

THE DESIGN, DEVELOPMENT AND EVALUATION OF TPSACK COURSEWARE TO FACILITATE THE ART AND DESIGN EDUCATION STUDENTS ARTISTIC SKILLS KNOWLEDGE

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ABSTRACT

This study examines the effectiveness of the TPSACK courseware which was developed with artistic skills practice to discover the Technological, Pedagogical and Content Knowledge components in the design of the courseware. The courseware was developed based on Dick and Carey Instructional Design Model (2009) to address instruction as an entire system and focusing on the inter-relationship between various factors such as context, content, learning and instruction. A total of 130 respondents Art and Design Education (ADE) group were selected to analyse the TPSACK courseware. The courseware is aimed to develop the students' artistic skills using technological assistance. The artistic skills included in the courseware are vital for students in preparation of becoming a future art educator. The TPSACK courseware was evaluated using questionnaire with a 5-point Likert scale comprising elements of interface design, content, artistic skills practice and the usability of the courseware. The findings revealed that the courseware indicated satisfactory and appropriate practices of artistic skills for Art students to improve their personal skills. Not only that, the study also suggests that the Dick and Carey Instructional model (2009) will be an ideal model to provide an instructional framework for courseware development.

KEYWORDS: *Artistic Skills, Dick and Carey Model, Development, TPSACK Courseware*

INTRODUCTION

Computer literacy has become indispensable under 21st century immense technological advancement in most parts of the world. With more demanding standards being put in the educational system worldwide, integrating technology in the classroom is almost inexorable. It is believed that using technology in the classroom could increase students' classroom engagement and can promote learning effectively (Schmidt et. al., 2009). Therefore, students are encouraged to improve their skills in computer literacy not only to ease and improve learning but also to keep them updated with technological changes beyond the school and learning settings.

Nowadays, Educational approaches have moved forward with multiple innovations under the advancement of 21st century computer and digital technology. The Malaysian educational system has experienced a lot of changes in the past few years in various aspects of utilizing technology to enhance its teaching and learning practices. With more concerns being raised by various quarters and stakeholders over the present system, the educational model has been given more technological incorporation for a much more productive model with the ideal resources that would encourage more active learning (Irfan Naufal & Amat Sazali, 2015; Alazam et. al, 2012; Ghavifekr & Rosdy, 2015). Importantly, meaningful technological integration is believed to be advantageous for teaching practices and learning (Pamuk, 2012) which further heightens the need to have a courseware which would help develop and improve teachers in training skills in technology, pedagogy, and content area. With the development of effective courseware, students in training could use communication and information technologies for personal development in certain spaces. On a more significant note, this would provide these students a form of exercise ground to ensure that they have the avant-garde skills and knowledge by converting modern applications in the form of instructions.

Recently, various teaching methods have been introduced and applied in the field of education. The emergence of Industry 4.0 has affected educational approaches various stakeholders, especially the Institutes of Higher Education. In line with the new direction of education towards the revolution of the Industry 4.0, students need to be equipped with trailblazing skills to enable them to take risks while trying out new techniques and methods and finding ways to improve their learning style with different concepts (Pérez-Fabello & Campos, 2007). Therefore, the educational system in Malaysia needs to adapt to new teaching methods in parallel with the rapid development of technology.

Technological advancement has impacted historical epoch while affecting lives innumerable in various areas and opening up opportunities beyond imagination. The ability to access technology has provided learners with the opportunity to communicate in formal or informal conditions either in a fixed or remote settings (Polly, 2011). However, it needs to be cautioned that the use of technology should be properly managed to maintain its usefulness and efficacy as the catalyst for skills development and training. With more easy access to technology, reckless use of its facilities would impede the sanguine objectives of teaching and learning. Importantly, valuable use of technology has elevated the teaching and learning of certain skills which has also unlocked countless talents among learners in various areas. The use of technology in shaping the skills of an individual is also adapted to the new generation to create effective and convincing learning methods.

Undeniably, artistic skill is fundamental in Art and Design and talent alone may not be sufficient for the ADE students to pursue further vocation in the field. Appropriate knowledge

and training would enable students to not only improve and develop their skills but expedite learning of the essentials. Teachers are considered to be the catalysts in developing artistic knowledge, understanding technology and aesthetics, to create and develop disciplines and positive attitude of the students (Iberahim Hassan, 2003). Visual art educators must possess appropriate skills in teaching with effective methods in order to improve learning quality (Chua et al, 2003). Hence, the ADE students need the necessary and appropriate artistic skills through knowledge training to teach arts and enable them to teach the VAE subject with efficacy. As technology becomes important in the classroom, hence this study focuses on the development of the artistic skills using the TPSACK courseware to enhance the ADE students artistic skills is timely.

BACKGROUND OF THE STUDY

Ideally, students in the ADE program are trained to become future Visual Arts teachers especially for the secondary school level. Hence, they are expected to have proper artistic skills and knowledge to teach the Visual Arts Education (VAE) subject. Appropriate trainings which provide these future Visual Arts teachers with essential and primary skills in teaching the arts are also emphasized on producing their own artwork as suggested by Koster (2001) that, teachers should master the elements of visual arts which include line, shape, colour, texture, and dimensional form to create meaning and order through the production of their own art products. Not only that, as future Visual Arts teachers, they should be able to demonstrate leadership qualities, good at planning and time management, able to make sound decisions and creative while being critical in thinking. It is necessary according to Gopnik (2012) that high artistic skills knowledge is to be ingrained in pre-service teachers so that they could function efficiently. With technology assisted training, pre-service teachers could develop and improve their skills by demonstrating strategies and techniques used in transferring information in sequential and useful knowledge (Sahin, 2011). Therefore, artistic talents when combined with other knowledge and skills should provide ample abilities for these students in training to develop necessary efficacy as educators.

In the teaching and learning of the VAE subject, the process involves many skills and processes related to observation, description, classification, presentation, visualization, creativity, artistic, analytical and formulation of conclusion. Artistic skills and abilities are required in attaining artistic skills knowledge in the visual arts as it involves mental processing, changing, visualizing and presenting the visual products to students. Obviously, art does not only involve the use of knowledge but it also involves a style of understanding the significance of art to acquire skills in task (Gopnik, 2012). Variation used in techniques and media would open up to long-term efforts which could stimulate interests and spark creativity among moderate and high achievement students.

PROBLEM STATEMENT

The ADE students need to be educated, trained and be well prepared to become qualified art teachers to face challenges in the increasingly demanding world of technology. Therefore, students need to be prepared to face the Industrial Revolution 4.0 as educational revolution is taking place while influencing innovation in teaching and learning in the classroom. Artistic skills training does not necessarily to be taught and practiced through traditional methods. With the technologically advanced methods, improved and more versatile trainings can be achieved through the use of avant-garde technology.

In this study, the TPSACK courseware has been designed and developed with the Dick and Carey Instructional Design Model (2009) as the guideline. This model is used because it is found to be more extensively precise and contemporary. The TPSACK courseware is specifically designed to assist the artistic skills knowledge enhancement concerning the courseware in measuring these artistic skills still have yet to be developed. Some tools may not be of contemporary standards which would indefinitely affect the effectiveness of some teaching methods and stakeholders' expectations especially when it concerns. Therefore, the TPSACK should be able to provide some essential skills for the students to not only develop their skills but also to refine their current standards.

The ADE students are required to master the artistic skills and knowledge while having the ability to identify the importance of the skills during the process of teaching and learning in the classroom. It is important to highlight that the ADE students underutilized their creative and critical thinking skills and at the expense of their artistic and evaluation skills based on the elements and principles of Visual Arts. However, artistic skills and knowledge are considered as prime constituents in VAE for profound exploration and to identify the value of art, inculcate art appreciation, producing quality work of art among students and as systematic guide for the students.

Therefore, artistic skills are crucial for the ADE students so that they could become excellent future educators because insufficient artistic skills among arts teachers is one of the many reasons that make VAE classes uninteresting and unattractive to school students. Hence, the TPSACK courseware has been designed, developed and evaluated with the artistic skills practice to examine the students' ability in developing their artistic skills and knowledge via technology.

OBJECTIVES OF THE STUDY

The main objective of this study is to gather responses from the ADE students to evaluate the effectiveness of the TPSACK courseware that was designed and developed based on Dick and Carey Instructional Design Model (2009) for artistic skills knowledge enhancement.

RESEARCH QUESTIONS

The research questions have been formulated to achieve the objectives of the study by looking into key questions as constructed below:

- i. Is the content in the TPSACK courseware able to attract the ADE students' attention?
- ii. Is the interface design of the TPSACK useful and suitable to be used by the ADE students?
- iii. Is the interactivity in the TPSACK courseware able to assist the ADE students in the learning process?

LITERATURE REVIEW

The development of the latest technology provides more dynamic presentation of information as compared to traditional teaching methods. The vibrant presentation displayed in the courseware with interactivity function provides users with distinctive learning experiences. The component of technology has been viewed as a system of knowledge with its own differences making this additional component applicable in important circumstances (Koehler & Mishra, 2005). As compared to other dynamic media nowadays, courseware are the most efficient and effective cognitive tools because of its advantages in terms of interactivity and it allows users to have full control in learning. This user interactivity and control enable students to manage, manipulate and explore information individually and which proved to have very positive impact on students.

The Revolution 4.0 implementation has exposed students to a more challenging world-based digital technologies by providing the internet, clouds and social media to beat the formal education system. Hence, classes in the future will no longer be in the form of a walled-room; instead, learning process can take place any time where the students can decide which time and place they wish to study. Teaching also will not be limited to the process of delivering information, but students need to be taught skills to obtain information. Hence, multimedia courseware plays an important role in achieving this objective.

Under certain circumstances, students need to repeat a lesson several times to understand a concept of learning. The repetition process performed through multimedia courseware could improve students' abilities to remember better as compared to printed material. An informative verbal presentation which includes texts and other non-verbal forms such as the display of pictures, animations, audio and videos will further enhance information retention among students.

The use of courseware has proven to be advantageous in creating active and engaging learning environment among students. Technology knowledge which mainly focuses on the connected skills to use computer practically could improve students' focus in learning while engaging themselves through interactive information transfer (Chai, Koh & Tsai, 2011). Obviously, interactivity encourages lively learning situation and the computer is the only media that can provide such learning experience. In a research conducted by Marino, Sameshima and Beecher (2009), the inclusion of assistive technology with instructional technology in the education programs of pre-service teachers have been proven helpful in occupying various opportunities related to social and academics conditions. Active learning provides beneficial outcomes such as facilitating students to focus towards learning, long-term memory fulfilment, learn faster and increased motivation of the students.

Learning with courseware encourages students to stimulate their sense of belonging in the learning process as it involves the various senses including sight, touch, listening and the cognitive ability. Learning process will be more effective when it involves all the human senses which consequently churn positive impact on the development of knowledge.

DEVELOPMENT OF THE TPSACK COURSEWARE

The TPSACK courseware was designed and developed based on the Dick and Carey Instructional Design Model (2009) as exhibited in Figure 1. The model was utilized as it is more

contemporary and consistent with its ten systematic and comprehensive developmental steps. The ten interconnected boxes represent sets of theories, procedures, and techniques employed by the instructional designer to design, develop, evaluate and revise instruction. The ten interconnected boxes are 1) Identify Instructional Goal(s), 2) Conduct Instructional Analysis, 3) Analyse Learners and Contexts, 4) Write Performance Objectives, 5) Develop Assessment Instruments, 6) Develop Instructional Strategy, 7) Develop and Select Instructional Materials, 8) Design and Conduct Formative Evaluation of Instruction, 9) Revise Instruction and 10) Design and Conduct Summative Evaluation.

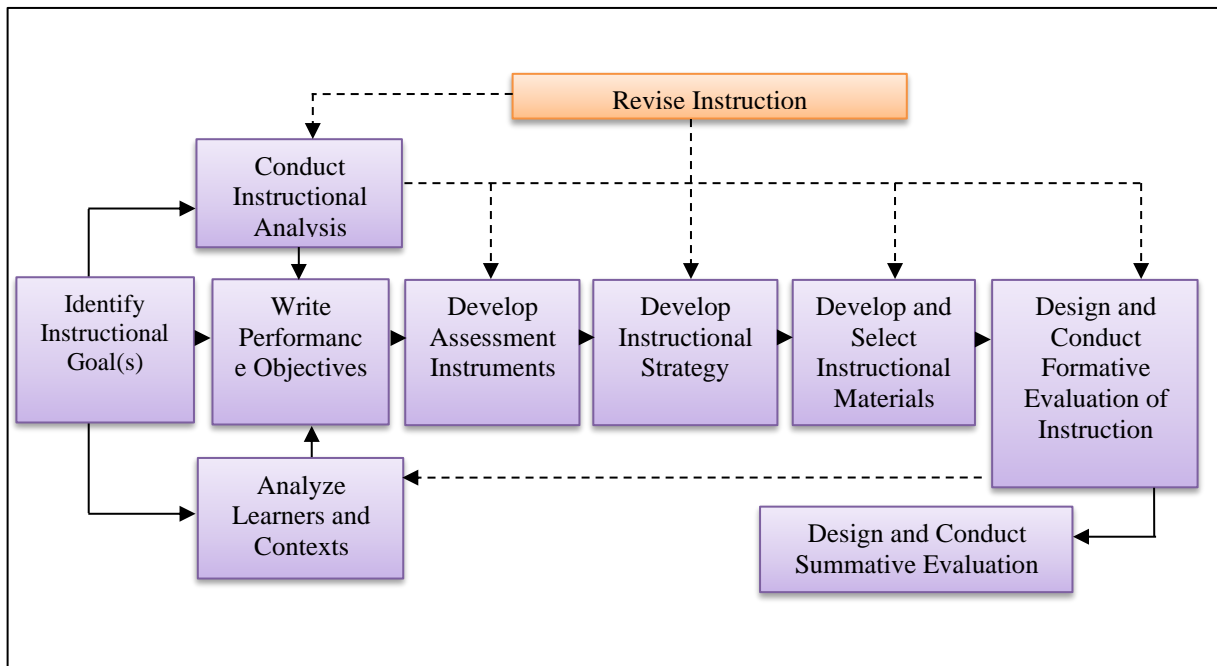


Fig. 1 The Dick and Carey Instructional Design Model (2009)

CONDUCTING INSTRUCTIONAL ANALYSIS

A crucial measure to be considered prior to designing the courseware is to perform the needs analysis. In this matter, data were collected from the ADE students to gather information of the learning requirements that the students need which would benefit their learning styles. Another important step taken was a discussion session held with lecturers from the Art and Design Education Program at the Faculty of Education and the Faculty of Art and Design. One of the concerns addressed during the discussion is the suitability of the topics identified which could improve not only learning but also teaching. The causes for recurring problems and concerns were identified and suggested solutions were then underlined to include the necessary elements for the courseware to be developed.

ASSESSING NEEDS TO IDENTIFY GOAL(S)

The objective of the learning outcome has been analysed to identify the artistic skills and knowledge that the ADE students will acquire and the stages of the learning process they will follow. The courseware objective is analysed to determine what will the students achieve

as well as to develop instructional materials specifically tailored according to the user's abilities. The objectives and criteria are also reviewed to facilitate the courseware development process. This would also determine the level of achievement at the end of the lesson. Hopefully, the courseware developed should be able to motivate the ADE students in the learning process, suitable to their learning requirement to generate active involvement and be able to provide proper guidance and feedback.

ANAYLYSING LEARNERS AND CONTEXTS

The existing individual differences in learning style preferences will influence the courseware implementation in constructing the artistic skills. The existing knowledge will also affect the students' ability to learn. Hence, the goals are analysed to identify the areas to be learned and steps to be followed for effective learning.

WRITING PERFORMANCE OBJECTIVES

This phase is to write the performance objectives that can be measured after the ADE students had used the TPSACK courseware. The test items are provided for each of the identified objective criteria. The TPSACK courseware developed were distributed through CD-ROMs as the information delivery medium.

DEVELOPING CRITERION REFERENCE

The term criterion is used because assessment items serve as the benchmark to determine the adequacy of a learner's performance in meeting the objectives; that is, success of these assessments will determine whether a learner has achieved the objectives in the instructional unit (Dick & Carey, 2009). The assessment of the TPSACK courseware is conducted through a questionnaire that is developed specially to evaluate the courseware. The content, interface design and the interactivity are measured as these are primary and essential elements that should appeal to users of the courseware. These elements are also included to measure the users existing knowledge and the effectiveness of the TPACSK courseware to enhance the artistic skills knowledge among the ADE students.

DEVELOPING INSTRUCTIONAL STRATEGY

This phase is intended to produce the courseware as it includes the process and the steps of producing it. According to Dick and Carey (2009), the instructional strategy is to identify suitable instructional medium to be implemented in the teaching and learning to ensure that the teaching and learning objective is achieved. The learning strategy used in the TPSACK courseware is based on tutorial method according to the tutorial learning style involving the process of learning in sequence. The ADE students are recommended to understand the objective of the lesson prior to using the courseware. They are given an instruction to understand the objective of the courseware and after that they are advised to follow the lesson according to the information presented.

INTERFACE DESIGN

The interface design is developed to enable the ADE students to access all the information more forthright providing ease to conduct self-directed learning. The interface design of the TPSACK courseware is developed using primary colours and simple layout for easy navigation. According to Shulman (1998), the interface design has to portray: (a) simplicity and (b) consistency (see Figure 2). A simple display of text using suitable fonts with bright colours, blue gradient background, graphics, animation, and buttons on the screen must not only appeal to the users but also be suitable to their different conditions. Subsequently, careful and thoughtful efforts put in the interface design should encourage users to continue exploring each of the information provided in the courseware and motivate them to learn in a more enjoyable manner.

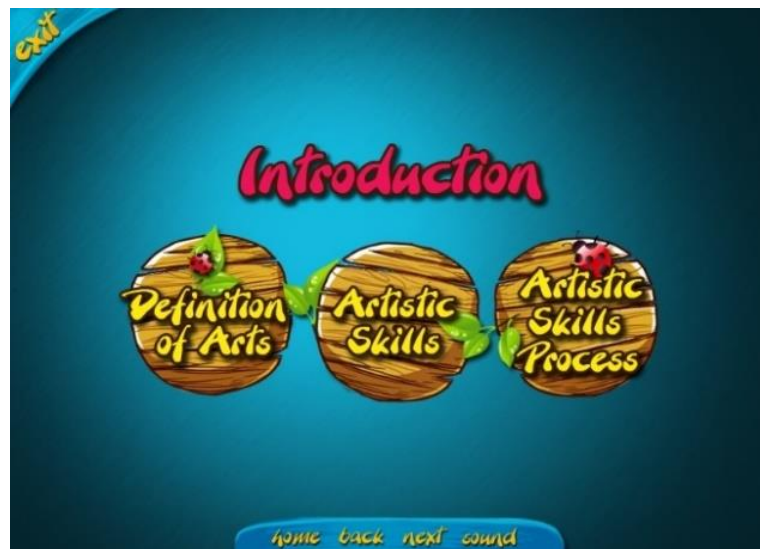


Fig. 2 The TPSACK courseware interface design

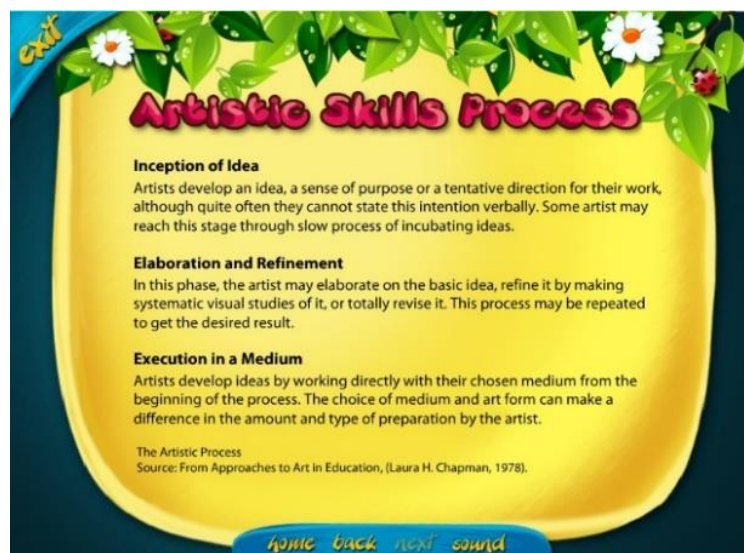


Fig. 3 The TPSACK courseware interface design



Fig. 4 The TPSACK courseware artistic skills practice

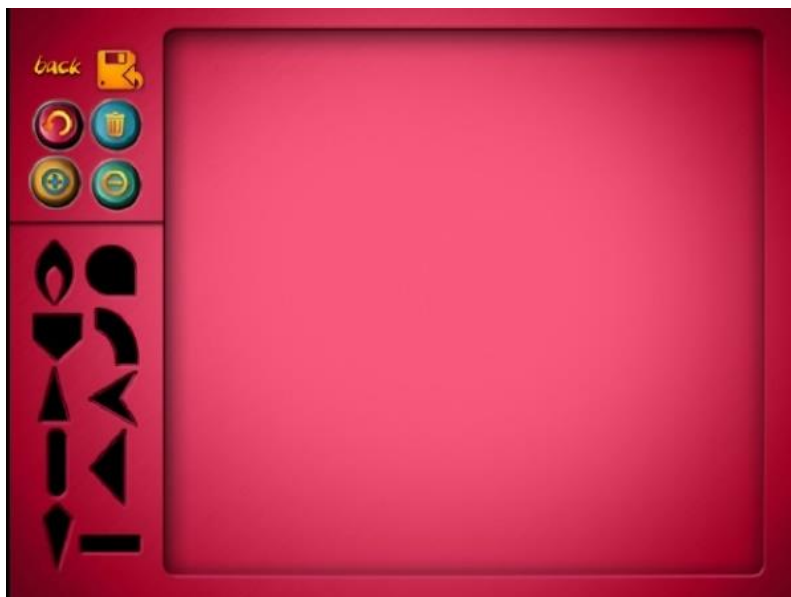


Fig. 5 The TPSACK courseware artistic skills practice

The section of the artistic skills practice as displayed in Figure 3 is provided among the content of the TPSACK courseware. The ADE students are required to arrange the shapes provided to create visual that has been given at the beginning of the lesson. The visuals created are as shown in Figure 4.



Fig. 6 An artwork from artistic skills displayed by the students



Fig. 7 An artwork from artistic skills displayed by the students

CONDUCTING AND SELECTING INSTRUCTIONAL MATERIALS

The next step is to identify whether the instructional medium selected fits into the objectives of the study. The selected materials should be considered as effective, beneficial to others, and worth the time spent in examining and creating it. The instructional strategy can be used to determine whether existing materials are adequate in the way they stand or whether they need to be adapted or enhanced prior to use (Dick & Carey, 2009). The information sources and the content of the TPSACK courseware were gathered mainly from text books and the artistic skills practice can be a self-developed idea.

THE FORMATIVE ASSESSMENT

The formative evaluation is the process of collecting data and information in order to improve the effectiveness of instruction (Dick & Carey, 2008). Apart from self-investigation and modifications, two experienced lecturers in the content and courseware development have been referred to evaluate the instructional design medium and the screen design of the courseware. Comments and opinions from the lecturers were referred to further refine the courseware. Data from the formative assessment are used to justify the teaching medium and to measure the users' existing knowledge and character. The formative assessment techniques involve interviews, observations and comments from the experts.

REVISING THE INSTRUCTION

When the instructional medium is assessed formatively, the instruction of the medium was revised to maintain the courseware standard and ideals. As mentioned by Dick and Carey (2009), there are two types of revised instructions to be considered with the materials; the first is the change that are made to the content or substance of the materials to make them more accurate or more effective as a learning tool, and the second is related to the procedures employed in using the materials. A pilot study has been conducted to collect the relevant data regarding the effectiveness of the courseware developed.

THE SUMMATIVE ASSESSMENT

The summative assessment is defined as the design of evaluation studies and the collection of data to verify the effectiveness of instructional materials with target learners (Dick & Carey, 2009). Summative assessment was conducted after the courseware is fully improved and developed. The summative assessment process involves data gathering via questionnaire method. This is the final step in the courseware development process which is also the most crucial step to establish the unblemished standards set at the beginning of the courseware development.

METHODOLOGY

This research applies a quantitative approach which attempts to identify the effectiveness of the TPSACK courseware. Descriptive survey of 5 point Likert scale was utilized to observe the TPSACK courseware developed and to identify the ADE students artistic skills and knowledge enhancement in the process.

RESPONDENTS

This study was conducted among the students of Art and Design Education Programme, Faculty of Education, UiTM Puncak Alam Campus. A total of 130 students have participated in the survey to evaluate the efficacy of the TPSACK courseware.

RESEARCH INSTRUMENT

According to Creswell (2013), a survey design provides a quantitative or numeric description of trends, attitudes, and opinions of a population by studying a sample of that population. Therefore, this study had utilized the Courseware Evaluation Survey questionnaire. Also, this phase demonstrated the quantitative data were gathered by implementing the survey to obtain the results regarding the evaluation of the TPSACK courseware. The questionnaire used a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Finally, data was analysed using the Statistical Package for the Social Sciences (SPSS) software to get the best result of the evaluated TPSACK courseware.

DATA COLLECTION PROCEDURE

Data was collected in four phases involving; 1) discussion with the administration at the Faculty of Education to identify the procedure required to obtain the data, 2) the respondents were assembled in the computer lab to use the computers which have been installed with the TPSACK courseware, 3) the respondents were allowed to use the TPSACK courseware within the time frame to view, explore and handle the courseware, and finally at phase 4) all respondents were given a set of questionnaire and they are required to provide their responses for each item to evaluate the effectiveness of the TPSACK courseware. The questionnaires distributed were collected after the students have provided all their responses for each of the item.

RESEARCH FINDINGS

The questionnaire was collected and translated into descriptive statistical analysis format in order to show the results. Results are tabulated and described in the table below to show the evaluation of the TPSACK courseware. Findings of the data collected from the ADE students has shown a positive result in the evaluation involving the content, interface design and interactivity of the courseware.

Table 1. Total distribution in the evaluation of the TPSACK courseware

No	Items	<i>m</i>	<i>SD</i>
	Course Content		
Q1	The content is relevant.	3.64	1.10
Q2	The content is accurate.	3.57	.86
Q3	The content has fulfilled my expectations.	3.36	1.16
	Interface Design		
Q4	Graphic Quality	4.41	1.09
Q5	Screen Quality	4.51	.63
Q6	Layout Quality	3.11	1.11
	Interactivity Use		
Q7	The navigation is easy.	4.65	.414
Q8	The pace of the courseware is appropriate.	4.34	.505
Q9	Overall the courseware is extremely easy to navigate and use.	2.84	.765

m mean, *l* *SD* standard deviation

The results tabulated in Table 1 indicated that majority of ADE students found the TPSACK courseware contains relevant and accurate content. They also agree that the content is up to date and challenging to them. Such response could be due to the fact that the respondents have similar learning and background knowledge of the arts and design education. The ADE students also indicated that the integration of the artistic skills practice is distinctively unique and have been brilliantly composed to help in shaping their artistic skills.

In relation to the interface design, the ADE students agreed that the design is pleasant as it displays only certain categories of colours and the interface carries straightforward information presentation. The respondents also agreed that the tools provided allows for smooth navigation of the artistic skills practice and they can interact with the tools in ease. However, they suggested the shapes to be provided with different colour mode to give the shapes a distinctive feature. Majority of the students responded that practicing the artistic skills via courseware is fun.

The students also agreed that it is easy to use and navigate the courseware. It takes them only minimal time to understand how the shapes from the artistic skills practice to be operated. Once the students could comprehend all the information provided, they managed to create an artwork with various ideas.

CONCLUSION

This study has successfully described the process of developing the TPSACK courseware and issues relating to the effectiveness of the elements to support the Dick and Carey Instructional Design Model (2009). Overall, the study has demonstrated that TPSACK is effective to improve the artistic skills and knowledge of the ADE students.

REFERENCES

- Alazam, A., Bakar, A., Hamzah, R. & Asmiran, S. (2012). Teachers' ICT Skills and ICT Integration in the Classroom: *The Case of Vocational and Technical Teachers in Malaysia*. *Creative Education*, 3, 70-76. doi: 10.4236/ce.2012.38B016.
- Berita Harian, (2017). *Cabaran Guru Persiap Pelajar hadapi Revolusi Industri 4.0*
<https://www.pressreader.com/malaysia/beritaharian5831/20171211/282123521850179>. Accessed 31 October 2018.
- Chua, P.T., Crivella, R., Daly, B., Hu, N., Schaaf, R., Ventura, D., Camill, T., Hodgins, J. and Pausch, R., (2003), *March. Training for physical tasks in virtual environments: In Virtual Reality, 2003*.
- Chai, C.S., Koh, J.H.L. and Tsai, C.C., (2011). *Exploring the factor structure of the constructs of technological, pedagogical, content knowledge (TPACK)*.
- Creswell, J.W. (2013). *Qualitative inquiry & research design: Choosing among five approaches*. Los Angeles: SAGE Publications.

- Ghavifekr, S. & Rosdy, W.A.W. (2015). Teaching and learning with technology: Effectiveness of ICT integration in schools. *International Journal of Research in Education and Science (IJRES)*, 1(2), 175-191.
- Gopnik, B., (2012). *Aesthetic science and artistic knowledge*. Aesthetic Science. Connecting Minds, Brains, and Experience.
- Irfan Naufal, U. & Amat Sazali, A. H. (2015) Malaysian teachers' levels of ICT integration and its perceived impact on teaching and learning. *Procedia-Social and Behavioral Sciences*, 197.
- Ibrahim Hassan. (2000). Matlamat dan Objektif Pendidikan Seni (Visual) Untuk Sekolah Menengah: Perlu Kajian Semula. *Prosiding Konvensyen Kebangsaan Pendidikan Seni Visual*. Pg-121 – 122.
- Koehler, M.J. and Mishra, P., (2005). What happens when teachers design educational technology? The development of technological pedagogical content knowledge. *Journal of educational computing research*.
- Koster, B., Dengerink, J., Korthagen, F. and Lunenberg, M., (2008). Teacher educators working on their own professional development: goals, activities and outcomes of a project for the professional development of teacher educators. *Journal Teachers and Teaching: theory and practice*.
- Marino, M., Sameshima, P. and Beecher, C., (2009). Enhancing TPACK with assistive technology: Promoting inclusive practices in pre-service teacher education. *Contemporary Issues in Technology and Teacher Education*.
- Polly, D., (2011). Examining teachers' enactment of technological pedagogical and content knowledge (TPACK) in their mathematics teaching after technology integration professional development. *Journal of Computers in Mathematics and Science Teaching*.
- Pamuk, S., (2012). Understanding preservice teachers' technology use through TPACK framework. *Journal of Computer Assisted Learning*.
- Pérez-Fabello, M.J. and Campos, A., (2007). Influence of training in artistic skills on mental imaging capacity. *Creativity Research Journal*.
- Schmidt, D.A., Baran, E., Thompson, A.D., Mishra, P., Koehler, M.J. and Shin, T.S., (2009). Technological pedagogical content knowledge (TPACK) the development and validation of an assessment instrument for preservice teachers. *Journal of Research on Technology in Education*.
- Sahin, I., (2011). Development of survey of technological pedagogical and content knowledge (TPACK). *TOJET: The Turkish Online Journal of Educational Technology*.
- Walter D., Carey, L. & O. Carey, J., (200). The Systematic Design of Instruction, Seventh Edition. *Pearson; 7 edition (October 16, 2008)*.