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Investigating Future Learning of Electronic Module Through Thematic Analysis in Secondary School: A Need Analysis

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Abstract: The Design and Technology (RBT) subject aims to equip student with knowledge, skills, and values in design, fostering critical, creative, and innovative thinking. However, the RBT curriculum, especially in electronic design, necessitates new teaching methods to align with updated Curriculum and Assessment Standard (DSKP) content. Current curriculum gaps include insufficient coverage of visualization skills essential for understanding electronics. This study investigates the need for developing 2-Dimensional (2D) simulation and AR module through qualitative research. Semi-structured interviews with five experienced RBT teachers were conducted, and the data were analysed by thematic analysis. The analysis revealed one major theme: the overview and expectations for the 2D simulation and AR module in the electronic design topic. This theme encompasses four sub-themes: challenges in the electronic design topic, resources for the electronic design module, contents of the module, and instructional strategy. The study underscores the urgent need for 2D simulation and AR modules to address these challenges and enhance students' understanding, and improve engagement. This approach aims to bridge gaps in the educational system, offering significant benefits to teachers, researchers, and the Ministry of Education.

Keywords: Augmented reality, digital education, 2d simulation, electronic module, design and technology

1. Introduction

Education is one of the most important aspects to survive as adults nor children (Aldrich, 2010). It is a must for people to be educated to achieve the fourth agenda in Sustainable Development Goals (SDGs) which is ensuring inclusive and equitable quality education and promotes lifelong learning opportunities for all. According to Hanemann (2019), the fourth SDGs aims to ensure successful, effective and relevant of learning outcomes for children, youth nor adults which improve their lifelong learning engagement in life. As revolution technology evolves, the standard curriculum will always be changes from time to time which leads to changes of curriculum knowledge or content in a subject or course. According to Oliva (2005), curriculum will always be changed based on ten axioms which are inevitability change, curriculum as a product of its time, concurrent changes, change in people, cooperative endeavour, decision-making process, systematic development, and starting from the existing curriculum. These axioms lead to developing of new curriculum knowledge to be taught in schools, colleges, and even universities to enhance their knowledge based on concurrent changes among time.

Design and Technology (RBT) subject is one of the newest subjects which was replaced from Integrated Life Skills (KHB) subject that leads to changes of new curriculum from Integrated Secondary School Curriculum (KBSM) to Secondary Standard Curriculum (KSSM) especially in electronic topic. RBT subject aims to provide knowledge, skills, values, aesthetics, and technology in world of design. Students can develop communication skills and generate ideas to produce new product and become designers who cultivate critical, creative, innovative, inventive, and entrepreneurial

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thinking. Electronic topic in RBT subject involves the interconnection of microcontroller and electronic components with programming language which is more challenging for students to understand the topic well which also leads to difficulty of teachers to teach students. There are several issues from students and teachers in electronic topic from Sahaat & Nasri (2020), Masingan & Sharif (2019) and Ajit et al. (2022) studies. Therefore, it has been proven that these issues must be taken seriously by the researcher.

As the education evolves due the presence of advance technologies, 2-Dimensional (2D) simulation, Artificial Intelligence (AI), and Augmented Reality (AR), Virtual Reality (VR), Mixed Reality (MR) and other are introduced into education system. This evolution can be convenient and effective in school administration systems, Teaching and Learning (T&L) procedures, and financial. Lai and Bower (2019) founded out in their studies that various kind of technology have been introduced in education which leads to advantages of T&L process. The presence of technology leads to the presences of new policy in education that is the Digital Education Policy which is introduced by the Ministry of Education (MOE) of Malaysia in 2023. There are multiple of articles use digital learning to educate students by using advance technologies especially in 2D simulation and AR such as Alfred et al. (2018), Tembo and Lee (2017), Yen et al. (2013), Billinghurst et al. (2015), Radu (2014), Lin et al. (2013), and Wieman et al. (2008) studies. These technologies can enhance students' academic achievement based on their test by applying 2D simulation and AR into T&L sessions.

Regarding to this matter, the purpose of this study is to identify and analyse the challenges and needs of 2D simulation and AR module for electronic design topic by using qualitative approach where semi-structured interview was conducted with five experiences RBT teachers which was conducted with five experienced RBT teachers which have experience on facing challenges and needs in RBT subject especially in electronic topic. The data collected from the semi-structured interviews was examined through thematic analysis and the results were illustrated by using thematic maps. In the following section clarify the issues and challenges face by students and teachers based on past research. This article also discussed the methodology and the findings of the needs analysis study.

There are several issues from students' and teachers' competencies in electronic topic from Ajit et al. (2022), Sahaat & Nasri (2020), Masingan & Sharif (2019) and other studies. According to Yong (2019) described RBT subject have less T&L aids which effect the students' academic achievement in RBT subject. Most of the teachers have less effective in providing assessment (Sahaat & Nasri, 2020) and teachers with no pedagogical contents in RBT subject having difficulty of teaching students in creative ways (Masingan & Sharif, 2019). Other study from Arshad et al. (2023) described that teachers are less efficient with electronic training which makes them hard to understand in electronic with the used of microcontroller. These statements show the variety of issues face by teachers which leads to poor students' academic achievements.

Together, students also faced variety of issues in learning electronic topic. A study from Ramli et al. (2024) discovered students still lack to memorise remembering electrical and electronic topics. Other study from Ajit et al. (2021) found out students could not reach their highest mastery skills due to poor thinking skills and problem solving which affect their visualisation that triggered their academic achievement. A study from Othman et al. (2024) had also discovered challenged on students understanding in electronic specifically microcontroller used. According to the study, the students have difficulty to understand electronic component with programming language aspects which they could not the interconnection of electronic components and microcontroller from programming language. Past research from Liono et al. (2021) had also discovered students have not yet to master the concept of microcontrollers which visualisation skills does not occurred from simulation through thinking skills.

2. Methodology

2.1 Research Design

The research design of this study uses a qualitative approach research design with the adaptation from Braun and Clarke (2006) and McKillip (1987). The objective of this research is to analyse the needs of developing 2D simulation and AR module in electronic design topic. The module development of this study uses Analyse, Design, Development, Implementation, and Evaluation (ADDIE) Model (Rosset, 1987) as a guidance to design and develop a systematic T&L instructional module. According to Handrianto et al. (2021) describes that systematic instructional design promotes learning to students through plan, develop, and evaluation process.

There are five phases in ADDIE Model which are analysis phase, design phase, development phase, implementation phase, and evaluation phase. This study is only focuses on analysis phase to achieve the objective of the study which is to analyse the needs of developing 2D simulation and AR module in electronic design topic. Thus, the researcher conducts interview session with teachers who have experience teaching RBT especially in electronic design topic. The researchers need to analyse the basic needs of a group to obtain educational goals which detect knowledge and students' skills (Spatioti et al., 2022). Therefore, the researcher only focuses on design and technology teachers due to having more experience and challenges on T&L in electronic design topic among students in secondary school. Fig. 1 shows the ADDIE Model approach in module development.

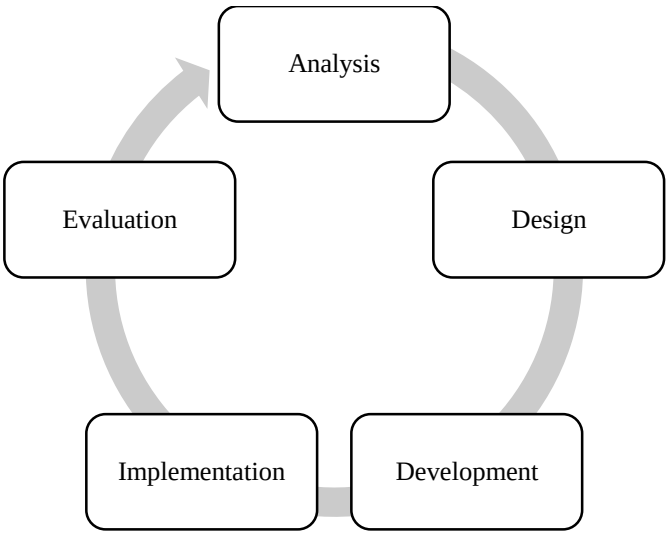

Fig. 1: ADDIE Model (Rossett, 1987)

2.2 Participants

Participants involves in this study were selected among teacher who taught RBT subject by using purposive sampling techniques. A total of five teachers are selected to be interviewed to find keyword on the challenges, resources, needs and instructional strategies which are needed in 2D simulation and AR module of electronic design topic. The optimal number of participants for qualitative research typically ranges from 1 to 3 for in-depth studies or 30 to 50 for broader investigations, depending on the research objectives (Creswell & Creswell, 2018). According to Markus (2021) studies, four samples of experts needed to be interviewed to gather the best information possible as it generates ideas to develop the module.

The need analysis is a must to develop a curriculum and syllabus in every course to align with concurrent changes of time (Dewi & Primayana, 2019). Therefore, the selected participants are well-versed in RBT subject which they have been teaching electronic design topic for over 3 years where they have experienced on issues and challenges on teaching electronic design topic in RBT subject. Simultaneously, they would know the needs in RBT subject based on the challenges faced by students and teachers in electronic design topic from their perspectives. Participants are allowed to give their perspectives on RBT issues related to electronic topic. They can also express their personal views on the issues as a support to develop 2D simulation and AR module in electronic design topic. Table 1 shows the summarisation on details of the research participants.

Table 1: Participants

Participants	Sex	Education Background (Major)	Minor	Experience in RBT Education
R1	Male	Bachelor's Degree (Honours) in Agricultural Science Education	Design and Technology	3 years
R2	Female	Bachelor's Degree (Honours) in Family and Consumer Science Education	Design and Technology	3 years
R3	Male	Bachelor's Degree (Honours) in Integrated Life Skills Education	Technical and Vocational	6 years
R4	Female	Bachelor's Degree (Honours) in Entrepreneurship and Commerce Education	-	8 years
R5	Female	Bachelor's Degree (Honours) in Integrated Life Skills Education	Technical and Vocational	8 years

2.3 Instrument

A set of semi-structured interview protocols template with set of questions will be organised and utilised by the researcher to gather raw data on 2D simulation and AR module needs as the research instrument. The researcher interview protocol was validated by three experts in RBT field which have experience as Final Semester Examination (UASA) drafters. According to Markus (2021), the semi-structured interview method was selected because it facilitates a through exploration of participants' experiences and emotions, enabling detailed data collection.

The interview protocol contained ten set of questions based in literature review by Khairul (2019), Galletta (2013), and Dahaman (2014). The interview session with participants will be conducted by using online platform such as Google Meet after making appointments based on teachers' availability with researcher. According to Whiting (2008) study, the

designated time for interview session with participants must be at least 30 minutes. However, some session lasted for an hour which depended on participants' responses. The interviews were audio recorded to assist the researcher with the transcription process (Whiting, 2008). The audio recordings were converted into text during the transcription process, and the resulting documents we sent back to the participants for reviews and validation (Whiting, 2008).

2.4 Data Analysis

The needs analysis study was collected from the raw data with document analysis support information gained (Cohen et al., 2007) in discovering students and teacher challenges in electronic design topic and needs of developing 2D simulation and AR module. The data was analysed manually from the adaptation of (Braun & Clarke, 2006) which contain six steps during the analysis. The help of experts' guidance was employed which they explained deeper on the process of each phase which ensured the thematic analysis was properly handled correctly. Table 2 shows the thematic analysis phase in the need analysis study of developing 2D simulation and AR module in electronic design topic of RBT subject.

Table 2: The thematic analysis of developing 2D simulation and AR module in electronic design topic

No	Phase	Process
1	Familiarizing data	Listen the recorded interview carefully and repeatedly while transcribe the conversation from audio to text. After that, read the text which had been transcribed repeatedly.
2	Generating initial codes	Code the highlighted point which is important in the text of the data systematically and collate them (pertinent data) systematically in a table.
3	Generating themes	Collate codes into the initiated themes by using theories of the research which will connect the codes to a specific and relevant theme. Next, the subthemes must be identified which as well connect to related codes.
4	Reviewing themes	The themes must be checked appropriately with both the coded extracts and the whole data set which will generate the analysis of the thematic map. Check whether the codes and themes are appropriate with experts.
5	Defining and naming themes	Keep analysing to fine-tune of specific code for each subtheme and the overall themes presented in the study which will generate clear definitions and names for each theme and subtheme.
6	Producing report	The analysis will be finalized from selected extracts by relating them to research questions and literature. After finalizing, the research will produce a scholarly report of the analysis.

Table 3 shows the codes collated of the identified subthemes and themes from interview transcripts with adaption of Discrepancy Model from McKillip (1987). The data from Table 3 was presented into thematic map with adaptation from Braun and Clarke (2006) which was discussed in the research findings section supporting by interview transcription.

Table 3: The codes collated of the identifies subthemes and themes from interview transcripts with the adaptation of discrepancy model (McKillip, 1987)

Themes/Definition	Subtheme generated from the transcripts	Codes generated form the interview transcripts
The overview and expectation in 2D simulation and AR module in electronic design topic in RBT subject. - The overview and expectation in 2D Simulation and AR module in electronic design topic in RBT subject refers to anticipation in RBT subject teachers' and students' performance level and hope (McKillip, 1987)	Challenges in electronic design topic	- The provision of teaching aids for electronic design topic is woefully inadequate. - Students grapple with comprehending the intricate concept of programming in electronic design topic. - Students struggle to correctly interconnect electronic components with the microcontroller the same as schematic sketches. - The internet connection at school is excruciatingly sluggish during T&L sessions. - Students find it exceedingly challenging to grasp symbol and schematic drawings. - Teachers lack adequate training of understanding programming language and electronics.

Themes/Definition	Subtheme generated from the transcripts	Codes generated form the interview transcripts
	Electronic design module resources	- Notes - Exercises - Experiment - Videos - 2D simulation - Augmented reality - Application
	Contents in electronic design module	- Symbol and schematic drawing process - Programming structure by using simulation process - Electronic circuit experiment build.
	Instructional strategy	- Flipped Classroom - 21st century learning style - Integrated digital learning and ICT in electronic design topic.

3. Findings and Discussion

The objective of the need analysis phase is to identify and analyse the challenges, and needs of developing 2D simulation and AR module in electronic design topic of RBT subject for form 2 students and teachers in secondary school. Fig. 2 shows the theme which denotes expectation in 2D simulation and AR module among students and teachers in secondary school.

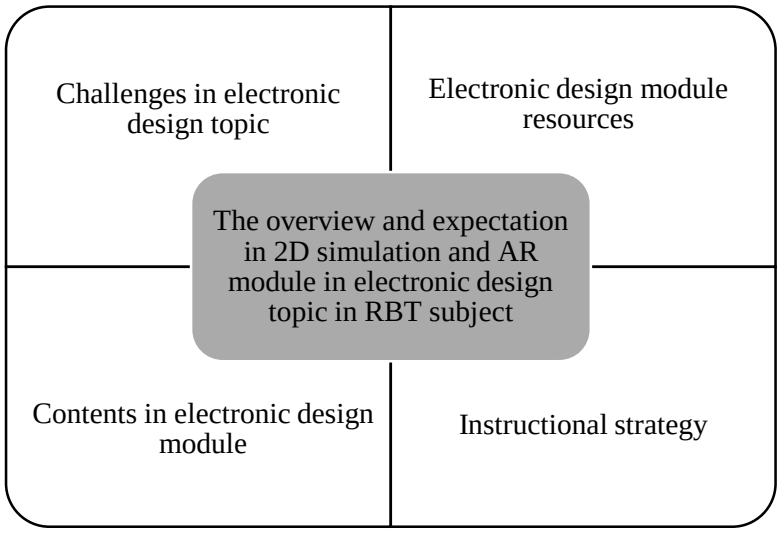

Fig. 1: The theme denotes the overview and expectation of developing 2D simulation and AR module in electronic design topic of RBT subject

Thus, the research questions were comprehensively analysed and answered through semi-structured interview which are:

a) What are the challenged faced by students and teachers during T&L session in electronic design topic?
b) What are the resources needed of developing 2D simulation and AR module in electronic design topic?
c) What are the important contents in electronic design topic needed in 2D simulation and AR module?
d) What are the appropriate instructional strategies which is suitable in electronic design topic during T&L session?

The theme emerged in the thematic analysis map which is the overview and expectation in 2D simulation and AR module in electronic design topic of RBT subject. This theme denotes four subthemes which are challenges in electronic design topic, electronic design module resources, contents in electronic design module, and instructional strategy. This theme indicates the overview of issues or challenges which were faced by students and teachers in electronic design topic during T&L session and the expectation of teachers and students which is needed in 2D simulation and AR module to enhance students' and teachers' competencies in electronic design topic of RBT subject. There are some RBT teachers admitted that they needed the module to assist students as a support to guide and teach them about electronic design topic.

3.1 Challenges in Electronic Design Topic

The first subtheme discussed about the challenges in electronic design topic faced by students and teachers from teachers' perspectives. There are three challenges among teachers in electronic design topic, which are the provision of teaching aids in electronic design topic is woefully inadequate, teachers lack adequate training of understanding programming language and electronics, and the internet connection at school is sluggish during T&L sessions. These statements discussed issued and challenges from teachers' competencies. Evidence noted by participants are as follows:

R2: "The internet in class so slow and cannot be used during lesson... There are some electronic items which is damaged that cannot be used in experiment... There was a student asking me on how to learn understand and learn about programming which makes me difficult to answer due to lack of programming knowledge."

R3: "The beginning of the topic, students have not faced any issues but when it comes to 2.4.3 until 2.4.8 subtopic, I am having difficulties of teaching students on how to make them understand because some students do not understand, and some does... There is no proper guidance on building electronic circuit... We do not have ways to teach students in sketching schematic... If the teachers understand well in the topic, they students wouldn't have any problem of understanding the topic."

R5: "The Magnetcode I need to buy new ones, because some Magnetcode for old version is undetected by the bluetooth ... Students cannot build electronic circuit from schematic drawing... The module which I use before this is too general about electronic which is not specific."

There are several studies which relates with teachers' competencies such as internet connection at school is sluggish during T&L sessions (Sufian et al., 2020; Lestari & Gunawan, 2020; Ating et al., 2020). The provision of electronic components in RBT topics effect the students and teachers T&L session. This was due to the damage of electronic components and fund in electronic design topic which lack of electronic components during T&L session and experiment. According to Achimugu (2017) study, teachers agreed factors of instructional materials that inhibit the effectiveness during T&L session which are insufficient funds to purchase instructional materials, high cost of instructional materials, absence of political determination from the current government, misuse of the funds intended for acquiring instructional materials, ineffective execution of educational policies. Other than that, teachers lack of training of understanding electronic topic with programming language which also can inhibit during T&L session as well. This would make the students hard to understand on how to deliver the knowledge among students which inhibit T&L process especially during experiment (Achimugu, 2017; Aburine, 2005).

There are three challenges among students' competencies from teachers' perspectives, which are students hard to understand the concept of electronic topic with programming language in electronic design topic, students struggle to visualise and build electronic circuit correctly with interconnection between electronic components and microcontroller based on schematic drawing, and students find it difficult and challenging to remember symbol and schematic drawings of electronic components.

R1: "Students do not understand programming language for each electronic components... Electronic components connect between Arduino and breadboard, they could not see."

R2: "Last day, there was a student complains about programming where he/she doesn't know how to read and remember the function of each programming... The same goes for sketches, students find it difficult to remember and draw symbols a schematic diagram... Students also struggles to make a proper connection between electronic components with Arduino."

R4: "Students hard to build a circuit and connect the electronic components on Arduino... If students only did the schematic drawing, the students wouldn't understand without simulation."

R5: "Simulation subtopic, students find it hard to connect the components between Magnet code, they tend to forget electronic symbol, which makes them hard to understand... They find it hard to understand and forget the coding of each electronic components, such as analog, digital input, and digital output."

There are students hard to understand the concept of electronic topic with programming language in electronic design topic is one of the challenges faced by students. The misconception of programming may lead to faulty of understanding electronic design topic. According to Qian & Lehman (2017) systematic literature review, students always having difficulties on understanding conceptual knowledge of programming language. They tend to make errors on basic mechanics in programming language. The key to understand of programming languages are variables of every component in computer programs (Qian & Lehman, 2017) on every electronic component. Other than that, students also struggle to visualize and build electronic circuit correctly with interconnection between electronic components and microcontroller based on schematic drawing. A research gap from Sung et al. (2019) founded out that study is mainly focuses on cognitive strategy which is used to guide students on sketching circuit to build a circuit for problem-solving which did not require building an actual circuit prototype based on the circuit sketches. Students also find it difficult to remember symbol and

schematic drawings in electronic design topic. A study from Ridgway & Cox (2024) founded out that students could not differentiate the arrangement of circuit diagrams. The study also shows that students wanted the diagrams to be labelled with names which makes the students easier two differentiate. This would not allow students to visualize and remember the symbol of electronic components. Therefore, these issues and challenges which were faced by students and teachers must be solved urgently to enhance both students' and teachers' competencies about electronic design topic.

3.2 Electronic Design Module Resources

The second subtheme discussed about resources or elements which needed in the module for students and teachers from teachers' perspectives. The resources needed in the module are notes, exercises, experiments, videos, 2D simulation, AR, and application are important resources to be included into the module. This statement shows that the resources and elements of the module is needed to designed as follows to solve challenges of students and teachers in electronic design topic. Evidence noted by participants are as follows:

R1: "For me, experiment because notes they can get through textbook, but if experiment, they don't understand through textbook... I always teach students based on textbook and then give them random exercises which will be discussed next class."

R2: "Notes is a must, they will know electronic theories. Experiment is important as well because if students only know about theory and didn't explore deep future such as building circuit, it is not good for them. We can find exercises from any module to ensure they understand the topic or not."

R3: "I would prefer notes and theory T&L process, implemented into experiment... I always give them exercise in class."

R4: "Notes, exercises, and experiment need to have in the module... Students can do first at home about the experiment because they all know what they need to install and apply."

R5: "Exercises and experiment are important in the module... They can apply the knowledge through experiment by their own... I can measure students' understanding on the topic through exercises."

The notes, exercises, and experiments are needed to be in the module. The development of e-module from Hamid et al. (2021) shows that notes, and assessments are needed to be included in the module. The notes were designed by using Microsoft PowerPoint with the content of two references book. Exercises will be provided for each topic in every subject (Hamid et al., 2021) which enables to help students' self-monitoring (Zhu & Bonk, 2019) of understanding each topic in the courses. According to Joyce et al. (2013) study, hands-on practical module can increase students' enjoyment and understanding deeper about the knowledge. Therefore, the experiment of electronic circuit must be included into the module which helps the students to motivate more and understand deeper about electronic design. Other evidence also noted by participants which are:

R1: "2D simulation such as Thinkercad which have various kinds of electronic components that can be used... We can use AR as well during project if it is in the module."

R2: "I use AR before this but under mechanical topic. Surprisingly, students can understand with the help of AR... Students can get access of the application in computer."

R4: "The resource of the module must contain videos to guide students and teachers to use the module... Module application can be accessed anywhere by students and teachers such as at home."

R5: "I teach students by using simulation... AR is suitable in electronic design because it gives visualize the reality of electronic components, the students can explore more from AR."

The videos, 2D simulation, AR, and application are important to be included into the module for them to learn more about the knowledge with easy access virtually. A study from Hamid et al. (2021) also included videos into the e-module during development phase. The videos enhance their understanding one subject which is easy to understand (Nabayra, 2020). Technologies nowadays can enhance T&L process (Lai & Bower, 2019) such as 2D simulation, AR, and application. A study from Abburi et al. (2021) shows positive feedback from students where the students find out 2D simulation helps them memorise and it is easy to stimulate the circuit. A study of experimental research from Lin et al. (2013) shows a significant difference of students' achievements between AR simulation and 2D simulation in pre-test and post-test results. According to the tests both AR simulation and 2D simulation had positive change and impact in post-test rather than pre-test. This is because the AR can visualise students more in details which is in 3D object that can be seen in real world through smartphone. A study from Radu (2014) stated visualisation of students is strong with 2D simulation and AR simulation. Therefore, the electronic design topic needed and AR to make sure that students can understand more in details by visualising the object of the electronic project in the module. An application can help students to get access anywhere and anytime. According to Lai & Bower (2019), the AR application does help students

to motivate more in learning. Therefore, notes, exercises, experiments, videos, 2D simulation, AR, and application are needed to be in the module which contains both traditional or vocational resources with integrated technology resources. Thus, the students and teachers would be convenient learning electronic design topic both vocationally and virtually.

3.3 Contents in Electronic Design Module

The third subtheme discussed about the contents of electronic design which needed in the module among students and teachers from teachers' perspectives. There are three contents which needed in the module which are symbol and schematic drawing process, programming structure by using simulation process, and electronic circuit experiment build. This statement shows that the contents of electronic design topic in the 2D simulation and AR module to solve challenges of students and teachers. Evidence noted by participants are as follows:

R1: "I use Arduino Uno in my lesson… A lot of my reference came from textbook. I want the module to content experiment procedure on how to build electronic circuit."

R2: "Programming structure needed to be included into the module when it will be needed when build a circuit."

R3: "Arduino is the one that I use… The process of building electronic circuit must be explained detailed."

R4: "I use Arduino… The module must explain a process on how to sketch, what are the steps... Explain more details on the process of building circuit by simulation."

R5: "Students must refer to textbook to understand about electronic circuit... All textbooks contents which contain a lot of diagrams… I use Magnetcode to build circuit."

The contents of electronic design module such as symbol and schematic drawing process, programming structure by using simulation process, and electronic circuit build must be included into the module. This is due to the lack of students' understanding about the knowledge of electronic design topic. The content of the module must fully follow Form 2 RBT Textbook which was written by Rahman et al. (2017) which is align with Curriculum and Assessment Standard (DSKP) of RBT. The students need to achieve every mastery level in RBT topics especially in electronic design topic. However, there are some participants prefer Arduino which does not included or explained in detail according to the textbook. According to Mahardika (2020), Masuwai et al. (2013), and Asri (2017) explained that students and teachers seek more information through textbook because it had been aligned with DSKP needs. Therefore, the symbol and schematic drawing process, programming structure by using simulation process, and electronic circuit experiment build for both Arduino and Magnetcode microcontroller used will be implemented into the module.

3.4 Instructional Strategy

The fourth subtheme discussed about the appropriate instructional strategy of teachers to teach students in electronic design topic to develop better module. There are three appropriate instructional strategies which can be used through the module which are Flipped Classroom, 21st century learning style, and integrated digital learning and ICT in electronic design topic. This statement shows that the appropriate instructional strategies are needed to be included into the module which can solve the challenges in electronic design topic. Evidence noted by participants are as follows:

R1: "I always teach students based on textbook... I show them real electronic components and explain it to them... I use Thinkercad website to teach students about simulation of electronic design... I think website is the most suitable platform to teach students... Some exercises, I ask them to answer at home and discussed the next following day."

R2: "I use 21st century learning which focused more on student-centred learning which will make them active such as Gallery Walk, Think and Pair, and others... I just show them through videos due to damage and lack of electronic components... I use guide students use Thinkercad on how to build electronic circuit by simulation... I want them to explore first about what I'm about to teach in next class, where we will all discuss together."

R3: "I teach students deeper about building a product... I use Thinkercad to teach students on how to connect between electronic component in a system... I use Youtube application as a guidance to teach students in class."

R4: "I always use textbook as main resources or contents to teach students... I use SimuIDE software to guide students on how to build electronic circuit."

R5: "I use all application, videos, modules, and software to teach students... I always give them exercises at home and discussed during experiments... I use Magnetcode application for Magnetcode microcontroller... Students always understand when I give diagrams... I love to use slide when it comes to teaching students which is convenient, and I have access to."

According to participants' interview transcription, there are three types of instructional strategies which can be implemented into the module that are Flipped Classroom, 21st century learning style, and integrated digital learning and ICT in electronic design topic. The Flipped Classroom can be used in exploration of T&L style where students need to explore the answer in the module through videos or textbook which will be discussed with teachers in the next class. A study of Flipped Classroom model from Nabayra (2020) helps the students and teachers to get flexible and sufficient of T&L process. The 21st century learning style with various kind of activities which includes collaborative learning such as group presentation and competitive games among students. The integrated digital learning and ICT such as 2D simulation, AR, and application will be applied in T&L session with related theories such as Connectivism, Multisensory Learning and Cognitive Theory of Multimedia Learning Theories. According to Morad (2009), the teachers need to use various kind of T&L methods which help the students to remember names, symbols, and functions of electronic components. The changes of attitudes of each student will avoid boresome during T&L session. Thus, there are various kind of T&L methods or instructional strategy can lead to the effectiveness of students' achievements which leads to better understanding of students in electronic design topic.

4. Conclusion

The education system nowadays has fulfilled the desire of human to integrate advance technology in it. RBT subject is one of the subjects where the students must create and innovate products with the use of technology. However, some issues occurred by students and teachers where students have not yet to master the skill of visualisation and programming in electronic topic while teachers have not yet to master the skill of electronic technically and to teach students in creative ways. Therefore, this article focuses more on needs analysis where the researcher will identify and analyse the challenges and the needs of students and teachers in electronic topic. The research design of this study is a qualitative approach where a module development occurred with the help from ADDIE Model approach. During need analysis phase, the researcher had chosen by using purposive sampling method where five RBT teachers with at least 3 years of experience teaching RBT subject in electronic design topic. The interview session will be conducted during the availability of teachers for at least 30 minutes through Google Meet. The finding of the research has supported the needs for the development of 2D simulation and AR module in T&L process of electronic design topic in secondary school. The development of the module provides students and teachers, acquiring deep knowledge and skills about electronic design topic based on two types of microcontrollers which are Arduino and Magnetcode. The research findings emphasise a thematic map which address as a theme and four subthemes. The theme of the finding is the overview and expectation in 2D simulation and AR module in electronic design topic in RBT subject which discussed four type of subthemes that are challenges in electronic design topic, electronic design module resources, contents in electronic design module, and instructional strategies. All subthemes are discussed with the support of interview transcriptions, and some past research. The development of 2D Simulation and AR module in T&L process of electronic design topic are all responsive to students' and teachers' needs which emerges as a viable solution to close existing gaps in the educational system. Overall, the research supports a holistic approach to educational development, aligning curriculum standard based on DSKP and textbook, promoting innovation of new teaching styles, and utilizing modern technologies to enrich T&L environment for both students and teachers.

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