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MARI BELAJAR MENGURUS MASA DAN WANG (MBMMW) COURSEWARE FOR TABIKA KEMAS: TOWARDS PROMOTING ACTIVE LEARNING AMONG YOUNG CHILDREN

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Abstract:

Nowadays, the use of web-based multimedia courseware encompasses all learning stages, especially among children. As an effort to assist teachers in promoting active learning among the children, Mari Belajar Mengurus Masa dan Wang (MBMMW) courseware is developed based on Tabika KEMAS core syllabus for mathematics focusing on money and time management. Proper interactive contents that include various activities and videos were provided in the courseware as the teaching and learning (T&L) aid for teachers, parents and students. Since there are limitations of current educational materials on money and time in Tabika KEMAS, MBMMW courseware is developed to assist both teachers and students in providing impactful T&L experience. This could later boost the students' understanding and learning performance while allowing students to accomplish active learning with teachers and parents. By implementing cognitive theory of multimedia learning (CTML) and user experience (UX) recommendations, MBMMW courseware was carefully developed via ADDIE Model. Functionality tests have been conducted to ensure the operations of the menu, buttons and links displayed in the courseware. Moreover, user evaluation for MBMMW has been performed towards understanding the initial acceptance of MBMMW courseware among the users. Results have mostly shown positive reactions from the users, thus acknowledging the usability of MBMMW as an interesting and fun active learning aid for presenting fundamental knowledge about money and time.

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Multimedia, Active Learning, Kindergarten, Cognitive Theory Of Multimedia Learning, Animation

Introduction

Tabika KEMAS is an Early Childhood Education Program coordinated and managed by the Early Childhood Education Division under the Ministry of Education Malaysia (MOE). The kindergarten's teaching method is built around games, singing, practical learning activities like drawing, and social interaction. Students are expected to gain significant knowledge during their early childhood based on the course curriculum provided by MOE. Mathematics is one of the courses that are being emphasized to be mastered among the young children as it is related to basic real-life skills. Among the topics that are encouraged to be learnt are time and money. It is important for the students to grasp the fundamentals of time and money whereas the knowledge can be applied throughout their lifetime, thus encouraging more interesting teaching and learning (T&L) resources to be created.

As a fun institution of learning for kids, Tabika KEMAS needs to improvise their T&L resources to align with the current technological changes. A good multimedia courseware is deemed to be appropriate as one of active learning tools for students since it incorporates interactivity between the user and the embedded modules. The current practice at Tabika KEMAS involves the use of books and papers for T&L process. Based on the interviews conducted with Tabika KEMAS teachers, this traditional T&L method has affected them to spend money on printing the learning materials, as well as other learning resources. Figure 1 shows an example of printed learning material held by a Tabika KEMAS kindergartner.

Figure 1: Example of A Printed Learning Material

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Moreover, the current syllabus for time and money used in Tabika KEMAS mathematic book is quite limited in terms of providing interactive activities for better learning experiences. To encourage an active learning process, the current syllabus should be integrated with other attractive T&L aids that are suitable for both teachers and students. Academic works on active learning among young kindergarten children were rarely done (Brod, 2021) although a lot of opportunities could be seized to improve the T&L processes. As one of the strategies of promoting active learning, the use of multimedia such as video has been proven to boost student's engagement, learning performance and positive attitude among young children (Martzoukou, 2022). At the same time, United Nations International Children's Emergency Fund (UNICEF) has also promoted the uses of digital learning to ensure the prosperous future for all children around the world (UNICEF, 2021). Nonetheless, studies on evaluation of T&L multimedia courseware for young children were lacking (Abdulrahaman et al., 2020) while most of previous works focused on primary school students and so forth.

Therefore, this study intends to design, develop and evaluate the web-based multimedia courseware called Mari Belajar Mengurus Masa dan Wang (MBMMW) that focuses on the topic of money and time based on Tabika KEMAS syllabus. By acknowledging the cognitive abilities of students, the courseware is designed and developed by using the fundamentals of active learning strategies, cognitive theory of multimedia learning (CTML) and user experience (UX) recommendations through ADDIE Model. For the courseware evaluation, both functionality and usability tests were performed.

Active Learning Strategies among Young Children

Nowadays, various T&L methods have been introduced for encouraging students' engagement in their learning process. Whilst traditional learning methods focus on the conventional lecture-style teaching, active learning on the other hand focuses on the participation of students during the learning process (Prince, 2004; Yang 2012). This will allow students to actively perform various activities via collaboration with their classmates or mentors and interaction with the learning materials such as multimedia courseware. The strategies of active learning could be implemented to all levels of students based on the complexities and learning contexts.

Brod (2021) has identified the needs to conduct more research on active learning among young children, especially from kindergarten to 12th grade (K-12). Most of the academic works on active learning had focused more on undergraduates (Freeman et al., 2014; Deslauriers et al., 2019) instead of young children, thus encouraging this study to be conducted. Moreover, several studies had identified the ability of young children to be adaptive active learners due to their metacognitive capabilities (Ruggeri, Sim & Xu, 2017; 2019). With the right approach and guidance from their instructors, these children would be able to remember their lessons via short-term and long-term memories.

Yang (2012) describes the benefits of active learning that includes improving knowledge retention, deepening understanding, and encouraging self-directed learning among students. Various techniques and strategies could be implemented to enable students' participation for active learning activities such as interactive lectures, hands-on technology, flipped classroom, case studies, peer teaching and others (Yang, 2012; Prince, 2004). The instructors must wisely select the age-appropriate activities based on the cognitive abilities of students, lesson objectives and available materials. For young children, among the suggested activities would revolve around games and play-based learning.

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Cognitive Theory of Multimedia Learning (CTML)

Multimedia offers various opportunities in T&L environment due to its interesting features. In understanding the uses of multimedia in learning, Mayer (2009) had suggested combining several multimedia elements for better learning experience among users. This is to prevent cognitive overload among learners whilst only one multimedia element is used. For example, it is better to combine text and graphics in the multimedia learning environment instead of using only text to convey the message to learners.

According to Theimer (2019), the Mayer's principles include:

- "coherence principle: eliminate extraneous words, pictures, and sounds;
- signaling principle: add cues that highlight the organization of the essential material;
- redundancy principle: graphics and narration are more effective than graphics, narration and on-screen text;
- spatial contiguity principle: corresponding words and pictures should be presented near to each other on the page or screen;
- temporal contiguity principle: corresponding words and pictures should be presented simultaneously rather than successively;
- pre-training principle: people learn better when they know the primary names and concepts;
- multimedia principle: people learn better from text and pictures than from text alone; and
- segmenting principle: present multimedia lessons in user-paced segments rather than as a continuous unit."

For developing multimedia courseware for young children, these principles should be implied to consider the metacognitive abilities of students. Sweller (1988; 2011) has emphasized the importance of understanding the cognitive load through Cognitive Load Theory (CLT) where the effects should be included in the instructional designs. The educational contents that include game features could increase or decrease the cognitive load of learners, depending on the educational media designs (Fisch, 2017).)

User Experience (UX) Design

User Experience (UX) is defined as a person's perceptions and responses resulting from the use and/or anticipated use of a product, system, or service (Díaz-Oreiro et al., 2019). From the planning session to the evaluation session of product development, users must be able to see the benefits, so an attractive appearance and design are necessary. As it will affect how the public gain experiences while using multimedia content, visual design is crucial in terms of the aesthetic dimensions utilized for graphics and other multimedia components.

From the other perspective, UX focuses on the interaction and communication that users would have with a website or software application in order to make it exciting and fun. According to Interaction Design Foundation (2021), there are seven factors that can influence user experience (UX):

- "Useful - The product or content must be original and fulfil a need of user.
- Usable – The courseware must be easy to use.
- Desirable – Images, logo, identity and other design elements are used in the content to evoke the emotion of user.

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- Findable – The content needs to be navigable and locatable onsite and offsite.
- Accessible – Content needs to be accessible to people with disabilities.
- Credible – Users must trust and believe of the content.
- Valuable – The product must deliver value to business."

This study has considered the seven factors as the fundamental design guidelines for developing the interface of the MBMMW courseware. While the courseware is expected to be used by the young children, teachers, and parents, it is important to provide a gratifying experience for the users.

Development and Methodology

For the development of MBMMW courseware, ADDIE Model has been utilized as the major reference. The abbreviation ADDIE stands for "analyze, design, develop, implement, and evaluate" (Moradmand et al., 2014; Reiser & Dempsey, 2017). Each phase of this model has a separate objective that must be completed throughout the development of a web-based multimedia application. This model was chosen for its robustness while it is also frequently used as a foundation for other instructional design models. Figure 2 shows the phases of ADDIE model for instructional design.

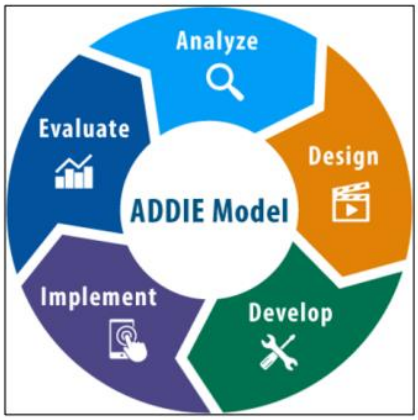

Figure 2: ADDIE Model Phases

Table 1 describes the use of ADDIE Model as the methodology for MBMMW courseware development based on each phase. During the analysis phase, interviews with several teachers of Tabika KEMAS were conducted in determining the issues of current T&L situation in the kindergarten. The problem statements were identified along with the project's requirements. The researchers had also performed the needs' analysis through the documentation reviews and observation at the kindergarten.

In the design phase, the storyboard, navigational maps and flow of the courseware were designed based on the current syllabus used in Tabika KEMAS. The topics of money and time were selected due to the recommendation of the teachers since there was lack of educational materials on the topics. Microsoft Word and Microsoft PowerPoint were utilized for designing the interfaces. The design incorporated the features suggested in the concepts of active learning, CTML and UX design. Table 2 shows the storyboard of MBMMW courseware along with the description.

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Table 1: MBMMW Courseware Development Methodology via ADDIE Model

Phases	Activities	Tools	Outcomes
Analysis	• Determine the current situation and problem statement. • Identify the project's target user, difficulties, challenges and goal. • Planning the project's requirement content	• Interview • Research • Observation	• The problem statement has been identified. • The target user, difficulties, challenges and goal of this project has been identified. • The content of the courseware has been finalized
Design	• Design the storyboard, navigation maps and flow of the courseware.	• Microsoft Word • Microsoft PowerPoint	• Storyboard • User interface • Navigation map
Develop	• Develop the web-based multimedia courseware based on the requirement of the project. • Create the animation, text, video, audio and graphic	• Adobe Illustrator • Adobe Animate CC • Adobe Character Animator	• Multimedia elements are created. • Interactivity and links are created.
Implement	• Project implementation. • Changes are being made on a continuous basis if needed.	• Web-based multimedia	• MBMMW Courseware implementation.
Evaluation	• Test the usability of the courseware	• Questionnaire	• Usability evaluation result.

Table 2: MBMMW Courseware Storyboard

Storyboard	Description
	**Start** This is the first page of MBMMW Courseware. This page will show the title of the courseware and user need to click on "Mula" button to go to the homepage.

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	**Main page** This is the main page of MBMMW and it consist of the topics and quiz button. This page also has "Exit" button to allow user to exit from the courseware and "Home" button will bring user to previous page which is start page.

Table 2: MBMMW Courseware Storyboard (Continued)

	**1.0** This page will show as user click on "Wang" button on previous page. This page has five buttons that user can use to start their lesson. The "Exit" button to allow user to exit from the courseware and "Home" button will bring user to start page. The "Previous" button will bring user to main page.
	1.1 This is the lesson page and will show as user click on "Mengenali Wang" button on previous page. There are notes and lesson on this page. The "Exit" button to allow user to exit from the courseware and "Home" button will bring user to start page. The "Previous" button will bring user to 1.0 page.

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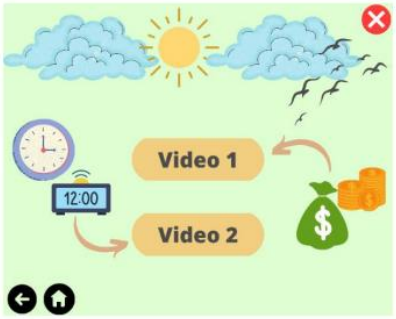
	**2.0** This page will show as user click on "Masa" button on main page. This page has four buttons that user can use to start their lesson. The "Exit" button to allow user to exit from the courseware and "Home" button will bring user to start page. The "Previous" button will bring user to main page.
	2.1 This is the lesson page and will show as user click on "Mengenali Jam dan Waktu" button on previous page. There are notes and lesson on this page. The "Exit" button to allow user to exit from the courseware and "Home" button will bring user to start page. The "Previous" button will bring user to 2.0 page.
	**3.0** This page will show as user click on "Kuiz" button on main page. This page has four buttons that user can use to start their quizzes. The "Exit" button to allow user to exit from the courseware and "Home" button will bring user to start page. The "Previous" button will bring user to main page.

Table 2: MBMMW Courseware Storyboard (Continued)

	**4.0** This page will show as user click on "Video" button on main page. This page has two buttons that user can use to start their quizzes. The "Exit" button to allow user to exit from the courseware and "Home" button will bring user to start page. The "Previous" button will bring user to main page.
	**End** The exit page will appear when the user clicks on the "Exit" button. The page has two buttons which are "X" and "✓". If the user clicks on "X" button, it brings the user back to the main page and if the user clicks on "✓" button, it will exit from the courseware.

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In the development phase, multimedia elements such as animation, text, video, audio and graphics were created by using Adobe Illustrator, Adobe Animate CC and Adobe Character Animator. The web-based multimedia courseware was carefully developed based on the requirements gathered in the analysis phase. All the interactivity and links were created in the courseware for smooth navigation.

During the implementation phase, changes to the courseware elements were made for continuous improvements. The interfaces were redesigned and amended to ensure the design quality to be met accordingly. After a series of amendments, the final version of MBMMW courseware was successfully implemented to be used by the users.

In the final phase of ADDIE model, the courseware was evaluated via functionality testing and user evaluation. The functionality tests were conducted through multiple test plans by the developers to ensure the operation of all embedded multimedia elements in the courseware. On the other hand, user evaluation was conducted where the questionnaires were distributed to potential users that involve Tabika KEMAS teachers and parents. The questionnaires were prepared in English to examine the MBMMW usability, multimedia elements, navigation and contents. Each question was carefully developed by adapting the constructs and elements used in previous studies of Lewis (1995), Khedif et al. (2014), Lee and Osman (2012) and Widyaningsih et al. (2020).

User Evaluation Results

The results of the evaluation process have been obtained based on the questionnaires that were given to 30 respondents. 30 respondents were considered to be more than enough whilst the recommended number of participants for quantitative usability testing is 20 (Nielsen, 2006). The survey was split into two sections, Part I - the demographics of the respondents and Part II - user perception (usability, multimedia elements, navigation and contents). Five-point Likert scale ranging from 1 = strongly disagree to 5 =strongly agree was used to measure the user perception.

Majority of respondents are female (53.3%) compared to male (46.7%). As for range of age, most of respondents are in the age range of 19 to 22 years old with 15 respondents (50%). The rest are 12 respondents (40%) in the age range of 23-26 years old and 3 respondents (10%) in the range age of under 18 years old. Furthermore, most respondents have children aged 4 to 6 years at home (66.7%) compared to (33.3%) who have not.

For measuring perception of user about MBMMW usability, the mean and standard deviation ranges are 4.23 to 4.5 and 0.66 to 0.77 respectively. The overall mean of usability is 4.34. This suggests most respondents agree with the usability of the courseware. Details of the result for each usability statement are shown in Table 3.

Table 3: MBMMW Usability Results

Section A: Usability			
Item	**Statement**	**Mean**	**SD**
A1	The web-based multimedia application is easy to use.	4.50	0.66
A2	The web-based multimedia application is user friendly.	4.23	0.77
A3	The user interaction with the courseware is clear	4.36	0.71
A4	The courseware has a clean and simple presentation	4.26	0.73

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A5	Overall, I am satisfied with the usability of the web-based multimedia application.	4.36	0.71
	Overall Mean	**4.34**	

In terms of MBMMW multimedia elements, the obtained mean and standard deviation ranges are 4.23 to 4.56 and 0.55 to 0.71 respectively. The overall mean of multimedia elements is 4.41. This indicates most respondents agree and are satisfied with the multimedia elements presented in the courseware. Details of the result for each multimedia elements statement are shown in Table 4.

Table 4: MBMMW Multimedia Elements Results

Section B: Multimedia Elements			
Item	**Statement**	**Mean**	**SD**
B1	The images used are relevant to the information included in the text.	4.56	0.62
B2	The text used are easy to read and understandable.	4.23	0.55
B3	The video enhances the presentation of information.	4.46	0.57
B4	The sound is relevant and can enhance the presentation of information.	4.33	0.71
B5	Overall, I am satisfied with the multimedia elements in the web-based multimedia application	4.46	0.62
	Overall Mean	**4.41**	

To evaluate the user's perception on navigation features in MBMMW, the mean and standard deviation ranges are 4.36 to 4.63 and 0.49 to 0.68 respectively. The overall mean of navigation features is 4.49. This result shows the majority of respondents are satisfied with navigation features in the courseware. Details of the result for each navigation statement are shown in Table 5.

Table 5: MBMMW Navigation Results

Section C: Navigation			
Item	**Statement**	**Mean**	**SD**
C1	The navigation functions are easy to use and understand.	4.63	0.49
C2	Navigation labels are clear and concise.	4.46	0.68
C3	The design of the navigation mechanism (icons, labels, functions) is working properly.	4.50	0.51
C4	Overall, I am satisfied with the navigation element in this web-based multimedia application.	4.36	0.61
	Overall Mean	**4.49**	

Finally, on the contents of MBMMW, the mean and standard deviation results are 4.26 to 4.6 and 0.62 to 0.74 respectively. The overall mean of content is 4.42. This indicates most respondents agree and are satisfied with the contents of the courseware. Details of the result for each content statement are shown in Table 6.

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Table 6: MBMMW Content Results

Section D: Content			
Item	**Statement**	**Mean**	**SD**
D1	The content is easy to understand.	4.60	0.62
D2	The content provided are relevant.	4.43	0.63
D3	The content helps to enhance my knowledge.	4.26	0.74
D4	The content has important information to deliver.	4.40	0.72
	Overall Mean	**4.42**	

Overall, it can be concluded that the majority of users are satisfied with the usability, multimedia elements, navigation and contents of MBMMW web-based courseware. These positive results are aligned with other courseware development studies by Che Ku Mohd & Shahbodin (2016), Septiani et al. (2020) and Khedif et al. (2014). It is essential to ensure the features presented in the courseware are tailored to the needs of potential users while acknowledging their satisfaction about the courseware.

Recommendations and Conclusion

From the user evaluation results, MBMMW web-based courseware has been proven to provide reasonable aspects for T&L process. By using the courseware, it is expected for the young children to enjoy their fundamental lessons about time and money, thus encouraging active learning among themselves. The courseware is recommended to be used along with the guidance of teachers and parents. As MBMMW is a web-based application, it can be accessed regardless of computing device, time and location.

Nonetheless, there are some recommendations for future enhancement of MBMMW courseware. The recommendations are to:

- Provide more interactive sound elements in the activity section.
- Provide more questions and exercise in the courseware.
- Provide more creative videos to enhance the understanding of children about the contents.
- Provide the integration with other learning management systems or media channels for better exposure.

MBMMW web-based courseware is developed based on CTML and UX suggestions as an extra T&L resource for parents and kindergarten teachers. Parents and teachers can use this courseware to introduce the fundamentals of time and money management to children in order to encourage their good habits in the future. In addition, the children could learn how to manage time and money via the multimedia elements presented in this courseware, thus stimulating their minds to be more creative and eventually establishing active learning. In all, as the courseware is a web-based application and is accessible at anytime and anywhere, it can surely enhance the T&L process among Tabika KEMAS teachers, parents and children.

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