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## IT - Based Mathematics Learning Module To Decrease Students' Mathematical Anxiety

### Modul Pembelajaran Matematika Berbasis IT untuk Mengurangi Kecemasan Matematika Siswa

Endang Istikomah<sup>1</sup>, Sari Herlina<sup>2</sup>, Nurmaliza<sup>3</sup>

<sup>1</sup>Riau Islamic University, Jl. Kaharudin Nasution No. 113, Pekanbaru-Riau,  
[endangistikomah@edu.uir.ac.id](mailto:endangistikomah@edu.uir.ac.id)

<sup>2</sup>Riau Islamic University, Jl. Kaharudin Nasution No. 113, Pekanbaru-Riau,  
[sariherlina99@edu.uir.ac.id](mailto:sariherlina99@edu.uir.ac.id)

<sup>3</sup>Riau Islamic University, Jl. Kaharudin Nasution No. 113, Pekanbaru-Riau,  
[nurmaliza@student.uir.ac.id](mailto:nurmaliza@student.uir.ac.id)

#### ABSTRAK

Tujuan penelitian ini adalah mengetahui tingkat kecemasan matematis dan hasil belajar mahasiswa setelah menggunakan modul Pembelajaran Matematika Berbasis *Information Technology* (PMB IT). Jenis penelitian ini yaitu *Pra-Eksperimen* dengan desain *One Group Pretest-Posttest*. Instrumen yang digunakan adalah lembar angket kecemasan matematis. Hasil belajar mahasiswa dapat diketahui melalui soal tes berbentuk Essay yang diberikan pada saat Ujian Akhir Semester (UAS). Teknik analisis data yang digunakan adalah analisis data kualitatif dan kuantitatif. Untuk pengolahan data, penulis menggunakan Software SPSS 16 dan *Microsoft Excell* 2013. Data-data kecemasan matematika mahasiswa yang diperoleh dianalisis secara deskriptif dan data hasil belajar mahasiswa diolah menggunakan uji t. Hasil penelitian diperoleh bahwa tingkat kecemasan matematis mahasiswa setelah menggunakan Modul PMB IT menurun dari rata-rata 85,05 menjadi 72,5. Tingkat kecemasan matematis mahasiswa setelah menggunakan modul adalah berkategori rendah, sedang dan tinggi, berturut-turut 40,5%, 56,8% dan 2,7% dan peningkatan hasil belajar matematika mahasiswa dilihat dari hasil uji-t pada satu sampel, diperoleh nilai sig. =  $0.029 < \alpha = 0,05$ , artinya  $H_0$  ditolak. Jadi dapat disimpulkan bahwa penerapan modul PMB IT dapat menurunkan kecemasan matematis mahasiswa.

**Kata Kunci :** Modul, PMB IT, Kecemasan Matematika, Hasil Belajar.

#### ABSTRACT

The purpose of this study was to determine the level of Students' mathematical anxiety and students' learning achievements after using the Information Technology-Based Mathematics Learning (PMB IT) module. The type of this research is Pre-Experiment with *One Group Pretest-Posttest* design. The instrument used was a student mathematical anxiety questionnaire. Student learning outcomes from Essay Test given during the Semester Final Examination (UAS). The data analysis technique used is qualitative and quantitative data analysis. For data processing, The author has used SPSS 16 software and Microsoft Excel 2013. The students' mathematical anxiety data obtained were analyzed descriptively and the students' learning achievements data were processed using t-test. The results showed that the level of students' mathematics anxiety after using the PMB IT module decreased from an average of 85.05 to 72.5. The level of students' mathematical anxiety after using the module was in the low, medium and high categories, respectively 40.5%, 56.8% and 2.7% and the increase in students' mathematics learning outcomes was seen from the t-test results in one sample, the score was obtained sig. =  $0.029 < \alpha = 0.05$ , it means that  $H_0$  is rejected. So, it can be concluded that the application of the PMB IT module can reduce students' mathematical anxiety.

**Keywords :** Module, PMB IT, Mathematics Anxiety, Learning Achievements.

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## **PRELIMINARY**

The rapid development of technology has penetrated all aspects of human life, including education. Technology in education can be used as a tool to improve the quality of education. As (Yusril, 2019) stated that overcoming problems related to the world of education can be done by utilizing information technology in the field of education. Today, the use of Information Technology (IT) in the classroom has been developed as an effort to improve the quality of education. Traditional learning methods are slowly being abandoned and replaced with modern learning methods. The emergence of new learning methods will facilitate students and teachers in the learning process. IT can be a medium for presenting ideas, notions, and learning materials (Puspita Sari & Setiawan, 2018). The use of IT is one of the important factors that enable the acceleration of the transformation of knowledge to students. To facilitate the implementation of learning, some parts of the learning elements have received a touch of information technology media. In learning, there are many challenges in using IT, which creates its own anxiety for students. This is in accordance with the results of the study (Istikomah & Wahyuni, 2018) the level of students' mathematics anxiety in using IT in learning mathematics is still relatively high.

Students' mathematics anxiety is a feeling of discomfort, fear, nervousness that interferes with a concentration in solving various problems of daily life and in the learning process (Ranjan, 2013). Furthermore (Halgin & Whitbourne, 2010) revealed that anxiety is a future-oriented and general attitude that refers to a condition when individuals feel anxiety, tension, and uncontrollable discomfort about the possibility of bad things that will happen. Student math anxiety has a positive or negative impact. A positive impact occurs when anxiety appears at a mild to a moderate level and provides the strength to do something good, helping individuals build their defenses so that the anxiety they feel can be reduced little by little (Leonard & Supardi, 2009). In line with that (Young, 2010) said that someone who has anxiety but is still at a low level, about learning mathematics, becomes a positive thing. This is because anxiety leads a person to do something to prevent

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the challenge or alleviate its consequences, for example, is to prepare for an exam by studying hard (Sadock & Sadock, 2007). Meanwhile, the negative impact of math anxiety is if the emergence of anxiety at a high level and physical symptoms arise and can hurt learning achievements (Leonard & Supardi, 2009). Anxiety will arise if there is an uncomfortable feeling about the environment and bad study habits (Ramadhani & Setyaningrum, 2018). The habit of students studying only when they are given assignments, before exams and the absence of a special study schedule will have an impact on the anxiety experienced. Anxiety levels can reduce motivation and academic achievement. The results of research conducted by Zeidner and also the results of research by Wolf, Smith, and Birnbaum (Prawitasari, 2012) show that the main problem of students with high levels of anxiety is that students do not master the subject matter at the beginning. As a result, students also experience difficulties when studying the next material and a further consequence is that students experience high levels of anxiety when facing exams. Based on the results of research (Istiatoro, 2018) that health disorders cause students' academic anxiety in the moderate category. Furthermore, the results of research (Rudiansyah, 2016) show that student anxiety in learning will hurt student learning and mental achievement. As for certain efforts to reduce student anxiety, namely the learning strategies and media used should be student-centered, materials, and questions of moderate difficulty, using a humanistic approach in classroom management, and developing a fun assessment system.

The use of the module is one of the efforts to reduce the level of student anxiety while increasing learning motivation. The utilization of PMB IT is one example of a solution to overcome the saturation of the mathematics learning system so far (Istikomah, & Herlina, 2019). The application of IT certainly does not stand alone but can also be combined by modules. In addition, the use of appropriate and varied media will have positive impacts, including learning becoming more effective and interesting, can explain something complex, accelerating long processes, presenting rare events, and instilling the right basic concepts (Rahmayanti, 2015). The level of students' mathematics anxiety in using IT in learning mathematics is still relatively high (Istikomah, & Wahyuni, 2018). If students' math anxiety is reduced, of course, student learning achievements will also increase. This is by the results of research (Vitasari, et.al, 2010) which states that the level of anxiety has a significant relationship with the achievement index. Furthermore, the smaller the results obtained by students, the higher the level of anxiety experienced by students and vice versa (Anggreini, 2010; Leonard & Supardi, 2009). Based on the

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background exposure, the purpose of this study was to determine the level of students' mathematics anxiety before and after learning mathematics using the module in the PMB IT course.

## METHODS

The design used in this study is One Group Pretest-Posttest (Setyosari, 2010), where the sample group is given treatment (independent variable) but the sample's Mathematical knowledge is known first through the pretest. After the treatment was given, the results of the study were observed and given. The research design can be seen as follows:

**Table 1. Research Design**

<i>Posttest Group</i>	<i>Pretest</i>	<i>Treatment</i>	<i>Posttest</i>
Experiment Class	T1	X	T2

(Sugiyono, 2018)

Information :

T1 = Initial Test before Treatment (Pretest)

T2 = Final Test after Treatment (Posttest)

X = Group with IT-based Mathematics Learning Module

The population in this study were students of mathematics education in the fourth semester of the 2019/2020 academic year with a total of 37 students. Where the entire population is sampled in this study is called the total sample (Sugiyono, 2018). The selection was made because there was only one class that took PMB IT courses. This sample selection is called the total sample.

The level of students' mathematical anxiety was obtained using a non-test instrument in the form of a students' mathematical anxiety questionnaire which was adapted from Suharyadi (2003) and has been re-validated in a research which conducted by (Istikomah, & Wahyuni, 2018; Satriyani, 2016). Questionnaires are given before and after learning using the module. Meanwhile, student learning achievements can be obtained during the UAS exam by filling out essay questions that have been made by the author according to the material that has been studied.

The data analysis techniques in this research are qualitative and quantitative. Students' mathematics anxiety data were analyzed descriptively. In processing the data, have used SPSS 16 software and Microsoft Excel 2013. After the data is processed, the researcher takes a percentage to determine the level of students' mathematics anxiety. The

calculation is done by scoring each choice of each student's statement of learning anxiety towards mathematics which is determined based on the distribution of respondents' answers (students) or in other words determining the scale value with a normal deviation (Saifuddin, 2012). The following are the criteria for the category of math anxiety:

**Table 2. Categories of Student Anxiety**

Score	Category
$X \leq (\mu - 2,0\sigma)$	Low
$(\mu - 2,0\sigma) < X \leq (\mu + 2,0\sigma)$	Medium
$X > (\mu + 2,0\sigma)$	High

Information:

$\mu$  = Average student anxiety obtained from research subjects

$\sigma$  = standard deviation

Based on the students' criteria above, so that the Mathematics Anxiety Criteria in this study were obtained:

**Table 3. Categories of Student Anxiety**

Score	Category
$X \leq 69,2$	Low
$69,2 < X \leq 92,3$	Medium
$X > 92,3$	High

Quantitative data is learning achievement data. In this study, the data is assumed to be normally distributed because the data is more than 30 and does not perform a homogeneity test because it is only carried out in one group. Furthermore, the data is processed using Inferential Statistics One-Sample T-Test. This technique is used to determine the average value of student achievement in PMB IT after using the PMB IT module.

## RESULTS AND DISCUSSION

### Student Mathematics Anxiety Analysis

This Student Mathematics Anxiety Analysis aims to see how students' mathematical anxiety before and after using the PMB IT Module. The anxiety analysis can be seen from the level of anxiety which is presented in Table 4 below:

**Table 4. Description of Students' Mathematics Anxiety Levels**

Category	Before		After	
	Total	Percentage	Total	Percentage
<b>Low</b>	2	5.4	15	40.5
<b>Medium</b>	24	64.9	21	56.8
<b>High</b>	11	29.7	1	2.7
	<b>37</b>	<b>100</b>	<b>37</b>	<b>100</b>

The data in Table 4 above was obtained using an anxiety questionnaire, it can be seen that the level of anxiety of fourth-semester students is still in the medium category. However, before using the PMB IT module, the percentage of students' mathematics anxiety level in the high category was still higher. Even though after using the PMB IT module the level of mathematics anxiety for high category students was reduced, students admitted that there was still anxiety in learning.

**Table 5. Student Mathematics Anxiety Data**

No	Data	Before	After	Number of Students
1	Score	3110	2681	
2	Average	84.05	72.5	
3	Min	65	58	37
4	Max	98	93	
5	SD	8.27	8.8	

Furthermore, the data in Table 5 explains that the mean of the anxiety level scores decreased but the standard deviation value increased. It means that there is a large spread of the students' mathematical anxiety data. It means, there is still a gap between students with high anxiety and students with low anxiety

From the research data, it has been explained that the level of students' mathematics anxiety after using the PMB IT module decreased. Although there are still people who experience anxiety, the anxiety is still relatively low. This is in line with the results of a study (Supriatna, & Zulkarnaen, 2019) which states that a lack of self-confidence in a person will cause anxiety. Apart from that, they lack confidence in their ability to learn the material and are confused by the transition from offline to online learning systems. The use of modules is very helpful in their learning process, but they still need face-to-face discussions and they reveal that they are not used to learning online. So the module is not the only reason that affects their anxiety level but the module adds to their reason not to worry about learning in any situation. (Denhere, 2015) suggested implementing intervention strategies could also help reduce math anxiety. The results of this study are by the results of research (Denhere, 2015; Olaniyan, O. M., 2015) which state that many factors can cause the level of mathematical anxiety. Even this module encourages them to realize that now is the time to enter the development of IT.

Low and moderate levels of anxiety can be adaptive, as they serve as a warning that the person must prepare for future events. That emotional response can help to initiate and sustain a learning effort. Conversely, high levels of anxiety will reduce ability by disrupting concentration and performance. This is in line with the opinion (Priyanto, 2017)

that anxiety has a positive value, as long as the intensity is not so strong because mild anxiety can be a motivation. Therefore, it is necessary to manage anxiety for 37 students who experience a moderate level of math anxiety so that student learning achievement experiences better development.

### **Analysis of Learning Results**

In the description, the results of the initial ability of students' mathematics learning achievements have an average of 7.8, while the results after the implementation of the PMB IT are presented in table 6. below:

**Table 6. Student Mathematics Learning Achievements**

No	Data	students	Score
1	Highest Score		98
2	Lowest Score	37	60
3	Average Learning Achievements		81.59
4	Standard Deviation		9,633

Based on Table 6, above student learning achievements shows an increase from before and after using the PMB IT module. Even though there were students who got the lowest score at 60, judging from the average their scores were already above 80. The standard deviation shows that the data distribution is still wide. This is because learning achievements are also influenced by student anxiety in both studying and exams.

Inferential analysis in this study uses data gain or improvement in student mathematics learning achievements. The data is processed using SPSS 21. The results of the data processing are described as follows:

**Table 7. Statistics of Improving Mathematics Learning Achievements**

	N	mean	Std. Deviation	Std. Error Mean
Mat Learning Achievements	37	81.59	9,633	1,584

The data in Table 7 above, explains that the average increase in learning achievements has increased, even though the data distribution is still wide. This indicates that there is still a gap between high-ability students and low-ability students.

Then to see if there is an increase in mathematics learning achievements in this study, the data processing uses one-sample t-test analysis. The statistical hypotheses proposed are as follows:

$H_0$  : There is no increase in student learning achievements using the PMB IT Module

$H_1$  : There is an increase in student learning achievements using the PMB IT Module

The basis for decision making on the one-sample t-test is:

If the value of sig. (2 – tailed) < 0.05 , then  $H_0$  is rejected

If the value of sig. (2 – tailed) > 0.05, then  $H_0$  is accepted

The results of data processing to increase student achievements can be seen in the following table:

**Table 8. Results of Data Processing Improving Student Learning Achievements**

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Mat Learning Achievements	2.270	36	.029	3.595	.38	6.81

Based on Table 8, the results of the t-test on one sample obtained the value of sig. = 0.029, it means that it is rejected and accepted. This means that there is an increase in students' mathematics learning achievements using the PMB IT Module. Thus, even though the average results have increased and the standard deviation is still high, the PMB IT module has been able to improve students' mathematics learning achievements.  $\alpha = 0,05 H_0 H_1$

Descriptively the initial ability of students in PMB IT courses is at a value of 7.8. After the application, the student's average score was 81.59. But the distribution of the data is still wide. This is because students' abilities are different. This result is reinforced from the results of inferential processing which shows that the range is wide between students with low and high abilities.

However, the increase in student learning achievements in PMB IT courses is due to the use of learning modules. This research is in line with the results of research (Ratna Dewi & Abdullah, 2020) which states that Learning using modules can improve results. The modules used have been arranged based on the mathematics education curriculum, students' prior knowledge from the results of the initial test so that in the sub-concepts that have many misconceptions, students have been given directions to straighten out students' misconceptions. This is also by the results of the study (Yusril, 2019) Modules that are by the curriculum can improve learning achievements. Furthermore, the application of learning modules can improve student cognitive learning achievements (Aryani, 2017). The module used is also equipped with clear, structured colored pictures, so that it attracts students' interest in reading. In addition, this module is designed according to how IT learning applications are used. The steps start from downloading, installing to how to use it, but some usage steps are intentionally not shown. This is to provoke students' creativity in perfecting the steps for their use independently.

## CONCLUSION

Based on the results and discussion of the research described previously, it can be concluded that the level of students' mathematics anxiety after using the PMB IT module decreased by an average of 11.55. While the level of students' mathematics anxiety after using the module in the low, medium, and high categories, respectively, was 40.5%, 56.8%, and 2.7%. Furthermore, there is an increase in student mathematics learning achievements using the PMB IT Module with sig. 0.029 and a mean of 81.59.

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