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Learning difficulties of mathematic students on real analysis courses with an online system

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Abstract: The aim of this research to describe the learning difficulties of Mathematic Student on Real Analysis with an Online System. The results of this study expected to be considered making policies to overcome learning difficulties. This research used a descriptive method with a qualitative approach. The researcher used questioner and interview to collect the data. The result of this research showed that the learning difficulties of Mathematic Student on Real Analysis with an Online System were influenced by two factors, they are an internal factor (from the students themselves) and an external factor (from outside of students). The first internal factor that causes learning difficulties is the interesting aspect with a percentage of 64.05% in quite hinder category, and this is because the student chooses real analysis learning, which is actually done face to face. The second internal factor is the motivation aspect, with a percentage of 70.71% in quite hinder category. This is because the student lacks the effort to learn real analysis. The third and fourth internal factors are the talent aspect with a percentage of 50.71% in a hinder category and the philosophical aspect with a percentage of 53.21% in a hinder category. This is because the student assumes that real analysis difficult subjects because the material is in the form of theorems and proofs. The first external factor that caused the learning difficulties is the infrastructure from the family, with a percentage of 64.64% in quite hinder category. This is because students don't have the complete infrastructure to support online learning. The second external factor is the lecturer quality aspect, with a percentage of 71.43% in quite hinder category. This is caused by the speed lecturer delivering learning material. The third external factor is the lecturers' learning method aspect, with a percentage of 58.92% in the hinder category. This is because, in learning, lecturers only use WhatsApp. The fourth external factor is the university facilities aspect, with a percentage of 59.29% in the hinder category. This is because subsidy pulse/quota given to students only a hundred thousand and must be used for 4-5 months of online learning.

Keywords: Learning Difficulties; Online Learning; Real Analysis

INTRODUCTION

Covid-19 pandemic is a tragic disaster for all inhabitants of the earth. All segments of life on earth are disturbed, without exception education. Many countries have decided to close schools, colleges, and universities, including Indonesia (Aji, 2020: 396). Excerpted from Upoalkpajor (2020: 25), *the Covid-19* epidemic has affected education globally, leading to closures of schools, colleges, and universities. Indonesia as one of the countries affected by the *Covid-19* pandemic through a circulated letter from the ministry of education and culture (*Kemendikbud*) Directorate of Higher Education No.1 the year 2020 about prevention of

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spread *Corona Virus Disease (covid-19)* in university, *Kemendikbud* provides instructions for universities to conduct distance learning and advise students to study from home (Firman, 2020:81). Government advice to stay at home dan physical, and social distancing must be followed by changing the face-to-face learning mode to online (Khasanah 2020: 41).

One of the study programs at Veteran Bangun Nusantara Sukoharjo University that also implements online/*daring* learning is Mathematics Study Program. All academic activities in the Mathematic Study Program are implemented by a long-distance system, including a lecture system that was initially carried out face-to-face into online learning by utilizing digital applications such as *Zoom Cloud Meeting, SPADA,* and *Whatsapp*. One of the courses that apply to learn with an online system by utilizing *Whatsapp* application as a means of learning Real Analysis.

Real analysis is a mathematics subject that is quite strict in applying the deductive-axiomatic system. The material content in Real Analysis is abstract, theoretical, and in-depth, which are composed of elements in the form of properties, definitions, principles, axioms, postulates, and theorems (Junizon, 2019: 44). Real Analysis courses are given to students with the hope of equipping students in terms of analytical abilities, logical and systematic thinking. Provision with ability, it is hoped that students can solve factual problems, especially in terms of proving a proposition or theorem that will greatly support learning activities when the students become an instructor (teacher). In following the course of Real Analysis, the students are required to always have good learning readiness in addition to requiring high reasoning and logical power (Sucipto dan Mauliddin, 2016: 198). However, not a few were also found to have learning difficulties experienced by students when receiving lecture material that they obtained unsatisfactory results (Suyedi dan Idrus, 2019: 121).

Based on a survey that was filled in by 21 Mathematic students taking analysis Real courses in the even semester in the academic year 2019/2020, the result is that 57.1% of students are less interested in taking real analysis learning with an online system, 71.4% students have problems with internet signals when participating in real analysis learning with an online system, 57.1% students do not get an understanding of the learning material which is conduct with an online system, 95.2% students are supposed that real analysis is a difficult subject.

In the midst of learning difficulties and unsatisfactory learning outcomes in real analysis, real analysis courses must be given to students. According to Harini et al. (2014: 945), the reasons for the importance of real analysis courses for students in Mathematics Program and Mathematics Education Courses are as follows:

1. Real analysis (along with algebraic structures/abstract algebra) is a marker that distinguishes Engineering students, Physics, Computer Science, and others. Courses outside Mathematics Program and Mathematics Education study calculus, geometry, numerical methods, differential equations but do not study real analysis.
2. Mathematics is currently built on the axiomatic system. Real analysis is a course that can present this axiomatic system.

3. Real analysis trains students to think structured and rational deductively. This is reflected in the problems posed, which are mostly authentication.
4. For mathematic students they must be trained to prove their mathematical competence, whether proposed by the government, NCTM, and others require ability in reasoning and proof where the ability in reasoning and proof is taught in real analysis course.

Research on learning difficulties with real analysis has previously been done by Yantina (2013), which found that provide factors for learning difficulties in the real analysis was internal factors which included low interest in learning and lack of motivation also disruption of concentration when attending lectures, while external factors that cause learning difficulties include lecturer factor, infrastructure, family economy, time and atmosphere of conducting lectures. The similarities between research conducted by researchers and research conducted by Yantina (2013) is that they both research about the difficulties of learning real analysis. At the same time, the difference in research lies in the research subject, data collection, and conditions in the field where Yantina (2013) research is conducted in face-to-face lecture condition, while the researchers' research was conduct during *the Covid-19* pandemic, which requires lecturers to be done online the application or digital platform.

Considering the importance of real analysis courses given to students, especially Mathematics students and Mathematics Education, then research about the analysis of learning difficulties of mathematic students on real analysis must be done again, especially in the midst of online learning conditions, which of course, creates difficulties in learning. This research aims to determine the causes of difficulties experienced by students in learning real analysis online so that efforts to help overcome learning difficulties can be made immediately. If difficulties in learning real analysis can be minimized, the learning objectives can be maximized and optimal.

METHOD

This research is qualitative descriptive because it is intended to describe the learning difficulties of Mathematic Students on real analysis with an online system. This research was conducted in the even semester in the academic year 2019/2020. The subjects in this research were Mathematic Students at Veteran Bangun Nusantara Sukoharjo University. They took real analysis courses in the even semester in the academic year 2019/2020 with 35 students.

Data collection techniques used questioner and interviews. Questioners are used to getting data related to learning difficulties of mathematic students on real analysis with an online system. The learning difficulties questioner is presented in the form of a *Likert* scale with answer choices *Sangat Setuju (SS)*, *Setuju (S)*, *Tidak Setuju (TS),* and *Sangat Tidak Setuju (STS)*. The learning difficulty questioner consists of 23 statements that appropriate with indicator and is given online to students through *the platform Google Form.* The questioner in this research refers to the learning difficulty grid according to Syahrir et al. (2013: 95-96) and adjusted to the conditions that occur right now. Then the learning difficulty grid is used as follows:

Table 1. Learning Difficulty Questioner Grid

No	Factor	Aspect	Indicator
1.	Internal Factor	a. Interest	➢ Interest in learning real analysis with an online system
	1.1 Student		➢ Attitude towards in learning real analysis with an online system
		b. motivation	➢ Attention to learning real analysis with an online system
			➢ The effort to learn real analysis
		c. talent	➢ Understanding of real analysis with an online system
			➢ The ability to solve real analysis questions
		d. Intelligence	➢ Proficiency in solving real analysis problems
2.	External Factor		
	2.1 Family	Infrastructures	➢ Study room
			➢ Tools and book
	2.2 Lecturer	a. Quality	➢ Mastery of the material
			➢ Clarity explains
		b. method	➢ Use of learning methods
	2.3 University	Facilities	➢ Giving stimulants/quota assistance
			➢ Availability of an effective online system for real analysis learning

Interviews were conducted by giving 14 questions that fulfill all indicators and sub-indicators. The interview is given through *Platform Google Form* to 5 students as a sample obtained by using *purposive sampling* technique followed by *random sampling* method using the lottery technique. Interviews were conducted to collect data and check the validity of the data. The instrument used is an interview guide which is a guide for researchers in developing open-ended questions to obtain information about learning difficulties experienced by Mathematic Students on real analysis with an online system. The interview guidelines used in this research refer to the interview guide grid according to Hidayah et al. (2017: 25) as follows:

Table 2. Interview Guide Grid

No	**Indicator**	**Sub Indicator**
1.	Internal	
	From the students themselves	Health
		Cognitive
		Interest, readiness, and attention
2.	External	
	Family Environment	Motivation
		House conditions
		Family attention and support
	University Environment	University management
		Lecturers' learning method
		Infrastructure
	Community Environment	Neighborhood
		Friends hang out

The data analysis technique used in this research is the descriptive qualitative data analysis technique. Questioner data analysis begins with examining and calculating the score of each answer chosen by the respondent in the questioner that has been given with predetermined scoring guidelines. Then, the percentage score for each respondent is

calculated based on the predetermined percentage formula. After that, interpret the percentage of the factors causing learning difficulties for each indicator into the predetermined criteria. While the interview, data analysis begins with data reduction, namely summarizing, selecting the main things, focusing on important things, look for themes and patterns. Furthermore, the interview data is presented in the form of an interview transcript.

Based on both analyzes, data validity using data triangulation. According to Moleong (in Pritandhari, 2016: 5), data triangulation is a data validity checking technique that utilizes something other than the data for matching purposes or as a comparison to the data. The data checking technique in this research is Method Triangulation. Data collection techniques in method triangulation use different techniques to get data from the same source. This research uses interviews and questioners for the same data source simultaneously.

RESULT AND DISCUSSION

Result of The Research

This research was conducted on Mathematics Students at Veteran Bangun Nusantara Sukoharjo University who took real analysis courses in the even semester in the academic year 2019/2020. The problems examined in this research are related to the factors that are cause learning difficulties when taking real analysis courses with an online system. This research was conducted to obtain data about the factors that cause learning difficulties. The results of this research are expected to be used as input and considerations for policymaking in the context of dealing with learning difficulties experienced by students. Data collection techniques used questioner and interview that is given online through *platform Google Form*.

Based on the results of a questioner that had been filled in by 35 Mathematic Students who took real analysis courses in the even semester in the academic year 2019/2020, the following results were obtained:

Table 3. The Results of a Questioner on Learning Difficulties in Every Aspect

Factor	Aspect	Score Obtained	Score Maximum	%	Category
Internal Factor	a. Interest	269	420	64.05	Quite Hinder Category
1.1 Student	b. Motivation	297	420	70.71	Quite Hinder Category
	c. Talent	142	280	50.71	Hinder Category
	d. Intelligence	149	280	53.21	Hinder Category
External Factor					
2.1 Family	Infrastructures	181	280	64.64	Quite Hinder Category
2.2 Lecturer	a. Quality	400	560	71.43	Quite Hinder Category
	b. Method	165	280	58.93	Hinder Category
2.3 University	Facilities	415	700	59.29	Hinder Category

Student learning difficulties in learning real analysis courses with an online system are caused by internal factors (from the students themselves) and external factors (from outside of students) (table 3). Internal factors cause learning difficulties which include aspects of interest, motivation, talent, and intelligence. In comparison, external factors cause learning difficulties which include infrastructure from the family aspect, the lecturer quality aspect, the

lecturers' learning method aspect, and university facilities aspect. These internal and external factors are included in the category hinder and quite hinder students in learning real analysis with an online system.

To get more in-depth information about the learning difficulties of Mathematic Students on real analysis course with an online system, then analyzed the results of the questioners and interviews. Based on these analyzes, method triangulation was carried out by comparing the effects of questioners and interviews regarding learning difficulties of Mathematic Students on real analysis course with an online system. This method of triangulation aims to check the validity of the research data. The following is a comparison of the results of the questioner and interview:

Table 4. Comparison of The Results of Questioner and Interview

Indicator	Analysis of The Questioner Results	Analysis of The Interview Results
Interest and attitude towards real analysis learning with an online system	The percentage of questioner result on the aspect of interest was 64.05%, so that it was included in the quite hinder category	➢ Two students were interested in taking real analysis learning with an online system, while the other three were not interested. ➢ Five students choose conventional learning.
Proficiency in solving real analysis problems	Proficiency in solving real analysis problems is included in the intelligence aspect, with 53.21% in the hinder category.	Five students answered that the real analysis course is a complex subject because the material provided contains theorems and proofs, so it is difficult if provided online.
The effort to learn real analysis	The effort to learn is included in the motivation aspect with a percentage of 70.71% in the quite hinder category.	➢ A student did not try to study real analysis courses more actively because of busywork. ➢ Four students try to study harder when they get unsatisfactory grades.
Attention to learning real analysis with an online system	Attention to learning is included in the motivation aspect with a percentage of 70.71% in the quite hinder category	➢ A student actively asks if she/he gets a turn to answer. ➢ A student answer sometimes. ➢ A student answered actively at the beginning of the lecture. ➢ Two students are active if they understand the material presented.
Study Room/house conditions	Study Room/house conditions are included in the family infrastructure aspect with a percentage of 64.64% in the quite hinder category.	➢ A student answered yes. ➢ Two students answered no. ➢ Two students answered that the study room was less supportive.
Family attention and support for ownership of tools and books	Family attention and support for the right of tools and books are included in the family infrastructure aspect, with a percentage of 64.64% in the quite hinder category	➢ Two students answered that their books were incomplete ➢ Three students responded that the infrastructure they owned was supportive.
Lecturers' learning method	The percentage of questioner result on the aspect of lecturers' learning method	The lecturer delivered the learning material quite well, but the learning

Indicator	Analysis of The Questioner Results	Analysis of The Interview Results
	was 58.93%, so that is included in the hinder category.	method was only through the WA group.
University Facilities	The percentage of questioner result on the aspect of university facilities was 59.29%, so that is included in the hinder category in learning real analysis courses with an online system.	➢ Three students answered that the credit subsidy is sufficient if it is for real analysis courses only. ➢ Two students answered that it was not enough.

Comparing the results of questioner and interview can be concluded that there is a correspondence between the results of the questioner and the interview (table 4). So, it can be concluded that the findings or data collected can be declared valid.

Discussion

The exposure to the research results shows that the learning difficulties of mathematic students on real analysis courses with an online system are caused by internal factors (from the students themselves) and external factors (from outside of students). Internal and external factors driving learning difficulties are included in the category hinder and quite hinder Mathematics Students at Veteran Bangun Nusantara Sukoharjo University in learning real analysis with an online system.

Based on the research, the first internal factor that causes learning difficulties is the interesting aspect, with a percentage of the questioner results of 64.05% in the category quite hinder students on real analysis learning with an online system. Interest is one of the aspects that quite hinder students on real analysis learning with an online system. The results show that students prefer real analysis learning to be carried out conventionally based on the interview. Hamalik (in Ariwaseso, 2013: 2) said a lack of interest in education causes a lack of attention in learning efforts which obstruction that study. This shows that students' interest in learning needs to be increased because, according to Djamarah (in Hadiya et al., 2015: 83), high interest in learning tends to result in high achievement.

The second internal factor that causes learning difficulties is the motivation aspect, with a percentage of the questioner results of 70.71% in the category quite hinder students on real analysis learning with an online system. Motivation is one of the aspects that quite hinder students on real analysis learning with an online system. Based on the interview, the results show that students have less effort to learn real analysis. Harianti and Amin (2016: 25) said that motivation is a factor that influences the learning process and outcomes with a contribution of 36% to academic achievement. This shows that students' motivation in learning needs to be increased because, according to Purwanto (in Nurmala et al., 2014: 2), learning motivation will have an influence on student activities in following the learning process if the motivation to learn is high, the learning activity will be high and collectively influence learning outcomes.

Efforts to resolve learning difficulties due to a lack of students' interest and motivation can be made by choosing a learning method to activate students' interest and motivation in learning (Darijani et al., 2015: 9). According to Hamalik (in Darijani et al., 2015: 9-10), one such effort is to avoid negative suggestions and statements that can weaken enthusiasm for

learning, verbal or written gifts, and encouragement, provide opportunities for individual/group to discuss their aspirations rationally and shows the benefits of lessons for the use of the students at this time and in the future.

The third and fourth internal factor that causes learning difficulties is the talent and intelligence aspect. The percentage of the questioner results of 50.71% dan 53.21% in the category hinder students on real analysis learning with an online system. Talent and intelligence are two aspects that hinder students on real analysis learning with an online system. Based on the interview, the results show that students consider the real analysis course to be a complex subject because it contains theorems and proofs. Novita et al. (2018: 23) said that talent and intelligence have a high enough influence as a factor causing student learning difficulties. This shows that students' talent and intelligence in learning needs to be increased because, according to Afniola et al., (2020: 8), talent and intelligence are one thing that affects academic achievement. Efforts to resolve learning difficulties due to a lack of students' talent and intelligence can be made by increasing the practice questions. Because according to Marsita et al. (2010: 519), the lack of practice questions carried out by students significantly affects students' skills in solving problems in question development.

The first external factor that causes learning difficulties is the infrastructure from the family aspect, with a percentage of the questioner results of 64.64% in the aspect that quite hinder seal analysis learning with an online system. Infrastructure from family is one of the aspects that quite hinder students on real analysis learning line system. Based on the inside interview, the results show that students do not have complete books. Harianti and Amin (2016: 24) said that incomplete infrastructure would hinder the learning process. Efforts to resolve learning difficulties due to a lack of students' incomplete tools and learning books can be made by using a digital *platform* as a learning resource. According to Manrique (in Yaumi, 2017: 207), digital learning resources can positively contribute to learning.

The second external factor that causes learning difficulties is the lecturer qualities aspect, with a percentage of the questioner results of 71.43% in the category quite hinder students on real analysis learning with an online system. Lecturer qualities are one of the aspects that quite hinder because based on the questioner, the results show that difficulties learning. According to Nugroho et al. (2018: 352), success in learning does not only come from the students themselves, but lecturers or educators also influence it. According to Nurtanto (2016: 563), a lecturer is essential in teaching and learning activities, so they must have competence, namely academic competence and skill that refer to pedagogical competencies, personable, social, and professional. Efforts to resolve learning difficulties due to the lecturer's qualities by monitoring and evaluating the performance of the lecturers (Wolo et al. 2011: 1).

The third external factor that causes learning difficulties is the lecturers' learning method aspect. A percentage of the questionnaire results of 58.93% in the category hinder student real analysis learning with an online system. The learning method is one of the aspects that hindrances based on the interview. The results show that o on real analysis learning with an online system in real analysis learning with an online system, lecturers only use *Whatsapp Group* as a learning tool. According to Sujatmiko and Nurlaili (in Desiningrum, 2017: 46), from

the cone of the learning experience, it is known that students will achieve learning outcomes of 10% of what is read, 20% of what is heard, 30% of what is seen, 50% of what is heard and seen, 70% of what is said and 90% of what is said and done. This shows that learning strategies and supporting media affect student learning outcomes so that the choice of strategy and supporting media must be really considered. Efforts to resolve learning difficulties due to the lecturers' learning method can be made by paying attention and considering ability, necessity, interest, motivation, development, and students' understanding. According to Saputra dan Purnama (2015: 61), teachers are required to be creative and innovative in finding learning breakthroughs, be able to combine text, images, audio, music, animated images, or videos in a unit that supports the achievement of learning objective.

The fourth external factor that causes learning difficulties is the university facilities aspect. A percentage of the questioner results of 59.29% in the category hinder students on real analysis learning with an online system. University facilities are one of the aspects that hinder real analysis learning with an online system because based on the interview, the results show that university facilities in the form of credit/quota subsidy of Rp 100.000,00 is only given once and must be used for approximately 4-5 months while for application/digital platform that is considered effective for real analysis learning with an online system is a *Whatsapp* application combined with *Zoom Cloud Meeting* or *Youtube.* Leadership or university management can minimize the number of student dissatisfaction, for example, by communicating periodically. Communication with students can be done by providing a good communication forum for students' complaints and handle these complaints quickly (Nastiti, 2015: 3).

CONCLUSION

Based on the research and discussion results, it can be concluded that the learning difficulties of Mathematic Students on real analysis with an online system are caused by internal and external factors in the category that hinder and quite hinder students in the learning process. So that efforts are needed to deal with learning difficulties so that learning objectives can be achieved maximally and optimally.

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