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ICT-Based Teaching Aid Materials in Rural High School Additional Mathematics Learning: Needs Analysis

(Bahan Bantuan Pengajaran Berasaskan ICT dalam Pembelajaran Matematik Tambahan Sekolah Menengah Luar Bandar: Analisis Keperluan)

SITI SERI KARTINI MOHD YATIM*, SALMIZA SALEH & HUTKEMRI ZULNAIDI

ABSTRACT

The needs analysis phase is the initial phase of the study when information is collected from the context and environment that are to be studied. This paper discusses the findings of a needs analysis carried out as the first step in the construction of an Information and Communication Technology-based (ICT) teaching module. This paper presents the difficulty levels of Form 4 Additional Mathematics topics and the students' motivation level in the subject of Additional Mathematics. A total of 147 students and 63 teachers of Additional Mathematics subject from 3 rural high schools in Kulim, Kedah were involved. This study used a quantitative method supported by a qualitative method. A questionnaire was administered to the respondents, followed by a semi-structured interview to collect data. Findings show that a majority of teachers and students suggested that the Differentiation topic as the most difficult topic for Form 4 Additional Mathematics subject, whereby students need ICT to understand the concept. Furthermore, this study discovered that teachers rarely use ICT and GeoGebra Software in teaching and learning (T&L) process. Based on the results, suggestions from teachers and students are taken into consideration for the beginning of the construction of an ICT module.

Key Words: Additional Mathematics, Differentiation, Motivation, Needs Analysis, Information and Communication Technology (ICT)

ABSTRAK

Fasa analisis keperluan merupakan fasa yang pertama bagi mendapatkan maklumat daripada konteks dan persekitaran yang akan menjadi kajian sebenar. Kajian ini membincangkan analisis keperluan yang dilakukan sebagai langkah pertama dalam pembinaan modul pengajaran berasaskan Teknologi Maklumat dan Komunikasi (ICT). Kajian ini bertujuan untuk mengetahui tahap jurang dan kesukaran topik Matematik Tambahan Tingkatan 4 untuk guru dan pelajar. Ia juga bertujuan untuk mengetahui tahap motivasi pelajar sekolah luar bandar dalam mata pelajaran Matematik Tambahan. Kajian ini menggunakan kaedah kuantitatif disokong oleh kualitatif. Ia menggunakan soal selidik mengenai tahap kesukaran Matematik Tambahan serta soal selidik mengenai tahap motivasi dalam mempelajari Matematik Tambahan. Responden terdiri daripada 147 pelajar Matematik Tambahan dari sekolah luar bandar di daerah Kulim. Soal selidik tahap kesukaran juga diberikan kepada 63 guru Matematik Tambahan. Dapatan menunjukkan bahawa majoriti guru dan pelajar menganggap topik Pembezaan sebagai topik yang paling sukar untuk subjek Matematik Tingkatan 4. Pelajar memerlukan bantuan ICT untuk memahami konsep Pembezaan. Walau bagaimanapun, kajian ini mendapati bahawa guru jarang menggunakan perisian ICT dan GeoGebra dalam proses pengajaran dan pembelajaran (T&L). Berdasarkan keputusan kajian ini, cadangan guru dan pelajar diambil kira untuk permulaan pembinaan modul ICT.

Key Words: Matematik Tambahan, Pembezaan, Motivasi, Kajian Keperluan, Teknologi Maklumat dan Komunikasi (ICT)

INTRODUCTION

Additional Mathematics is an elective subject at high school level in Malaysia. It is also the most feared subject because it is said to be the most difficult compared to other subjects (Khalin 2014; Yahya & Amir 2018). Additional Mathematics by nature promotes meaningful and challenging learning. Students are mostly not exposed to the importance of learning Additional Mathematics in school, so they often think that the subject is not important and that there is no necessity for it to be learned (Abu & Leong 2014). Students who take Additional Mathematics will have a high chance of entering the field of Science,

Technology, Engineering and Mathematics (STEM) at a higher level of education. The Programme for International Student Assessment 2015 (PISA 2015) report shows that only 13.2% of Malaysian students are interested in Science and Engineering careers (OECD 2016). Teaching strategies and teaching aid materials that are not fully effective are among the reasons why optimum learning and development among students for Science and Mathematics subjects cannot be generated (Fazil & Salmiza 2016; Jumiran 2014).

There are eleven topics in the Integrated Secondary School Curriculum (KBSM) of Form 4 Additional Mathematics subject: Functions, Quadratic Equation, Quadratic Function, Simultaneous Equation, Indices & Logarithms, Coordinate Geometry, Statistic, Circular Measure, Differentiation, Solution of Triangle and Index Number (*Huraian Sukatan Pelajaran Matematik Tambahan Tingkatan 4 2*012). Each topic provides its own challenge for students while teachers have their own perspectives on the level of difficulty for the Teaching and Learning (T&L) processes that take place. Students have the tendency to think that learning mathematics is hard because there are topics that require abstract knowledge and this cause them to face difficulties in understanding the conceptual knowledge of certain topics (Saad 2002; Yahya & Amir 2018). The process of T&L of Mathematics also focuses more on memorizing formulae and doing exercises, skills to answer examination questions, and teacher-centred teaching practice, which cause students to feel afraid and face difficulty in following what is being taught in the classroom (Puteh & Khalin 2016; Yahya & Amir 2018)

Motivation plays a role as the basic and essential component in learning process (Simsek 2014). It has also been identified that motivation can stimulate and maintain learning behaviour and play an important role during the T&L process. Previous studies have shown that there is a positive correlation between the level of motivation and the achievement of students in a different learning environment (Lee 2013). According to Veloo & Muhammad (2011), lack of motivation and problem-solving skills are among the factors that cause the deterioration in the performance of Additional Mathematics.

In addition to motivation, other factors contributing to students' poor performance in the subject of Additional Mathematics have also been discovered, such as the inconsistency of the strategy and the teaching approach of the teacher compared to the needs and learning styles of students, since students do not know the techniques and means of effective learning (Jing Kae 2010). According to a study conducted by Abu and Leong (2014), there is a clear relationship between teaching approach and the achievement of the Additional Mathematics students. In other words, students may think that their teachers' teaching method directly affect their performance in the subject.

In the 21st century, Additional Mathematics teachers and students need to continue to transform and evolve following changes in the global arena. T&L using information and communication technology (ICT) is very important so that students and teachers can familiarize themselves with the use of the latest technology in the subject of Additional Mathematics. In fact, the PISA 2015 was also implemented for the first time based on ICT (OECD 2016). According to a preliminary report of the Malaysia Education Blueprint (PPPM) 2013-2025, the first wave, which is to bring about the government's desire for the seventh PPPM shift, has caused the Ministry of Education has allocated the largest capital for infrastructure and ICT in schools. However, based on the inspection report of the Inspectorate of Schools (JNJK) in the year 2012 and 2013, the percentage of teachers using technology across Malaysia was very low, at 1.20% in 2013 and 0.00% in 2012 (Khor & Ruzlan 2016). Previous studies suggest that despite the many benefits of using technology in teaching Mathematics, overall technology utilization in the classroom is slow (Cuban et al. 2001).

Based on the Malaysian Examination Board 2018 report, the percentage of students who failed Additional Mathematics for three consecutive years from 2015 to 2017 in the Malaysian Certificate of Examination (SPM) increased from 22.2% to 22.7% and then to 24.2%. The average grade of Additional Mathematics in the year 2017 is still low (5.81), compared to other subjects. Likewise, the percentage of failed students in rural schools for the last three years had increased from 28.18% to 28.74% and 31.35% (Examination Board report 2018). There is still a huge percentage gap of passing students between rural and urban students in 2017, id est 68.65% for the former and 78.27% for the latter. The wish to close the gap between rural and urban students as expressed by the government in Malaysia's National Education Blueprint 2013-2025 is still not met with this huge gap. Students' confidence to register Additional Mathematics as a subject for the Malaysian Certificate of Education (SPM) also decreases. In 2015, the number of SPM candidates for Additional Mathematics was 152 004, in 2016 the number of candidates was 126 880 and in 2017 the number of candidates was 125 636. Students are less motivated to register Additional Mathematics for SPM because of how difficult it is to get good results for the subject.

Based on the problems and discussions above, the researchers found out that a study needed to be done to help the teachers in terms of developing ICT-based teaching aids for the subject of Additional Mathematics. Based on previous studies, ICT modules

have been successfully developed as can be seen from modules developed by Hutkemri (2013), Ayu Erlina (2013) and Nordin (2010). These ICT modules have solved problems in terms of conceptual, procedural, problem solving faced by students when learning mathematics. In order to obtain the initial information to develop the ICT module, a needs analysis has to be conducted beforehand. The needs analysis was carried out with the following objectives:

1. To identify the teachers' perspective of Form 4 Additional Mathematics topics' difficulties
2. To identify the students' perspective of Form 4 Additional Mathematics topics' difficulties
3. To identify the students' motivation levels in learning Additional Mathematics
4. To identify the students' and teachers' need in the T&L of Additional Mathematics

ICT AS TEACHING AID (ABM)

The current learning method and teaching aid (ABM) need to be diversified and cannot be restricted to the traditional methods used in the classroom only. The assimilation of technology in the educational process happens all the time and as a result, many different types of tools, materials and pedagogy methods are introduced in our education system. According to Brandt (1997), ICT can be used as a new technological support for visualizing abstract concepts through virtual representations generated by computers and therefore helps in education. Technology can also be used for meaningful learning processes as well as for understanding a concept clearly (Altıparmak 2014). By using computer software, students can interact with educational materials designed to develop required skills and solve everyday situations using their mathematical backgrounds. This learning technology needs to be useful and in keeping with our education system so it will not just be in vain. By using new technology in the classroom, there are evidence showing that there is a relationship between ICT-enabled activities, positive attitude towards mathematics, improvement of mathematical learning, and students' performance (Kenneth 1996; Rosas et al. 2003). As noted by Jonanssen and Carr (2000), technology is used as a mindtool that can be utilized to support deep reflective thinking and is needed for meaningful learning. The existence of open-source software has gained the attention of many educators in the world who use ICT in their teaching. This includes GeoGebra software which is a good example of software that can be used in the process of learning mathematics.

ICT-assisted learning is an alternative method that should be selected to improve conceptual understanding in a deep, meaningful and accurate way. It also helps students to solve Additional Mathematics problems because ICT allows the use of animation and visualization which cannot be done by textbooks or any exercise and reference books. The use of calculators, computers, educational software, internet sites and existing learning packages can improve pedagogical approach and further enhance the understanding of mathematical concepts. Numerous studies (Li & Ma 2010; Cheung & Slavin 2013) have shown that ICT can play an effective role in tackling the challenges of teaching mathematics. Therefore, the use of ICT as teaching aids can have a significant impact on improving students' mathematics achievement (Zhang & Liu 2016). Based on previous studies, Shatila et al. (2011) have shown that ICT can be helpful in terms of visualization of conceptual understanding in mathematical subjects, which is the topic of Derivatives.

In their study, Dockendorff & Solar (2017) have determined the benefit of ICT as teaching aid in promoting mathematical learning at secondary school and its impact on teachers' conceptions about teaching and learning mathematics. Teachers face difficulties when using ICT in their teaching practices (Vrasidas 2015; Ward and Parr 2010; Wastiau et al. 2013). The main concern faced by teachers who do not use this approach is that a large expense will be required to obtain licenses for the software if the government decides to implement the use of ICT materials and mathematics software in school. However, earlier researchers have criticized this statement by pointing out that mathematics software is widely available as open source on the internet, and therefore huge spending is no longer required (Howard 2013; Player-Koro 2012; Teo 2013). These researchers also show that teachers with a positive attitude toward ICT are more likely to use ICT in the T&L process of students, perhaps because they are aware of the benefits of this pedagogical tool.

METHODOLOGY

RESEARCH DESIGN

This needs analysis used survey research design to identify the needs in the construction of an ICT module and is intended to help researchers decide whether or not the needs have to be rectified through treatment, which is the use of ICT modules for difficult topics in Additional Mathematics subject. This needs analysis uses quantitative method (questionnaire) that is supported by qualitative method (semi-structured interview). This research has obtained ethical approval by the Education Policy Planning and Research Division (Ministry of Education Malaysia) (Reference:

KPM.600-3/2/3-eras(2339)) and Universiti Sains Malaysia Research Ethics Committee.

SAMPLE

This study used simple random sampling method, where a total of 63 Additional Mathematics teachers and 147 Additional Mathematics students (96 Form Four and 51 Form Five) were involved. The students were selected from three rural high schools in the district of Kulim, Kedah. All the students had learned the entire syllabus for Form 4 Additional Mathematics. The teachers were selected from a community of Additional Mathematics teachers in Kedah using Google Form questionnaire. The respondents' backgrounds are shown in Table 1 and Table 2.

At the same time, purposive sampling technique was used to select respondents for the semi-structured interview of the qualitative method. Three Form Four students who had studied the topic Differentiation and three teachers who had more than 10 years of experience in teaching Additional Mathematics from different rural schools were selected.

Table 3 shows the students' results for Mathematics subject in the Form Three Assessment (PT3). Researchers acquired their results of PT3 Mathematics in order to look at their backgrounds and prior knowledge levels of basic mathematical concept. However, 16 of the students did not fill in their PT3 Mathematics results.

TABLE 1. Teachers' profile

School Type	Gender		Teaching experience					Total
	Male	Female	Less than a year	1 to 3 years	4 to 6 years	7 to 9 years	10 years or more	
Urban	8	28	-	1	2	10	23	36
Rural	7	20	-	-	1	8	18	27
Total	15	48	-	1	3	18	41	63

TABLE 2. Students' profile

School	Gender		Form		Race				Total
	Male	Female	Form 4	Form 5	Malay	Chinese	Indian	Others	
SMK A	23	41	46	18	63	-	1	-	64
SMK B	20	49	36	33	48	5	15	1	69
SMK C	2	12	14	-	10	2	1	1	14
Total	45	102	96	51	121	7	17	2	147

TABLE 3. Respondents' results for PT3 Mathematics

School	Results for PT3 Mathematics						Total
	A	B	C	D	E	F	
SMK A	5	4	14	22	10	-	55
SMK B	6	7	8	10	21	10	62
SMK C	0	1	3	3	5	2	14
Total	11	12	25	35	36	12	131

INSTRUMENTATION

The instruments involved in this study are questionnaires on the topic difficulty of Form 4 Additional Mathematics and students' motivation in learning Additional Mathematics.

The questionnaire on the difficulty of Form 4 Additional Mathematics topics was derived from Hutkemri's (2013) needs study and does not require any modification. In the questionnaire, there are 2 parts; Part A collects data on respondents' background and Part B collects data on the T&L of Additional Mathematics. The instrument was piloted and obtained Cronbach's Alpha value of 0.81. The questionnaire was given to both students and teachers respondents to assess their perceptions on the difficulty of all topics in the Form 4 Additional Mathematics syllabus as well as to appraise the respondents' T&L process for Additional Mathematics.

The questionnaire on students' motivation in learning Additional Mathematics was adapted from the questionnaire of Physics learning motivation from Azlina's study (2018). This questionnaire on motivation was derived from the Science Motivational Questionnaire (SMQ) developed by Koballa and Glynn (2006). Since the questionnaire on motivation was

originally in English, researchers had it translated into Malay with the aid of 3 field experts and then translated it back into English with the aid of 3 field experts. Researches performed the back translation according to the recommendations by Brislin, Lonner and Thondike (1973). This questionnaire used 5-point Likert-scale and consisted of six constructs: i) intrinsic motivation, ii) extrinsic motivation, iii) personal linkage, iv) choice determination, v) self-efficacy, and vi) anxiety. The instrument was piloted and obtained Cronbach's Alpha value of 0.88. This questionnaire was administered to all student respondents.

For the semi-structured interview, the researchers had constructed an interview protocol (as shown in Table 4) for the teachers and students in order to obtain supporting data for the objectives of the study. Before carrying out the real study, the researchers carried out a pilot study on a teacher and a student that had similar characteristics to the real respondents, in order to find out the suitability of the questions that would be used for the actual study.

DATA ANALYSIS METHOD

The quantitative data from the questionnaire was analysed using descriptive statistics with the help of IBM SPSS version 22. The difficulty level of topics was analysed using mean and standard deviation to compare the data between teachers and students. The motivation level of learning Additional Mathematics was also analysed using mean and standard deviation, which is interpreted according to Pallant (2010); mean values of 1 to 2.332 are considered as low level, 2.34 to 3.66 are considered as moderate level, and 3.67 to 5 are considered as high level. For the use of ICT and the use of GeoGebra software by teachers in the T&L process, percentage value was used.

The qualitative data from the semi-structural interview was analysed using thematic analysis method. The interview recording was transcribed and then returned to the respondents to be checked, which they then signed interview verification forms to validate the information in the interviews. This was done as a means of truthfulness and trustworthiness of the data (member-checking).

TABLE 4. The interview protocol questions for teachers and students

No	Research Objectives	Teachers	Students
1	Form 4 Additional Mathematics topics' difficulties.	In your opinion, what are the topics that are most difficult for teachers to teach and topics that are most difficult for students in Additional Mathematics syllabus form 4 Form?	What is the most difficult topic for you in the subject of Additional Mathematics Form 4?
2		Why is it considered the most difficult topic for students? Can you please explain.	Why is it considered the most difficult topic for you? Can you please explain.
3	Students' motivation levels in learning Additional Mathematics		Do you like to learn Additional Mathematics subject?
4			Do you think that learning Additional Mathematics is difficult? Why?
5	Students' and teachers' need in the T&L of Additional Mathematics	What is the need for teachers to improve Additional Mathematics performance for rural students?	What is the need for students to improve Additional Mathematics performance?
6		Do you need technologies devices in the teaching and learning of Additional Mathematics? Do you think that ICT modules are needed?	Do you need technological devices in the teaching and learning of Additional Mathematics? Why?

FINDINGS AND DISCUSSIONS

TEACHERS' AND STUDENTS' PERSPECTIVE OF FORM FOUR ADDITIONAL MATHEMATICS TOPICS' DIFFICULTIES

The following Table 5 and Table 6 shows the teachers' and students' perspective of Form Four Additional Mathematics topics' difficulties. The topic with the highest mean score is considered to be the most difficult topic.

Based on Table 5, it was found that teachers believe that the topic Differentiation is the most difficult topic for students (mean=4.30, SD=0.69), followed by Indices & Logarithms (mean=3.79, SD=0.88), and Functions (mean=3.11, SD=0.74).

Based on the interview with the 3 teachers, it was revealed that they all agreed that the most difficult topic in Form 4 Additional Mathematics syllabus was Differentiation. The teachers suggested a few reasons for why this topic was considered to be most difficult by students. Among the reasons are students lack

conceptual understanding of Differentiation, lack basic mathematical knowledge, as well as lack problem-solving skills. The following are the teachers' responses:

"*...even though there are formulae for teaching Differentiation, students still cannot understand the topic and cannot clearly see the concept of Differentiation...*" (RG1)

"*...students face difficulty when answering problem-solving questions especially for paper 2 Additional Mathematics...*" (RG2)

"*...Differentiation is the beginning of calculus for students... students need to master the basics of mathematics first, like algebra, before they can do the next operation in the topic Differentiation...*" (RG3)

TABLE 5. Teacher's perspective of Form 4 Additional Mathematics topics' difficulties

No	Topic	Level of difficulty	
		Mean	SD
1	Functions	3.11	.74
2	Quadratic Equation	2.33	.72
3	Quadratic Function	2.95	.73
4	Simultaneous Equation	2.22	.77
5	Indices & Logarithms	3.79	.88
6	Coordinate Geometry	3.00	.72
7	Statistics	2.84	.68
8	Circular Measure	2.87	.68
9	Differentiation	4.30	.69
10	Solution of Triangle	3.03	.82
11	Index Numbers	2.29	.99

TABLE 6. Students' perspective of Form 4 Additional Mathematics topics' difficulties

No	Topic	Level of difficulty	
		Mean	SD
1	Functions	3.10	.89
2	Quadratic Equation	2.56	.92
3	Quadratic Function	3.30	.96
4	Simultaneous Equation	2.50	1.11
5	Indices & Logarithms	3.64	.99
6	Coordinate Geometry	3.33	.96
7	Statistic	2.69	.95
8	Circular Measure	3.29	.91
9	Differentiation	3.94	1.01
10	Solution of Triangle	2.74	1.04
11	Index Number	2.23	1.12

According to Table 6, students think that the most difficult topic is Differentiation (mean=3.94, SD=1.01), followed by Indices & Logarithms (mean=3.64, SD=0.99) and Coordinate Geometry (mean=3.33, SD=0.96).

Based on the interview with the 3 students, the researchers found out that the students faced difficulty in the form of conceptual understanding and problem solving in learning the topic Differentiation. The 3 students RP10, RP83 and RP103 responded as follows:

"Differentiation. It is difficult to understand a concept that requires a high level of method and thinking that involves life application and it is hard to understand a concept with steps that are too long" (RP10)

"Differentiation. Because of incapability to understand the concept and lack the skills in problem solving" (RP83)

"Differentiation. Because a good understanding of the concept is required and there is a lot of confusion and HOTS questions are often asked" (RP103)

Based on the findings above, it is clear that there is a similarity of perception between teachers and students about Differentiation being the most difficult topic in Form Four Additional Mathematics. Differentiation is part of Calculus and it is a very important topic that needs to be mastered by students. This is because Differentiation is the basic for other topics such as Integration and Motion Along a Straight Line which will be taught in Form 5. This topic is often considered to be difficult by students because it needs conceptual understanding and problem-solving skills that are based on Higher Order Thinking Skills (HOTS).

Differentiation is the first level of Calculus learning in high school where students are faced with the concept of limit which involves calculations that are no longer done using simple arithmetic and algebra and is an infinite process than can only be done with an indirect argument. Teachers often try to avoid problems by using "informal" approach that plays with techniques (Dockendorff & Solar 2017). The best way to understand the concept of Differentiation is by giving students visualizations of graphs and functions using ICT and mathematics software (Shatila et al. 2011).

According to earlier studies by Firouzian (2014), the majority of students do not clearly understand the concept of Differentiation. They also have difficulty in applying their knowledge about Differentiation to solve the problems that are given to them. Not only students who perform poorly academically face problems with Differentiation. Even the most excellent students do not fully understand the concepts taught in the topic. They have difficulty solving problems in questions that are unfamiliar and non-routine (Selden et al. 2000; Carlson

1998; Bezuidenhout 1998; Selden et al. 1988). These findings are supported by a study conducted by Nasir et al. (2013) which states that based on teachers' feedback, Differentiation is one of the most difficult topics in their syllabus.

STUDENTS' MOTIVATION IN LEARNING ADDITIONAL MATHEMATICS

The following Table 7 shows the students' motivation level in learning Additional Mathematics.

TABLE 7. Students' motivation in learning Additional Mathematics

Motivation Construct	Students' Responses	
	Mean	SD
Intrinsic Motivation	3.44	.69
Extrinsic Motivation	3.79	.56
Personal Linkage	3.46	.62
Choice Determination	3.30	.59
Self-Efficacy	3.43	.67
Anxiety	3.68	.55
Total	3.52	.44

Based on Table 7, the overall students' motivation in learning Additional Mathematics is at a moderate level (mean=3.52, SD=0.44).

From the interviews, the researchers found out that students were interested in learning Additional Mathematics, but their problem was lack of motivation. One of them answered: "*I am interested in Additional Mathematics, but the subject is difficult. I am not confident that I can answer most of the questions in the Additional Mathematics tests*" (RP83). This shows that students' weak mathematical abilities have reduced their motivation to learn and end up causing poor achievement in Additional Mathematics. This is supported by a study by Nicolescu (2015) who discovered that students' self-efficacy in mathematics, along with other affective factors such as worry about test and the use of mathematics, affect students' performance in mathematics. Therefore, it is not enough for educators to only focus on teaching mathematical contents to students, educators need to also consider the factors of emotion or attitude that affect how students learn mathematics.

In addition, it was revealed that even though the rural school students have a low level of understanding in the topic of Differentiation, their self-efficacy in responding to Additional Mathematics questions is moderate. In this situation, a pedagogical agent would play a significant role in improving the students' motivation to learn Additional Mathematics. This is because good pedagogical agents can act as experts and study buddies that provide explanations and help to improve conceptual understanding and improve students' achievement in solving problems in the topic of Differentiation. The existence of pedagogical agents in an ICT module can help increase students' motivation and indirectly, it will also help increase students' self-efficacy for the topic Differentiation.

STUDENTS' AND TEACHERS' NEEDS IN THE TEACHING AND LEARNING OF ADDITIONAL MATHEMATICS

From the questionnaire question (QC12), it was discovered that students require the use of ICT in the learning of Additional Mathematics (mean=3.75, SD=0.86). This was also supported by the data from interviews with the students; whereby the students felt that they struggle to understand certain concepts especially the concept taught in the topic Differentiation. Students need an approach that is different from the conventional approach currently used by teachers to help them understand the abstract concept of Differentiation, which requires visualization aid. Two of the respondents answered:

"*yes, I need technological devices while learning Additional Mathematics. Technological devices such as computers help with understanding difficult concepts.*" (RP83)

"*yes, I need technological devices to help with understanding difficult concepts.*" (RP103)

However, the teachers' responses revealed that less than 27.0% of teachers use ICT and only 20.6% use GeoGebra software in the T&L of Additional Mathematics. Table 8 shows the comparison of ICT and GeoGebra software usage between urban high school teachers and rural high school teachers.

Additionally, the teachers suggest a few issues regarding the T&L of Additional Mathematics. Among the suggestions are: i) the time allocated to teach Additional Mathematics should be increased, ii) basic knowledge in mathematics especially algebra needs to be improved before learning Additional Mathematics, iii) methods and approaches in the T&L of Additional Mathematics should be broadened, and iv) the use of technology can help in understanding the concepts in Additional Mathematics.

Furthermore, the teachers agree that the use of ICT and technology can help them in teaching Additional Mathematics. However, teachers do not have the time for the preparation of ICT materials and that has become a problem for them. Nevertheless, the teachers agree that the availability of an ICT module can help in terms of time and topics' conceptual understanding. Here are some of the teachers' responds:

"the use of technology and ICT can help improve students' performance... Yes, an ICT module is needed. It can save time in terms of material preparation" (G1)

"Use PAK 21 method…Yes, a good ICT module is needed" (G6)

"Allocate more time in the T&L for understanding the concepts and thinking techniques. Access to mathematics software greatly helps students…Yes, an ICT module is needed to improve students' conceptual understanding" (G54)

"Introduce easy methods for the learning and teaching of Additional Mathematics…Yes, an ICT module is one of the simple methods needed for the T&L of Additional Mathematics" (G56)

These findings show that teachers need an ICT module that can help make it easier for the concepts of a topic to be understood by students, especially if it is a difficult topic like Differentiation. Apart from that, it can help teachers save time in terms of material preparation.

This finding is supported by previous study that technology used within an instructional design can enable students to focus on understanding concepts and solving problems rather than arithmetic operations (García-santillán et al. 2017). In addition, Yousuf and Behlol (2015) also supported the use of ICT systems when teaching mathematics by reporting that the application of ICT as a teaching strategy was found to be effective as compared to traditional strategies.

TABLE 8. The use of ICT and GeoGebra software in T&L of Additional Mathematics

School	Teachers who use ICT in T&L		Teachers who use GeoGebra software in T&L	
	No.	Percentage	No.	Percentage
Urban	9	14.3%	8	12.7%
Rural	8	12.7%	5	7.9%
Total	17/63	27.0%	13/63	20.6%

CONCLUSION

This needs analysis gives a clear picture of the needs and problems faced in the T&L of Additional Mathematics in schools in the district of Kulim, Kedah. Overall, teachers and students regard the topic Differentiation as the most difficult topic in the Form 4 Additional Mathematics syllabus. Students' motivation in learning Additional Mathematics was found to be moderate. In addition, students face difficulty in answering questions that require problem-solving skills. A majority of the students require the use of ICT such as GeoGebra software in the T&L process to help them understand the abstract concept of Differentiation, which requires visualization aid. However, teachers who use ICT in T&L are few in numbers. Not many teachers use GeoGebra software during T&L. A number of teachers were of the opinion that a T&L module incorporating ICT into the teaching of Additional Mathematics would be of value. This implicates that there is a need for an Additional Mathematics T&L module incorporating ICT to be built because it can help both teachers and students in the process of T&L of Additional Mathematics, and to address the problems mentioned above.

This needs analysis only took place around the district of Kulim, Kedah. It is suggested that further studies be carried out which involve several classes in other schools to get a more comprehensive picture of the issue. The background of the area of study is rural and it is believed that similar phenomena also occur in high schools in rural areas in other states. Similar studies are proposed to be carried out in rural areas of other states as well as in urban areas for comparison. Researchers also would like to suggest that studies be conducted on the Indices & Logarithms topic as both teachers and students labelled this title as the second most difficult title in the Form 4 Additional Mathematics syllabus.

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Siti Seri Kartini Mohd Yatim
School of Educational Studies
Universiti Sains Malaysia
Email: serisskmy@gmail.com

Salmiza Saleh
School of Educational Studies
Universiti Sains Malaysia
Email: salmiza@usm.my

Hutkemri Zulnaidi
Department of Mathematics and Science Education
Faculty of Education
Universiti Malaya
Email: hutkemri@um.edu.my

*Author for correspondence, email: serisskmy@gmail.com

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