Penerbit Akademia Baru

Journal of Advanced Research Design

Journal homepage:
https://akademiabaru.com/submit/index.php/ard
ISSN: 2289-7984

Bridging Gaps in HVAC Education: A Comprehensive Approach to Water-Cooled Chiller System Modelling with TVET and VAK Integration

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ARTICLE INFO

Article history:
Received 7 January 2025
Received in revised form 24 April 2025
Accepted 18 May 2025
Available online 26 July 2025

Keywords:
Technical and Vocational Education and Training (TVET); VAK learning styles; ADDIE model

ABSTRACT

Educators must be imaginative in using instructional resources that align with the latest technological breakthroughs due to the rapid progress of technology in the field of education. Technical and Vocational Education and Training (TVET) for refrigeration and air conditioning is advancing to keep up with technological developments in the area. However, it is usually challenging to invest a significant amount of money on refrigeration and air conditioning equipment for educational sessions. Therefore, researcher has designed and developed a Water-Cooled Chiller System model to address the issues that arose, to be used as an educational tool during teaching and learning sessions. The design and development research (DDR) for this model used the ADDIE approach, consisting of five primary elements: Analysis, Design, Development, Implementation, and Evaluation, for the creation of the Water-Cooled Chiller System Model. The approach is based on Visual, Auditory, and Kinaesthetic (VAK) learning styles, with the goal of improving learning experiences for students and teachers. A questionnaire was utilized as the study instrument, and the research involved a sample of three experts in the field of refrigeration and air conditioning. An industry expert and two lecturers specializing in refrigeration and air conditioning assessed the suitability analysis of the content design, interaction design of the Water-Cooled Chiller System model, and the functionality of the contest. Ultimately, the design and development of this Water-Cooled Chiller System model can positively influence teaching and learning sessions. The researcher has successfully created a Water-Cooled Chiller System model to improve the educational experience for teachers and students utilizing this teaching approach.

1. Introduction

Teachers in Malaysia are encountering a significant difficulty in education due to the rapid technological improvements in the country. The rapid advancement of technology poses a significant challenge in the field of education [1]. Educators need to be innovative in utilizing educational resources that are in line with the most recent technological advancements. Teaching aids are

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https://doi.org/10.37934/ard.140.1.176189

additional materials used by teachers to involve students in instructional sessions [2]. A teacher should thoughtfully choose instructional aides to captivate students and guarantee they concentrate on the lesson according to their comprehension level. The teaching aids should be easy to use for teachers to start the teaching and learning process in the classroom [3].

Non-electronic teaching aids including models, simulations, flash cards, magazines, journals, or relevant photos play a crucial role in the effectiveness of learning content, particularly in TVET disciplines. These educational tools can engage students in comprehending the material being taught and assist them in maintaining concentration on learning through impactful characteristics [4]. The teaching aids need to be effective in order to enhance students' knowledge of the learning topic and increase the quality of teaching and learning. As such, TVET instructors specializing in Refrigeration and Air Conditioning are facing a struggle because of the expensive instruments they need [5]. Therefore, a teacher must be cautious in selecting instructional aides to capture students' attention and maintain their focus in class.

In Malaysia, teachers frequently use these teaching tools as a method to efficiently convey educational information to their students especially in TVET subject [6]. Teaching aids are implements utilized in a classroom to support the educational process. The lack of teaching aids impedes the classroom teaching and learning process, particularly for practical instruction on the water-cooled chiller system. According to Noetel *et al.,* [7], incorporating superior and enough teaching resources into the teaching process enhances the effectiveness of teaching and learning. Creating top-notch teaching materials for the refrigeration and air conditioning course is straightforward and seamlessly fits the curriculum. Baharudin *et al.,* [8] discovered that teaching aids were commonly utilized in several TVET courses, including Refrigeration and Air Conditioning, as well as electronic equipment repair and maintenance courses. These aids are models that collect feedback from students and teaching professionals, demonstrating that this method is commonly preferred by teachers and students, making it a very helpful educational tool for both sides.

Teaching aids are utilized in Malaysia and internationally to engage students in the educational process. Teaching aids are utilized because of budget constraints, particular situations, and to stimulate students' interest in the educational material [9]. Creating a model for a Water-Cooled Chiller System is necessary due to financial constraints for purchasing a water-cooled chiller package. Developing a Water-Cooled Chiller System model is crucial for educational purposes to provide a more in-depth explanation of the system's functioning and enhance students' understanding. Developing this product can assist organizations in saving money by providing a cost-efficient alternative to purchasing a complete water-cooled chiller equipment. Developing the product improves students' understanding of commercial air conditioning systems, leading to a better understanding of the market for these systems.

This research intends to assess the usefulness of a Water-Cooled Chiller System model in the context of Water- And Air-Cooled Chiller System Maintenance at Vocational Colleges. Willis [10] discovered that the VAK model serves as a common learning technique in classrooms and acts as an intervention for student learning. The VAK model is well respected among educators and can be utilized in student learning to accommodate each student's unique learning style. Utilizing the VAK approach in educational media has been demonstrated to enhance students' comprehension of learning material. Research indicates that educational media designed using the VAK model is highly authentic, practical, and effective in facilitating students' understanding of subjects. Figure 1 displays the study's conceptual framework:

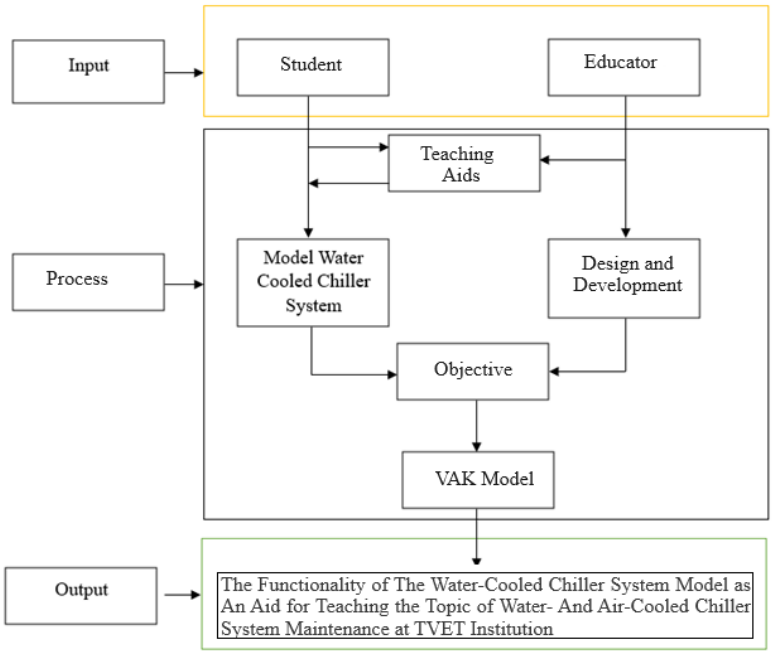


Fig. 1. Conceptual framework for the study

Creating a Water-Cooled Chiller System Model could be a beneficial instructional resource for teachers to improve their teaching techniques. Developing a Model Water Cooled Chiller System is beneficial for engaging students due to its hands-on nature, functionality, and holistic approach. The institution's budgetary limitations impact the advancement of the Water-Cooled Chiller System design. The pricing analysis suggests that buying a water-cooled chiller package is a high-cost item in the market, possibly requiring a significant expenditure to obtain the system [11]. Creating a Water-Cooled Chiller System model is essential for educational reasons as it clarifies the system's cycle, improving students' comprehension. Creating this product can help organizations save money by providing a more cost-effective option compared to buying a whole water-cooled chiller system. Creating the product enhances students' comprehension of commercial air conditioning systems, resulting in a deeper grasp of the systems offered in the market. The primary objective of this research is to:

i. Designing a Water-Cooled Chiller System model for educational use on the topic of Water- And Air-Cooled Chiller System Maintenance at Vocational Colleges.
ii. Develop a Water-Cooled Chiller System model for educational use on the topic of Water- And Air-Cooled Chiller System Maintenance at Vocational Colleges.
iii. Identifying the usability of a Water-Cooled Chiller System model on the topic of Water- And Air-Cooled Chiller System Maintenance at Vocational Colleges.

The primary goals of creating these educational tools are to assess their efficacy and achieve the particular research objectives related to specific issues. This main goal will serve as a guiding structure for the researcher throughout the development process. This study seeks to evaluate experts' approval of a Water-Cooled Chiller System model designed using content design, interactivity, and content rating to improve the learning experience of the topic. This method can improve students' understanding by increasing their engagement with educational materials and boosting their desire to gain knowledge.

2. Methodology

The design and research development of this product is widely known as Design and Research Development (DDR) [12]. Design research is a systematic approach used by researchers to collect essential information for problem-solving through the use of specific methodologies to gather data and evaluate results. The Water-Cooled Chiller System model incorporates quantitative data collection methods in its design and development. Abundant data sources are crucial for successful research efforts. The study employed the ADDIE Model for its product development process, a systematic approach with numerous stages used by researchers to produce a product. The ADDIE Model comprises five phases: Analysis, Design, Development, Implementation, and Evaluation. The diagram below depicts each phase of product development with the ADDIE Model. To effectively achieve the study's objectives, it is crucial to have a meticulously planned and implemented research approach. Strategic planning helps reduce unexpected errors. The application was developed utilizing the ADDIE paradigm as part of the product development process. The ADDIE model offers a systematic method for creating educational materials, including a cyclical process and all necessary stages for developing a high-quality course or program. Figure 1 illustrates the five main steps of the ADDIE model technique, providing advice for developing applications.

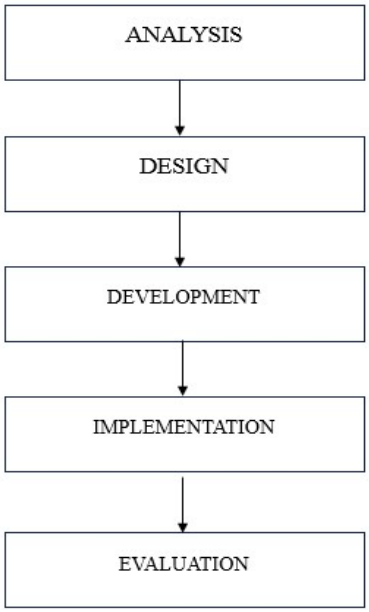


Fig. 2. Model ADDIE [13]

2.1 Sampling

The researcher utilised a questionnaire to evaluate the gathered data in the investigation. The researcher selected three refrigeration and air conditioning experts who had at least five years of experience in the sector to take part in the study. This sampling method is employed to gather essential data from specific experts [14]. The researcher will select three experts with predetermined qualities to participate as a sample in this investigation. Professional specialists are chosen based on their expertise, number of publications, and professional background [15]. The study found that a crucial criterion is having five or more years of expertise in a similar profession, particularly in the refrigeration and air conditioning sector.

2.2 Data Analysis

The researcher needs to confirm if the product is in line with the set objectives outlined in this study. The goal can be assessed using a designated research tool, which includes using a questionnaire form created by experts in the field. The researcher must examine and develop the product based on feedback from experts to ensure it is created in accordance with the appropriate standards. Henderson *et al.,* [16] stated that the study will examine the feedback provided by the assessor. A study with a validity level of 70% indicates a significant level of accomplishment. The researcher assesses the validity of the Water-Cooled Chiller System model by dividing the expert's total score (x) by the total actual score (y) and then multiplying the quotient by one hundred.

Table 1
Determination level table

Assessment	Deterministic Level Indicators
High	80-100
Medium	40-79
Low	0-39

The researcher will assess the design and development of the Water-Cooled Chiller System model by using a questionnaire as the research tool. Three specialists in the refrigeration and air conditioning business provided feedback through a questionnaire. This questionnaire is designed to improve the accuracy and exactness of the research being conducted. The questionnaire contains details regarding development requirements, product design, functionality, and a section for feedback and suggestions from participants. Before distributing, the researcher designed a questionnaire divided into four main sections: item A for responder demographics, item B for development needs, item C for product design, and item D for product functionality.

2.3 Product Design

The Water-Cooled Chiller System model for this teaching aid was designed and developed following the ADDIE paradigm. The ADDIE model is commonly used in educational product development and was chosen for designing and creating a water-cooled chiller system. The ADDIE methodology comprises five comprehensive phases, commencing with the analysis phase when the researcher scrutinizes the purpose, objectives, scope, problem description, and other pertinent elements. Next, the procedure will move to the design phase where the researcher will start developing the initial model sketches either manually or using Thinkercad software. After the design phase, the researcher moves on to the product development stage to build the product until it is finished, and then moves to the implementation phase to test its functionality. After completing the implementation phase, the researcher will move on to the design evaluation step and the creation of the Water-Cooled Chiller System model.

2.3.1 Analysis phase

At this stage, multiple activities are conducted, such as identifying and acknowledging the issue that has to be resolved. The goal of the analysis phase is to pinpoint the components or factors that lead to the problem's occurrence. The analytical phases involve user analysis, learning environment analysis, and analysis of teaching goals to assess the need for integrating the design and development process of the Water-Cooled Chiller System model into the teaching and learning process. An

evaluation to determine the appropriateness of creating this model is carried out while teaching and learning. The researcher needs to evaluate the quality and cost of the equipment to minimise the expenses of building the teaching board model for the basic cycle system of aircraft air cooling, as indicated in Table 2.

Table 2
Analysis phase process for the design and development of teaching aids model

Criteria	Explanation
Functionality	This Water-Cooled Chiller System model design must possess operational value that aligns with or fulfils the study's scope.
Controllability	Users must follow the handbook to effectively oversee this Water-Cooled Chiller System model and demonstrate its operation clearly.
Outline	This Water-Cooled Chiller System model development must align with the functions and operational methods utilized for educational objectives.
Endurance	Choosing materials for this Water-Cooled Chiller System model crucial as it impacts both its longevity and functionality.
Economy	Factors such as cost, time, and energy must be taken into account when developing this Water-Cooled Chiller System model. This teaching aids model is affordably priced and serves as an effective tool for educational purposes.

2.3.2 Design phase

During the design step, the information collected in the analytical phase is transformed into a physical sketch for the development process. The information in this stage originates from the initial analysis phase. An in-depth analysis of the structure's appearance is carried out to evaluate the level of advancement in the product's development. During this stage, precise teaching goals are defined, examination questions are created, and teaching approaches are chosen. To improve teaching and learning results, research needs to investigate the materials' design, teaching organisation, and the relationship between learning theory and model usage.

The Water-Cooled Chiller System model is created with a focus on safety, functionality, size, and other essential aspects. An ideal model must meet the essential needs for teaching and learning in this class, offering pupils a thorough knowledge and safeguarding their safety. Important elements include clear visuals, an informative video with a QR link, and hands-on participation. Table 3 illustrates the utilisation of the VAK Learning Model in the instructional aids design process:

Table 3
Utilizing the VAK Learning Model in the design phase for the Water-Cooled Chiller System model

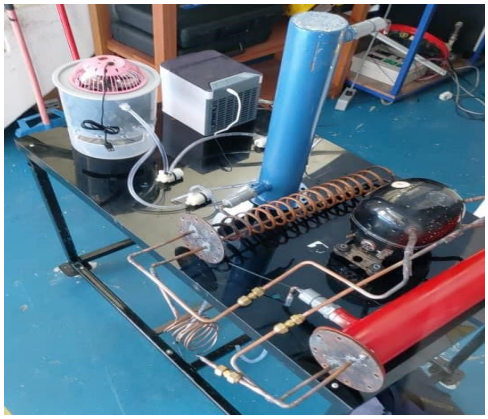
No	VAK Learning Model	Display and Description
1.	Visual	 Final Sketch Final Product The researcher created a Water-Cooled Chiller System model to represent the visual aspect accurately as an actual product.
2.	Auditory	This instructional approach involves the researcher creating a QR code for consumers to scan, directing them to the TikTok app where they will receive an explanation of the Water-Cooled Chiller System cycle.
3.	Kinesthetic	 The researcher has created a Water-Cooled Chiller System model as educational tools to demonstrate the functionality of each unit, aiding teachers in their teaching and learning sessions.

2.3.3 Development Phase

During this phase, the researcher elaborates on the systematic process of constructing the model. The researcher must transform the drawing into a tangible form following the original design. The water-cooled chiller type will be conceived and built first, followed by the water handling unit and cooling tower. The main progress is attributed to the chiller unit, which acts as the primary source of both cold and hot air. The chiller unit is made of a 2.5-inch diameter stainless steel rod that measures 20 inches in length. A tank made of stainless steel is used to build the chiller, which has two rods since the chiller unit is composed of two parts: the evaporator and the condenser. Stainless steel is

selected for its exceptional thermal conductivity characteristics. This chiller concept transfers cold or hot temperatures to water, which is subsequently sent to the next system. The chiller tank has a copper coil that carries the gas and forms a system cycle with 15 copper coils, each having a 2-inch diameter. Table 4 shows the development phase for the Water-Cooled Chiller System model:

Table 4
The development phase for the Water-Cooled Chiller System model

No	Description	Display
1.	Chiller Tank Development Upon finishing the chiller tank construction, the researcher shifted attention to building the water handling equipment and the cooling tower. The researcher has chosen to adapt the air cooler into an air handling device and transform the medium-sized container into a cooling tower. The researcher incorporated a copper coil into the air cooler of the air handling unit to serve as a cold temperature transfer component.	
2.	Air Handling Unit After constructing the three units, the researcher chose to join them to form a complete system comprising the chiller, pump, water handling unit, cooling tower, frame, and electrical wiring. The researcher must assess the compatibility and positioning of all unit types inside the current frame in the refrigeration and air conditioning workplace. Once the decision is finalized, the researcher proceeds to install the full machine, which involves setting up the water hose.	
3.	The entire equipment is installed. After constructing the three units, the researcher chose to connect them to the full system, comprising the chiller, pump, water handling unit, cooling tower, frame, and electrical wiring. The entire unit is connected using the existing frame in the refrigeration and air conditioning workshop. However, the researcher must assess the compatibility and choose the appropriate placement for all unit kinds. Once the option is finalized, the researcher commences assembling the entire apparatus, which involves installing the hose.	

2.3.4 Implementation phase

The researcher has finished developing the product at this implementation phase. After completing the final product, the researcher must go on to the implementation phase, which includes evaluating the design and development of the Water-Cooled Chiller System model. Testing will be carried out to evaluate the performance of this model and ascertain whether it functions effectively or needs improvements by the researcher. The researcher evaluates the functionality of certain units such as the chiller unit, air handling unit, cooling tower, and pump throughout the implementation phase.

Each component in the Water-Cooled Chiller System has a distinct purpose and depends on the others. The cooling tower unit functions successfully under typical circumstances, as long as there is no water leakage that may result in water loss in the condenser chiller tank. This stage will evaluate the functionality of the electrical wiring to ascertain if the item is operational. Prior to commencing the review process, all issues are taken into consideration. Three experts in refrigeration and air conditioning will evaluate the project to assess its appropriateness as a teaching tool.

2.3.5 Evaluation phase

The evaluation step will analyse the Water-Cooled Chiller System model to determine if it aligns with the researcher's aims. Three experts in refrigeration and air conditioning will evaluate if the built model is suitable as a teaching tool in Vocational College courses. The evaluation step will include distributing a questionnaire containing numerous elements that responders are required to answer. The components consist of the background of the chosen responses, the appropriateness of the design, the creation of the teaching model, and its effectiveness as an educational tool. Respondents must reply with two spaces. The researcher incorporates a Likert-type scale, such as agree or disagree, in the initial section. Respondents in the second column utilised a Likert-type scale with choices such as accept, not accept, requires improvement, and a section for experts to provide remarks.

3. Results

3.1 Expert Demographic Analysis

Expert review requires the input of three individuals from relevant fields. The evaluation procedure involves assessing the design, evaluating the interactivity of the teaching board, assessing the applicability of the material, and gathering feedback from experts for the Water-Cooled Chiller System model. Table 5 presents the demographics of experts in pertinent disciplines.

Table 5
Expert Demographic Analysis

Details	Expert 1	Expert 2	Expert 3
Gender	Male	Male	Male
Job	Lecturer	Lecturer	Technician
Work experience	11 – 15 years	1 – 5 years	1 – 5 years
Jobs	HVAC	HVAC	HVAC
Field of Specialization	Male	Male	Male

3.2 Expert Evaluation Analysis

Three experts in a related field assessed the design, the interaction of the teaching board, and the applicability of the content. The research findings regarding the content design, interaction design of the Water-Cooled Chiller System model, and the functionality of the contest are presented in Table 6.

Table 6
Expert evaluation analysis for content design, interaction design and product functionality

No	Item	Yes	No	Acceptance Percentage (%)
Analysis for Content Design				
1.	The Water-Cooled Chiller System model is portable.	3		100%
2.	The Water-Cooled Chiller System model is safe to be used as a teaching aid.	3		100%
3.	The Water-Cooled Chiller System model components facilitate a straightforward and lucid learning experience.	3		100%
4.	The Water-Cooled Chiller System model has a captivating feature.	3		100%
5.	The Water-Cooled Chiller System model is appropriate for educational purposes.	3		100%
6.	The Water-Cooled Chiller System model closely mirrors that of a real system.	3		100%
Analysis for Interaction Design				
1.	The Water-Cooled Chiller System model is compatible with the syllabus content.	3		100%
2.	The material composition selected for the Water-Cooled Chiller System model is suitable and easily understood.	3		100%
3.	The installation components of the Water-Cooled Chiller System model are useful for teaching processes.	3		100%
4.	The coupling of materials for the model frame in the Water-Cooled Chiller System is sturdy.	1	2	33%
5.	The installation of electrical components on the Water-Cooled Chiller System model is suitable for educational purposes.	1	2	33%
6.	The Water-Cooled Chiller System model was presented neatly and effectively	3		100%
Analysis of Functionality as an Effective Teaching Aid Tool				
1.	The Water-Cooled Chiller System model is user-friendly.	3		100%
2.	The Water-Cooled Chiller System model serves as a teaching aid for teachers in the teaching and learning process.	3		100%
3.	The labels on the Water-Cooled Chiller System model can help enhance student comprehension.	2	1	67%
4.	Using the Water-Cooled Chiller System model might aid students in comprehending the functionality of the system.	3		100%
5.	Adding a QR code to the Water-Cooled Chiller System model can simplify students' access to the video about the system.	3		100%
6.	Creating Standard Operating Procedures (SOP) for the Water-Cooled Chiller System model type can help users operate it safely and efficiently.	3		100%

Following a design suitability examination, all three experts concurred that the design of the mobile teaching model matched the criteria. All three experts unanimously concurred that the design of this model is safe for use as a teaching aid. Three experts all concurred that the third question in the teaching approach is easily distinguishable. All three experts unanimously agreed that the teaching model's design is appealing for the fourth question. All three experts concur unequivocally that the design size of this teaching model is suitable for use as a teaching tool. All three specialists agree that the design of this model closely resembles the real system.

All three experts concurred that the allocation of resources in this teaching approach is suitable for analysing its progress. All three experts agreed unanimously that the resources used for this

teaching approach are appropriate for the second question item. All three experts unanimously concur that the installation of components on this teaching model is practical for the third inquiry. One expert, accounting for 33%, confirmed that the connection of elements in the scope of this teaching style is robust for the fourth item. Two additional experts emphasised the need for improvements in this teaching approach. An expert agreed that the arrangement of electrical components on this educational model is appropriate for the fifth item. Two professionals recognised the necessity for enhancement in this instructional framework. All three experts concurred that the cleanliness of the teaching board was satisfactory.

All three experts unanimously agreed that the teaching model proposed is user-friendly for instructional purposes. All three experts unanimously agreed that the teaching model established is advantageous for teachers working as teaching aids in the teaching and learning process for the second question. Only two out of the experts surveyed, representing 67%, agreed that the labels on the teaching model improve student comprehension. An expert recommended that it needs upgrading. All three experts agreed that using this teaching technique can improve students' understanding of the water-cooled chiller system's operation for the fourth item. All three experts agreed that adding a QR code to the teaching model would let students easily access the video on the water-cooled chiller system. All three experts concurred that establishing Standard Operating Procedures (SOP) for adopting this instructional approach can help ensure safe and efficient operation for users.

Three experts endorsed the Water-Cooled Chiller System model's creation following an analysis of the design data. The investigation scrutinized essential elements like mechanical and electrical components used in the model's development. Soliman *et al.,* [17] asserts that a successful instructional tool should possess key attributes such as longevity, quality, and user-friendliness. This variant was designed to be user-friendly with the addition of easily manoeuvrable wheels on the frame. All three experts concur that the architecture of this instructional paradigm is transferable. The evaluation assesses the visibility and clarity of this specific component of the model to users, as well as the attractiveness of the teaching model's design. According to Le [18], engaging lectures delivered by professors might enhance students' motivation to participate in the educational process.

This Water-Cooled Chiller System model focuses on creating appeal to engage students in the session. Experts concur that this teaching method is straightforward and visually appealing, with an attractive design element. This instructional model's qualities are appropriate for use as a teaching tool and closely mirror the real system, as approved by three experts. As to Manthra Prathoshni *et al.,* [19] a model is a reproduction made with certain materials to closely mimic the original thing. The primary goal of developing a Water-Cooled Chiller System model for instructing Water- And Air-Cooled Chiller System Maintenance at Vocational Colleges has been met. The researcher considers the emphasis on implementing this paradigm to be crucial. Visualization is using the sense of sight for mental imagery and reflection [20]. Visualization is data displayed in a visual manner that can be represented visually. Visualization is essential in the VAK model for forming mental images in the mind.

Marietta Papadatou-Pastou *et al.,* [21] found that teachers commonly use the VAK model to study student learning styles and integrate them into teaching and learning. Utilizing the VAK paradigm in teaching improves students' critical thinking abilities. The VAK model improves student performance and identifies a learning style that is especially advantageous for students with a TVET background. The VAK Model assists in determining a student's favoured learning mode, which might be visual, auditory, or kinesthetics'. This shows that the VAK model functions as both a teaching method and an assessment tool for students' cognitive preferences [22].

The teacher's duty is to educate students by helping them use teaching aids to apply gained knowledge and express new concepts effectively [23]. Visualization in psychology entails creating mental representations or rehearsing movements to improve skills or performance. Marsh [24] defined teaching aids as characterized by their safety and user-friendly design. The Water-Cooled Chiller System model should be user-friendly for teachers and students since it is an essential tool for educational sessions. Experts have verified the validity of the VAK model and its impact on students in relation to the design and development of the Water-Cooled Chiller System model created by the researcher.

In addition, the study utilized a TikTok app to display authentic vacation videos and system procedures for the auditory component. Users can just scan the QR code supplied by the researcher. The researcher offers a Water-Cooled Chiller System model for kinesthetics' learners to interact with through tactile exploration, water manipulation, and model maintenance. TikTok can enhance student engagement by utilizing project-based learning or creative tasks. Students can produce brief movies to explain the subjects they are studying, exchange ideas with peers, and enhance their comprehension through collaborative efforts [25].

Additionally, an evaluation will be conducted to assess the appropriateness of installing electrical components on this Water-Cooled Chiller System model. Electrical wiring is crucial for the progression of this architecture [26]. Experts have evaluated the electrical wiring. One expert finds it adequate, while the other two suggest relocating the main switch due to its proximity to a water source, which could lead to electric shock in case of a leak. This review assesses the effectiveness of this teaching method in terms of neatness. All three experts concur that the method demonstrates strong organization and clarity. Billett [27] outlines the tidying process as involving the creation and construction of the Water-Cooled Chiller System model, fastening copper pipe connections, organizing wiring, and labelling the instructional model.

4. Conclusion

The Water-Cooled Chiller System model has been successfully designed and built to achieve the defined objectives and effectively address the research problems. Three refrigeration and air conditioning professionals evaluated the Water-Cooled Chiller System model. Evaluation of the teaching model has shown positive results, indicating its effectiveness as an instructional aid for subjects concerning water- and air-cooled chillers. The VAK model is a learning style framework that helps students recognize their learning preferences and enhance their academic achievement. This study seeks to be a reference for other educators as an alternative teaching technique in the classroom. The uniqueness of the VAK technique, which integrates Visual, Auditory, and Kinaesthetic components, improves student involvement and learning efficiency in all subjects. The vocational college is now undergoing system maintenance. Experts have provided feedback on this instructional method to guide future developers looking to enhance their skills. The researcher has successfully created a Water-Cooled Chiller System model to improve the educational experience for teachers and students utilizing this teaching approach.

Acknowledgement

This research was supported by Universiti Tun Hussein Onn Malaysia (UTHM) through Tier 1 (Vot Q531) and GPPS (Vot J066). We would also like to thank UTHM-Labtech Digital Innovation Centre of Industry for their efforts in assisting this project.

References

[1] Bujang, Siti Dianah Abdul, Ali Selamat, Ondrej Krejcar, Petra Maresova, and Ngoc Thanh Nguyen. "Digital learning demand for future education 4.0—Case studies at Malaysia education institutions." In *Informatics*, vol. 7, no. 2, p. 13. MDPI, 2020. https://doi.org/10.3390/informatics7020013

[2] Hashim, Suhaizal, Siti Hajar Zakariah, Fatin Afiqah Taufek, Nurul Nadwa Zulkifli, Noor Hidayah Che Lah, and Dewi Eka Murniati. "An observation on implementation of classroom assessment in technical and vocational education and training (TVET) subject area." *Journal of Technical Education and Training* 13, no. 3 (2021): 190-200. https://doi.org/10.30880/jtet.2021.13.03.019

[3] Ismail, Siti Noor, Mohd Norakmar Omar, Yahya Don, Yoppy Wahyu Purnomo, and Muhamad Dzahir Kasa. "Teachers' Acceptance of Mobile Technology Use towards Innovative Teaching in Malaysian Secondary Schools." *International Journal of Evaluation and Research in Education* 11, no. 1 (2022): 120-127. https://doi.org/10.11591/ijere.v11i1.21872

[4] Khan, Aamna S., and Irshad Ullah. "Applicability of teaching aids in extension education." (2021): 217-227. https://doi.org/10.33687/ijae.009.02.3464

[5] Mesuwini, Joseph, and Sello P. Mokoena. "TVET lecturer work-integrated learning: Opportunities and challenges." *International Journal of Learning, Teaching and Educational Research* 22, no. 8 (2023): 415-440. https://doi.org/10.26803/ijlter.22.8.22

[6] Rahman, A. B. A., Mohd Azlan Mohammad Hussain, and Rafeizah Mohd Zulkifli. "Teaching vocational with technology: A study of teaching aids applied in Malaysian vocational classroom." *International Journal of Learning, Teaching and Educational Research* 19, no. 7 (2020): 176-188. https://doi.org/10.26803/ijlter.19.7.10

[7] Noetel, Michael, Shantell Griffith, Oscar Delaney, Taren Sanders, Philip Parker, Borja del Pozo Cruz, and Chris Lonsdale. "Video improves learning in higher education: A systematic review." *Review of educational research* 91, no. 2 (2021): 204-236. https://doi.org/10.3102/0034654321990713

[8] Baharudin, Nurhayati, Khairul Anuar ABDUL RAHMAN, DEBIE DEVISSER GERIJIH, MOHD BEKRI RAHIM, and Mohamad Faiz Asyrawi Mohd Suhaimi. "A Simulation Of Basic Air Conditioning System As Teaching Tool (ABBM): Basic Air Conditioning System As Teaching Tool (ABBM)." *Research and Innovation in Technical and Vocational Education and Training* 1, no. 2 (2021): 151-158.

[9] Obe, Pauline Ijeoma, Maureen Anayo Madu, and Eunice N. Onah. "Innovation in Technical Vocational Education and Training (TVET) Instructional Delivery: Problems and Prospects." *IGWEBUIKE: African Journal of Arts and Humanities* 7, no. 4 (2021).

[10] Willis, Samara. "Literature review on the use of VAK learning strategies." *The STeP Journal* 4, no. 2 (2017): 90-94.

[11] Huang, Sen, and Wangda Zuo. "Optimization of the water-cooled chiller plant system operation." In *Proc. of ASHRAE/IBPSA-USA Building Simulation Conference, Atlanta, GA, USA*. 2014.

[12] Richey, Rita C., and James D. Klein. "Design and development research." In *Handbook of research on educational communications and technology*, pp. 141-150. New York, NY: Springer New York, 2013. https://doi.org/10.1007/978-1-4614-3185-5_12

[13] Molenda, Michael. "In search of the elusive ADDIE model." *Performance improvement* 42, no. 5 (2003): 34-37. https://doi.org/10.1002/pfi.4930420508

[14] Sekaran, Uma, and Roger Bougie. *Research methods for business: A skill building approach*. john wiley & sons, 2016.

[15] Cabero-Almenara, Julio, Rosalía Romero-Tena, and Antonio Palacios-Rodríguez. "Evaluation of teacher digital competence frameworks through expert judgement: The use of the expert competence coefficient." *Journal of new approaches in educational research* 9, no. 2 (2020): 275-293. https://doi.org/10.7821/naer.2020.7.578

[16] Henderson, Michael, Tracii Ryan, David Boud, Phillip Dawson, Michael Phillips, Elizabeth Molloy, and Paige Mahoney. "The usefulness of feedback." *Active Learning in Higher Education* 22, no. 3 (2021): 229-243. https://doi.org/10.1177/1469787419872393

[17] Soliman, Maged, Apostolos Pesyridis, Damon Dalaymani-Zad, Mohammed Gronfula, and Miltiadis Kourmpetis. "The application of virtual reality in engineering education." *Applied Sciences* 11, no. 6 (2021): 2879. https://doi.org/10.3390/app11062879

[18] Le, Thi Tuyet Minh. "A case study of students' views on effective online learning." *AsiaCALL Online Journal* 12, no. 5 (2021): 24-33.

[19] Manthra Prathoshni, S., V. Vishnu Priya, and R. Gayathri. "Effect of teaching aids on student's academic performance in professional courses." *Drug Invention Today* 10, no. 12 (2018).

[20] Dennis, Brandon, and Ramyaa Ramyaa. "Comparative analysis of object visualization tools with respect to their use in education." *Bulletin of the Technical Committee on Learning Technology* 21, no. 4 (2021): 10-14.

[21] Papadatou-Pastou, Marietta, Anna K. Touloumakos, Christina Koutouveli, and Alexia Barrable. "The learning styles neuromyth: when the same term means different things to different teachers." *European Journal of Psychology of Education* 36, no. 2 (2021): 511-531. https://doi.org/10.1007/s10212-020-00485-2

[22] Kawther, Parween Shawkat. "The Academic Effects of VAK Learning Styles on EFL (English as a Foreign Language) Students to Learn English Vocabulary." *Zanco Journal of Human Sciences* 24, no. 3 (2020): 276-287. https://doi.org/10.21271/zjhs.24.3.17

[23] Hashim, Suhaizal, Affero Ismail, and Alias Masek. "The characteristics of collaborative portfolio assessment learning system as a tools in school based assessment environment." In *2017 7th IEEE International Conference on System Engineering and Technology (ICSET)*, pp. 1-6. IEEE, 2017. https://doi.org/10.1109/ICSEngT.2017.8123410

[24] Marsh, David D. "Educational leadership for the twenty-first century: Integrating three essential perspectives." *The Jossey-Bass reader on educational leadership* (2000): 126-145.

[25] Khlaif, Zuheir N., and Soheil Salha. "Using TikTok in education: A form of micro-learning or nano-learning?." *Interdisciplinary journal of virtual learning in medical sciences* 12, no. 3 (2021): 213-218.

[26] Kob, Che Ghani Che, Arman Shah Abdullah, Noor Aida Aslinda Norizan, and Halimaton Shamsuddin. "Effects of learning aid (kit) on student performance for Electric Circuits topics." *International Journal of Academic Research in Business and Social Sciences* 9, no. 1 (2019). https://doi.org/10.6007/IJARBSS/v9-i1/5400

[27] Billett, Stephen. *Learning in the workplace: Strategies for effective practice*. Routledge, 2020. https://doi.org/10.4324/9781003116318