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Development of 21st Century 4C Skills E-Module for Zhumadian Vocational and Technical College Students

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Abstract: The 4Cs, consisting of communication, collaboration, critical thinking, and creativity, refer to 21st century skills that need to be applied in a variety of situations. Furthermore, 21st century skills are essential in today's global marketplace. China needs to learn from new experiences of educational reform in other countries. The aim of this study is to develop an e-module of 21st century 4C skills (communication, collaboration, critical thinking, and creativity) for students at Zhumadian Vocational and Technical College. This study will use the modified ADDIE model for the development of the 4C skills e-module. 5 experts and 218 lecturers were selected as a sample for the study. The experts filled in the expert evaluation form to evaluate the functionality of the e-module and the lecturers filled in the questionnaire form to evaluate its usability, and three experts ensured the validity of the expert evaluation form and the questionnaire. SPSS 26.0 was used for data analysis to evaluate the e-module. The results of this study showed that five experts considered the e-module to be highly functional in terms of format, content, language, media display and interactivity. The 218 lecturers who participated in the questionnaire also found the e-module highly functional in terms of usability, ease of use, attractiveness, and clarity. At the same time, experts and lecturers agreed that the e-module is an effective learning material that can have a positive and effective impact on students' learning of the 4C skills.

Keywords: 4C skills, 21stcentury skills, learning module

1. Introduction

Malaysia, USA, Singapore and Canada, as well as international organizations such as the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the Organization for Economic Co-operation and Development (OECD), have developed their own 21st century skills frameworks to promote 21st century skills reforms in national policy or local practice, and to develop human resources with high-level skills or competencies for the 21st century to participate in global economic competition. Their experience in developing the 4Cs of 21st century skills is therefore worth learning from. In the era of globalization, education must be oriented to the world. Educational institutions must be able to innovate to help students acquire the skills they need for the 21st century (Redhana, 2019; Bialik & Fadel, 2015). The challenge for schools is to find new ways for students to succeed in work and life through the acquisition of critical thinking, adaptive problem solving, collaboration, and innovation skills (Kipper et al., 2021).

Malaysia's Ministry of Education (MOE) began implementing 21st Century Learning (*Pembelajaran Abad Ke-21 – PAK21*) in the first half of 2014. According to Stone and Deadrick (2015), in order to face the challenges of globalization, Malaysians need a rigorous education in a wide range of basic skills in the field with a wide range of generic skills, including communication skills, mastery of multiple languages, critical thinking and innovation. It is emphasized that the

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acquisition of 21st century skills in the Learning and Easy Ways (*Pengajaran dan Pemudahcaraan – PDPC*) method should start with the application of 21st century-skills building. Most of the research works on the design and development of the 4C skills curriculum in China are still in the exploratory stage, and most of the research works focused on the adaptation of traditional curriculum or the teaching practice of creative curriculum (Zhan & Chen, 2021; Zhan et al., 2021; Wahidmurni et al., 2019; Druzhinina et al., 2018). So that, the research works on the design and development of 4C skills in China are limited, especially the design and development of modules for the development of 4C skills in the 21st century. Therefore, it is necessary to develop the 4C skills modules (communication, collaboration, critical thinking, and creativity) for the students of the 21st century.

The PAK21 approach is considered to meet the needs of today's education. This is because it produces excellent human capital from all aspects. PAK21 is a student-centered process. Various elements are applied in this learning process. According to Idris (2010), teachers today need to have certain skills. The skills for the 21st century are critical, with teachers prioritizing skills such as creativity and innovation, critical thinking and problem solving, collaboration, and communication about other content (Ningsih & Jha, 2021; Haryani et al., 2019). The elements of 21st century education include the 4Cs: communication, collaboration, critical thinking, and creativity. The application of these elements will help to improve the quality of students, which in turn will generate excellent human capital and create a quality workforce. World education trends have shifted to a clearer focus on 21st century skills or cross-cutting competencies (Esther Care, 2017). Learners must learn essential skills for success in today's world, such as critical thinking, problem solving, communication, and collaboration (Kartimi et al., 2021).

Module teaching methods can reduce the learner's dependence on other individuals in their learning or called self-instructional (Sow, 2007). Referring to Rahayu and Sukardi (2020), modules have great potential in the development process. Thus, to realize this potential, the development of modules has been enhanced over time so that existing modules are readily developed and updated. According to Shaharom and Yap (1993), one way to overcome problems or limitations is to individualize instruction by modifying materials and learning activities to suit students' abilities based on the differences in their interests, attention spans, and pace of gathering information. In addition, students can independently redevelop what they want to know in order to gain some knowledge, make decisions, and develop more positive values. The use of modules in the learning process can help students learn and have an impact on improving learning outcomes (Ahdhianto & Santi, 2020; Suryawati & Osman, 2017). The use of e-modules for learning can make lecture material more accessible to students (Darwin & Ahyanuardi, 2020). However, as of now, no teachers at the Zhumadian Vocational and Technical College use e-modules to assist in teaching.

Therefore, the use of sensory skills modules is ideal for helping students at vocational colleges. For students at Zhumadian Vocational and Technical College, modules can be used as a guide and reference to implement more effective learning activities. In this study, preliminary research work was conducted on the aspects of 21st century 4C skills for students at Zhumadian Vocational and Technical College. An online questionnaire survey was conducted with the participation of lecturers at six secondary colleges of Zhumadian Vocational and Technical College. A total of 218 valid questionnaire forms were collected (168 males and 50 females). The data was analyzed and the 4C skills are very important to students at Zhumadian Vocational and Technical College. Students are more aware of the components of the 4C skills but have difficulties in mastering them and need to learn them, and there is a need to develop e-modules to help lecturers engage students and better understand mastery of the 4C skills.

Based on the background of the problem and previous literature, it was found that students had problems with the acquisition of communication, collaboration, critical thinking and creative skills. Interviews with instructors revealed the need to develop an e-module. The e-module could help instructors plan their teaching activities. Currently, there are no lecturers at the Zhumadian Vocational and Technical College who have developed and used the e-module to assist in teaching. In this regard, there is therefore a need to develop a 21st century 4C skills e-module as a reference to assist educators and students in the successful teaching and learning process. the implementation of the 4C skills can enhance students' confidence in dealing with society and even prepare them for their future careers. The e-module can provide students with guidance to help them use these skills effectively and develop self-help learning. These positive impacts can help the education system to produce well-rounded and competitive graduates in the era of the Industrial Revolution 4.0.

This study aims to develop 21st Century 4C Skills (Communication, Collaboration, Critical Thinking, and Creativity) e-module for Zhumadian Vocational and Technical College Students. The objectives of this study are as follows: 1) investigate the components of 21st century 4C skills for students at Zhumadian Vocational and Technical College; 2) development of an e-module of 21st century 4C skills for students at Zhumadian Vocational and Technical College; 3) evaluate the functionality of the 21st century 4C skills e-module for students at Zhumadian Vocational and Technical College; and 5) to assess the usability of the 21st century 4C skills e-module for students at Zhumadian Vocational and Technical College.

2. Methodology

The e-module's framework was developed by modifying the five phases of the ADDIE design model into three phases, which are analysis, design, and development phases. This ADDIE model was chosen because it has a clear hierarchy and facilitates the implementation and development of modules (Manan et al., 2010). Fig. 1 depicts the methodological

process for the development of the 21st century 4C skills e-module for students at Zhumadian Vocational and Technical College.

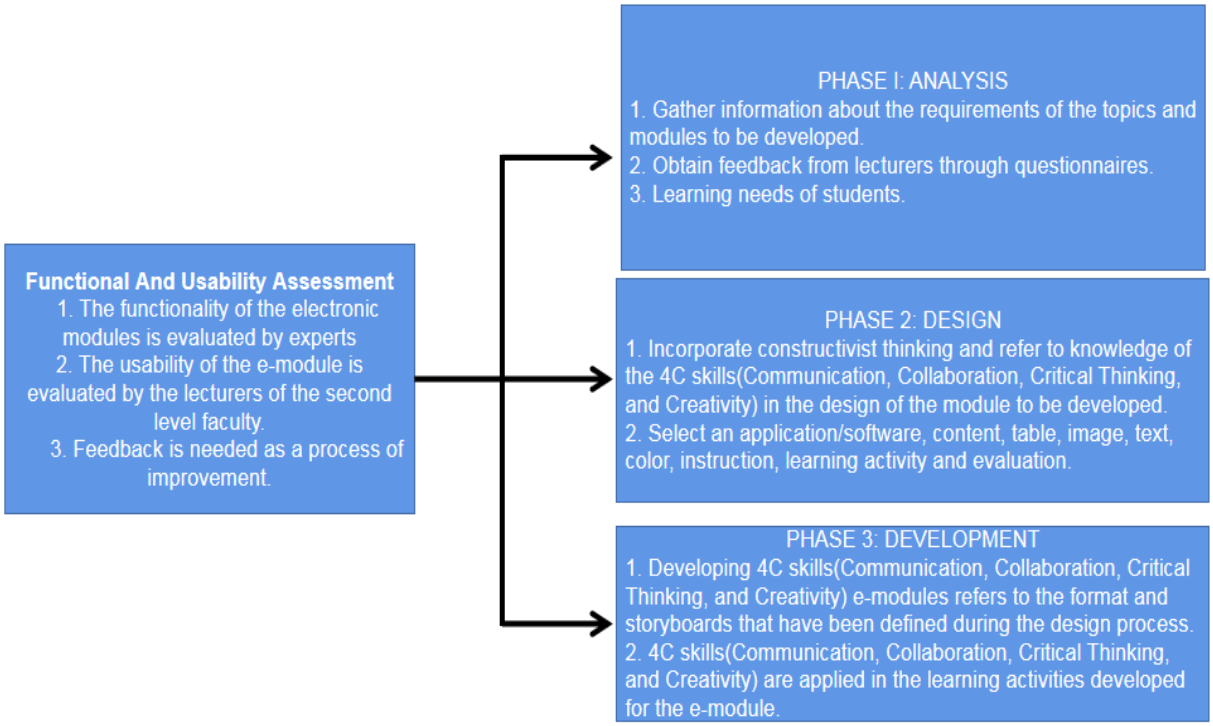

Fig. 1: E-module development's methodology flow

3.1 Analysis Phase

Past research works were reviewed and analyzed, and it was found that the 4C skills of the 21st century are essential skills for today's global job market. It is very important for students to acquire the 4C skills for the 21st century. Schools and other educational institutions need to help students master the 4Cs for the 21st century and find new ways for students to succeed in work and life. However, teachers are still teaching their courses by conventional means, usually using handwritten slates or with the help of PowerPoint presentations, which are not sufficient in engaging students. E-modules have the advantages of being easy to learn, relevant, and attractive, but up to now, no teachers at Zhumadian Vocational and Technical College use e-modules to assist in teaching.

In addition, preliminary research work was conducted by using an online questionnaire to examine the learning needs of 4C skills based on the responses from the lecturers at six secondary colleges of Zhumadian Vocational and Technical College. The results of the mini study showed that students have difficulties in learning the 4C skills, which are communication, collaboration, critical thinking, and creativity. The results of the analysis of the questionnaire provided important data to inform the design of the course content.

3.2 Design Phase

The design phase involved the design of the e-module based on the 4Cs and the application of learning theories involving the constructivist theory and e-module components, including content design, interaction, and interface presentation. According to Mohamad (2021), interface, content, and interaction designs are the three main aspects to be emphasized in the design of online learning developed through computer programs or software applications. The process used to generate interfaces that enable effective use of the cognitive load is an important aspect of interface design. Also, identifying appropriate learning and teaching theories to make the learning experience meaningful is a central theme of content design. For interaction design, the behavior of the application needs to be predictable and usable. A good interaction design has features that are easy to use, efficient, secure, easy to learn, and easy to recall. In this phase, a storyboard was provided as an e-module development guide, covering key units such as content, topics, learning activities, media, notes, and assessments. The content of the e-module was based on expert feedback and the literature review.

3.3 Development Phase

In this phase, the process of building the e-module content will be completed, i.e., preparing interactive notes, selecting videos, conducting learning activities, applying 4Cs, and evaluating activities. All e-module content will be stored in a storage site provided by the chosen Web 2.0 technology. The content of the e-module will first develop based on the storyboard set in Phase 2. The 4C skills and the constructivism learning theory are important components in developing the e-module to meet the pedagogical approach and its objectives. In addition, the website Google Sites was chosen as the main medium for the development of the e-module because it works across Google's operating systems and has the flexibility to operate with other web applications. Users can also access the same data from multiple operating platforms at any time and from anywhere via their computers or cell phones.

3.4 Evaluation of the Functionality and Usability of the E-Module

The evaluation of the functionality and usability of the e-module was conducted through an expert evaluation form and a user questionnaire (Liu, 2016). The expert evaluation form was used for the functionality assessment and the data results collected included Part A, i.e., demographics, and Part B, i.e., format, content, language, media display, Interactivity. The data results used for the usability assessment included Part A, i.e., respondent demographics, and Part B, i.e., usability, ease of use, attractiveness, clarity. the obtained evaluation results were used to improve the developed e-module.

3. Results and Discussion

4.1 Functionality

The data obtained by the researchers were analyzed and displayed in numerical and percentage (%) form. The following are the results of the data analysis of the respondents' assessment of the functionality of the electronic modules, covering format, content, language, media display, Interactivity.

4.1.1 Format of the E-Module

Table 1 shows the results of the analysis obtained through expert feedback on the design of the e-module format. Five items were involved to assess the functionality of the e-module format design. The data shows that all respondents (100%) agree that the developed e-module has a high level of functionality in terms of format.

Table 1: Frequency and percentage of expert evaluations of electronic module format design

4 = Very agree **3 = Agree** **2 = Disagree** **1 = Very disagree**		**Disagree**				**Agree**			
		VD (1)		**D (2)**		**A (3)**		**VA (4)**	
		No	**%**	**No**	**%**	**No**	**%**	**No**	**%**
1	Clarity of instructions for use	0	0	0	0	1	20	4	80
2	Content conformity on material	0	0	0	0	1	20	4	80
3	The suitability of colors on module learning media	0	0	0	0	2	40	3	60
4	The suitability of images on module learning media	0	0	0	0	3	60	2	40
5	The suitability of text material on module learning media	0	0	0	0	2	40	3	60
	Overall average	0	0	0	0	2	40	3	60

4.1.2 Content Design of the E-Module

Table 2 shows the results of the analysis obtained through expert feedback on the content design of the e-module. Four items were involved to assess the functionality of the content design of the e-module. The data shows that all respondents (100%) agree that the developed e-module is highly functional in terms of content design.

Table 2: Frequency and percentage of expert evaluations of electronic module content design

4 = Very agree 3 = Agree 2 = Disagree 1 = Very disagree		Disagree				Agree			
		VD (1)		D (2)		A (3)		VA (4)	
		No	%	No	%	No	%	No	%
1	Conformity of learning activities with e-module learning media on 4C	0	0	0	0	2	40	3	60
2	Clarity of concepts of learning activities with e-module learning media on 4C	0	0	0	0	1	20	4	80
3	Conformity of animation in e-module learning media with the concept of 4C learning activities	0	0	0	0	2	40	3	60
4	Clarity of animation in conveying the concept of 4C learning activities with e-module learning media	0	0	0	0	1	20	4	80
	Overall average	0	0	0	0	1	20	4	80

4.1.3 Language of the E-Module

Table 3 shows the results of the analysis obtained through expert feedback on the linguistic aspects of the electronic module. Five items were involved to assess the functionality of the linguistic aspects of the electronic modules. The data shows that all respondents (100%) agree that the developed electronic modules are highly functional in terms of language.

Table 3: Frequency and percentage of expert evaluations of the language of the e-module

4 = Very agree 3 = Agree 2 = Disagree 1 = Very disagree		Disagree				Agree			
		VD (1)		D (2)		A (3)		VA (4)	
		No	%	No	%	No	%	No	%
1	The use of standard language	0	0	0	0	2	40	3	60
2	Ease of understanding the language used	0	0	0	0	2	40	3	60
3	The effectiveness of the sentences used	0	0	0	0	1	20	4	80
4	Complete sentences/information needed by students	0	0	0	0	1	20	4	80
5	Word usage in accordance with enhanced English spelling system	0	0	0	0	1	20	4	80
	Overall average	0	0	0	0	1	20	4	80

4.1.4 Media for the E-Module

Table 4 shows the results of the analysis obtained through expert feedback on the media aspects of the electronic module. Seven items were involved to assess the functionality of the media aspects of the e-module. The data shows that all respondents (100%) agree that the developed electronic modules are highly functional in terms of media.

Table 4: Frequency and percentage of expert evaluations of the electronic module media

4 = Very agree 3 = Agree 2 = Disagree 1 = Very disagree		Disagree				Agree			
		VD (1)		D (2)		A (3)		VA (4)	
		No	%	No	%	No	%	No	%
1	Simple display of text on e-module learning media	0	0	0	0	2	40	3	60
2	The design of the e-module learning media display is easy to understand	0	0	0	0	1	20	4	80
3	The use of text in the e-module learning media is in accordance with the characteristics of students	0	0	0	0	3	60	2	40
4	The colors used in the e-module are suitable for learning	0	0	0	0	1	20	4	80
5	The images used in the e-module are suitable for learning	0	0	0	0	2	40	3	60
6	Neatness of e-module learning media	0	0	0	0	2	40	3	60
7	Suitable navigation button layout	0	0	0	0	1	20	4	80
	Overall average	0	0	0	0	2	40	3	60

4.1.5 Interactivity of the Electronic Module

Table 5 shows the results of the analysis obtained from the expert feedback on the Interactivity aspects of the electronic modules. Four items were involved to assess the functionality of the electronic module in terms of Interactivity. The data shows that all respondents (100%) agree that the developed electronic modules are highly functional in terms of interactivity.

Table 5: Frequency and percentage of expert evaluations of electronic module Interactivity design

4 = Very agree 3 = Agree 2 = Disagree 1 = Very disagree		Disagree				Agree			
		VD (1)		D (2)		A (3)		VA (4)	
		No	%	No	%	No	%	No	%
1	Ease of use	0	0	0	0	1	20	4	80
2	Use of navigation buttons	0	0	0	0	1	20	4	80
3	Ease of operation	0	0	0	0	2	40	3	60
4	Operation of all components	0	0	0	0	2	40	3	60
	Overall average	0	0	0	0	1	20	4	80

4.2 Usability

The data obtained by the researcher was analyzed and presented in numerical and percentage (%) form. The following are the results of the data analysis of the user respondents' assessment of the functionality of the electronic modules, covering the aspects of usability, ease of use, attractiveness, clarity.

4.2.1 Usability of the Electronic Modules

Table 6 shows the results of the analysis obtained through user feedback on the usability of the e-module. Eight items were involved in assessing their usability. The data shows that all respondents (100%) agree that the developed e-module has a high level of usability in this respect.

Table 6: Frequency and percentage of user evaluations of the developed electronic module usability

4 = Very agree 3 = Agree 2 = Disagree 1 = Very disagree		Disagree				Agree			
		VD (1)		D (2)		A (3)		VA (4)	
		No	%	No	%	No	%	No	%
1	Module can increase the independence of learners in learning	0	0	0	0	50	23	168	77
2	Module in being able to transfer knowledge well so that teaching materials are easily understood by learners	0	0	0	0	42	19	176	81
3	Module can help educators / teachers to deliver learning contents	0	0	0	0	29	13	189	87
4	Module developed can add insight to readers (educators and learners)	0	0	0	0	38	17	180	83
5	The module can help teachers motivate students in learning	0	0	0	0	57	26	161	74
6	Modules can help educators in encouraging learners' courage in achievement	0	0	0	0	66	30	152	70
7	Worksheets on Module can direct learners on 4C learning activities	0	0	0	0	20	9	198	91
8	Evaluation questions mastery tests on Module can train students' 4C mastery	0	0	0	0	28	13	190	87
	Overall average	0	0	0	0	41	19	177	81

4.2.2 Ease of Use of the Electronic Module

Table 7 shows the results of the analysis obtained from the user feedback on the ease of use of the electronic module. Eleven items were involved to assess their usability. The data shows that all respondents (100%) agree that the developed electronic modules have a high level of usability in this respect.

Table 7: Frequency and percentage of developed electronic modules ease of use user evaluations

4 = Very agree 3 = Agree 2 = Disagree 1 = Very disagree		Disagree				Agree			
		VD (1)		D (2)		A (3)		VA (4)	
		No	%	No	%	No	%	No	%
1	The use of module in the learning process can save time	0	0	0	0	43	20	175	80
2	The use of module in the learning process can be utilized effectively	0	0	0	0	36	17	182	83
3	The use of language on module is easy for learners to understand	0	0	0	0	27	12	191	88
4	The presentation of materials on module is clear	0	0	0	0	99	45	119	55
5	The presentation of materials on module is simple	0	0	0	0	106	49	112	51

Table 7: Frequency and percentage of developed electronic modules ease of use user evaluations (Continued)

4 = Very agree 3 = Agree 2 = Disagree 1 = Very disagree		Disagree				Agree			
		VD (1)		D (2)		A (3)		VA (4)	
		No	%	No	%	No	%	No	%
6	The presentation of exercises on module is clear	0	0	0	0	72	33	146	67
7	The presentation of exercises on module is simple	0	0	0	0	122	56	96	44
8	The modules are practical because it can be stored	0	0	0	0	88	40	130	60
9	Modules are easy to carry because it fits into a small compartment	0	0	0	0	63	29	155	71
10	Module is practical to use repeatedly as needed	0	0	0	0	76	35	142	65
11	Module is easy to use repeatedly as needed	0	0	0	0	48	22	170	78
	Overall average	0	0	0	0	71	33	147	67

4.2.3 Attractiveness of the Electronic Module

Table 8 shows the results of the analysis obtained from the user feedback on the attractiveness of the electronic module. Six items were involved to assess their usability. The data show that all respondents (100%) agree that the developed e-module has a high level of usability in this respect.

Table 8: Frequency and percentage of user evaluations of developed electronic modules attractiveness

4 = Very agree 3 = Agree 2 = Disagree 1 = Very disagree		Disagree				Agree			
		VD (1)		D (2)		A (3)		VA (4)	
		No	%	No	%	No	%	No	%
1	The design of the module is eyes catching	0	0	0	0	96	44	122	56
2	The appearance of the module is very attractive	0	0	0	0	56	26	162	74
3	The description of the material on the module is equipped with appropriate images	0	0	0	0	83	38	135	62
4	The description of the material on the module is equipped with appropriate illustrations	0	0	0	0	45	21	173	79
5	The type of writing (font) on the module can be clearly read	0	0	0	0	130	60	88	40
6	The selection and color combination used in the module is fascinating	0	0	0	0	19	9	199	91
	Overall average	0	0	0	0	71	33	147	67

4.2.4 Clarity of the E-Module

Table 9 shows the results of the analysis obtained from the user feedback on the clarity of the electronic module. Seven items were involved to assess its usability. The data shows that all respondents (100%) agree that the developed e-module has a high level of usability in this respect.

Table 9: Frequency and percentage of developed e-module clarity user evaluations

4 = Very agree 3 = Agree 2 = Disagree 1 = Very disagree		Disagree				Agree			
		VD (1)		D (2)		A (3)		VA (4)	
		No	%	No	%	No	%	No	%
1	The image displayed in the module is clear	0	0	0	0	49	22	169	78
2	The objectives to be achieved in the module are clear	0	0	0	0	66	30	152	70
3	The instructions for the use of module are clear	0	0	0	0	55	25	163	75
4	The font type on the e-module is clearly read	0	0	0	0	73	33	145	67
5	The description of the material on module is clearly presented	0	0	0	0	96	44	122	56
6	The activities on module are clearly presented	0	0	0	0	133	61	85	39
7	The worksheets on module are clearly presented	0	0	0	0	30	14	188	86
	Overall average	0	0	0	0	72	33	146	67

4.3 Overall Comparative Analysis

Table 10 shows the comparison of the percentages of experts and users for overall functionality and usability based on the aspects evaluated in this e-module. The analysis shows that in terms of functionality, experts gave higher ratings in terms of language, content and interactivity. In terms of usability, users gave full approval in terms of usability. Overall, the e-module shows a relatively high level of functionality and usability.

Table 10: Comparative percentages of whole aspects assessed

Project		Aspects of evaluation	Frequency and percentage			
			Agree		Very agree	
			No	%	No	%
Functionality	1	Format	2	40	3	60
	2	Content	1	20	4	80
	3	Language	1	20	4	80
	4	Media display	2	40	3	60
	5	Interactivity	1	20	4	80
Overall functionality			**1**	**20**	**4**	**80**
Usability	1	Usability	41	19	177	81
	2	Ease of use	71	33	147	67
	3	Attractiveness	71	33	147	67
	4	Clarity	72	33	146	67
Overall usability			**64**	**29**	**154**	**71**

4. Conclusion

The results of the study show that the developed e-module has met all four of the intended research questions. The interviewees, consisting of experts and users, also cooperated well in providing the necessary feedback. The overall evaluation provided positive feedback on the developed e-module in terms of functionality and usability. In addition, the choice of the ADDIE development model was also considered to be helpful to the researchers in the development of the e-module as one of the mediums of instruction and as a teaching aid that is systematic, attractive and influential to the users. e-Module as a whole fulfils the 4Cs of learning through the application of the 4Cs of knowledge in the learning activities of the students. It is agreed that it helps learners in the teaching process and in turn engages them in their learning. Thus, the e-module not only benefited the lecturers but also had a positive impact on students' learning. Future research could consider the following observations and recommendations: The quality of the e-modules should be further improved; Further expand the scope of the study.

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