiety is due to unpreparedness and lack of knowledge about the application of some software in mathematics learning. Furthermore, the student's mathematics anxiety is examined based on the indicators for each dimension of mathematics anxiety as presented as follows.

Cognitive Dimension

There are four indicators on the cognitive dimensions of mathematics anxiety. The results of questionnaire for each indicator are presented in Table 5.

Table 5. The Cognitive Dimension of Mathematics Anxiety

No.	Indicator	Score	Mean per Indicator	Category	Mean Total	Category
1.	Self-ability	461	115.25	High		
2.	Self-confidence	217	108.5	High		
3.	Difficult in concentration	77	77	Moderate	111.22	High
4.	Fear of failure	246	123	High		

Based on Table 5, almost all indicators of cognitive dimension of mathematics anxiety are included in the high category. It shows that students are very anxious in solving problems on the use of technology in mathematics learning.

Affective Dimension

In accordance with the affective dimension, there are three indicators of mathematics anxiety. Based on the results of questionnaire, data recapitulation of each indicator is presented in Table 6.

Table 6. The Affective Dimension of Mathematics Anxiety

No.	Indicator	Score	Mean per Item	Category	Mean Total	Category
1.	Nervous	236	118	High		
2.	Unpleasant	496	124.25	High		
3.	Restless	241	120.5	High	120.90	High
4.	Nausea	357	119	High		

Table 6 demonstrates all indicators on the affective dimension indicate the student's mathematics anxiety is included in the high category. It means that the students are very anxious in following the learning process and solving problems given by lecturers related with the use of technology in mathematics learning.

Physiological Dimension

There are three indicators on the physiological dimensions of mathematics anxiety among students. The results of questionnaire of each indicator of physiological dimension are presented in Table 7. Data in Table 7 shows the entire indicators on the physiological dimension indicate the student's mathematics anxiety is classified into the high category. It means that the students are very anxious in following the learning process and solving problems given by lecturers related with the use of technology in mathematics learning.

Table 7. The Physiological Dimensions of Mathematics Anxiety

No.	Indicator	Score	Mean Item	Category	Mean Total	Category
1.	Excessive sweating	227	113.5	High		
2.	Rapid heartbeat	209	104.5	High	112.83	High
3.	Dizziness	241	120.5	High		

The findings of this study indicate that the students have a high anxiety level in all dimension in the use of technology in the course. The result of interview showed that most students expressed severe anxiety during the first lecture meeting and when receiving the task related with application of some software. Here, anxiety refers to the curiosity of how the technology-based mathematics learning system, the lack of self-confidence to complete the task, the fear in presenting the paper directly using the software, and the fear of forgetting the procedure in implementing the software. Nevertheless, such situations could be eliminated after the guidance and direction from the supervisor.

Under the pressure circumstance, the capacity of students in solving the problems demonstrates their actual student's ability. It will be easier for those who are calm and have good ability in solving the problems. Conversely, students with high anxiety level will face difficulty in solving problems. They need to control their anxiety so as not to interfere with their concentration in solving the problems. Uncontrollable anxiety will have diverse impacts on the cognitive, affective, and psychological dimension. The noticeable symptoms are the changes in student's attitudes, i.e., nervous, panic, and nausea.

The level of mathematics anxiety that can be categorized as "high" can be minimized by paying attention to the indicators with high score. Lecturers have a capacity to direct the student's point of view by encouraging their self-confidence. Lecturers can show that the course is fun and provide guidance on a regular basis. In addition, they should start the course with motivation about the need for understanding and knowledge of materials. It is in accordance with Wilson (2009) who suggested that a good understanding and knowledge of mathematics, as well as high confidence in one's competence is a basic need for a teacher. In addition, the participation of other parties is also very helpful in lessening mathematics anxiety (Saputra, 2014). It is expected that in this strategy will reduce student's mathematics anxiety. Why does mathematics anxiety need special attention? Because such an anxiety can affect other learning abilities, especially learning achievement (Zakaria & Nordin, 2008).

Conclusion

The findings of this study show the high level of mathematics anxiety of the students of Mathematic Education Program, UIR, particularly in the use of technology in mathematics learning. The indicators include the cognitive, affective, and physiological dimension, in which both of them can be classified into high anxiety level. Anxiety particularly emerges at the first lecture meeting and when there is task that requires the application of some software.

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APENDIX A

Mathematics Anxiety Questionnaire

Answer the statements based on your experience and perception. Put an X in your answer choice:

SA = Strongly Agree,   A = Agree,   SD = Disagree,   SD = Strongly Disagree

No.	Statement	SA	A	D	SD
1	I am not nervous when my Mathematic lecturer approaches me.				
2	I get stressed when there is a math quiz on the next day.				
3	It is difficult for me to concentrate on using technology in mathematics learning.				
4	I blank out identifying procedures in the use of technology in learning media				
5	I am relieved when I finish my presentation with technology learning media				
6	I am unpleasant when the lecturer gives a task that requires Geogebra.				
7	I enjoy drawing constructs with Geogebra.				
8	I am less interested in Math class since the lecturer explicates too fast and less understandable.				
9	I am panic every time the lecturer asks me to solve a problem using learning media or software.				
10	I am convinced that I am capable to solve the problems using Geogebra.				
11	I have nausea during math quiz.				
12	I am prepared when the lecturer asks over an assignment.				
13	I am confident that I win the competition of the best score.				
14	If I am instructed to solve problem in front of the class using learning media or *software*, I never have excessive sweating.				
15	Mathematics is such a difficult course.				
16	I have no dizziness even when the problem requires technology-based learning media.				
17	I love Math since it explores my intellectuality.				
18	I am nervous every time the class involves learning media.				
19	If I am instructed to solve a problem in front of the class, I am not sure I can do it appropriately.				
20	Despite I have nausea, I will do my best to complete the test.				
21	I am panic when the lecturer asks me, "Have you understood it?"				
22	I have excessive sweating when I cannot answer the lecturer's question.				
23	Technology-based Mathematics learning is boring.				
24	It is easy for me to recall steps in Geogebra.				
25	I less understand the material, hence I ask the lecturer about it.				
26	If I have not understood a material, I will directly ask about it.				

APENDIX B

Interview Questions on the Student's Mathematics Anxiety

1. What encourage you for taking technology-based mathematics?
2. Are you stressed when working on a problem that requires software?
3. Are you convinced or skeptical in working on problems and tasks assigned to this course?
4. Are you nervous during your presentation?
5. Do you have dizziness or nausea during a quiz?
6. Do you find challenges in this course? If so, what kind of challenges do you find?
7. Have you ever felt restless while studying this course?
8. What do you feel about applying various math software?
9. In applying various software, do you find any constraints? What is it/are they?
10. What do you feel when/during learning material with Geogebra?
11. Are you nervous when the lecturer asks, "Have you understood the material?