

A Proposed Vision for Electronic Training for Computer Teachers According to the TAWOCK Model

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Received: April 9, 2024

Accepted: June 12, 2024

Online Published: September 8, 2024

doi:10.5539/jel.v13n6p100

URL: <https://doi.org/10.5539/jel.v13n6p100>

Abstract

This study proposed a conceptualization for the e-training of computer science teachers based on the TAWOCK model. After analyzing several scientific papers, a proposed conceptualization based on the TAWOCK model was presented for training computer science teachers in specialized topics in the field of computing and reviewed by several specialists. This study recommended using this proposed conceptualization for designing and delivering e-training for computer science teachers and suggests other studies using this model in training teachers on many computer science topics, and other studies using this model in training teachers in other specialists.

Keywords: constructivism, adult education, instructional design

1. Introduction

Teacher training falls within the scope of adult education, which poses a challenge for the field of instructional design in terms of considering their characteristics (O'connell & Medeni, n.d.).

- Adults are experienced individuals who have gone through various stages in their lives, accumulating knowledge and experiences. The trainer must take this wealth of experience into account and constantly encourage participants to share it with others. The trainer should not treat the adult learner as a passive recipient. These experiences enable adults to have the ability to perceive, act, and use information as a basis for acquiring additional knowledge (Zaytoun, 2004).
- Adults are self-directed learners. We cannot change a person, but we can provide them with knowledge and resources that allow them to choose the change that suits them best. The ultimate choice remains with the learner. Therefore, the trainer should provide a training environment that encourages participants to take initiative, assume responsibility, and play a leadership role within groups.
- Adults prefer applied activities. They want to apply the knowledge they acquire. It is not enough for the trainer to explain action plans, negotiation strategies, public speaking skills, and so on. Adults need to prepare and work on applying them.
- Adults focus on achieving goals. They want to know how the training course will contribute to improving their lives. How will it enhance their professional prospects or develop the skills they need? There are differences among adults in terms of their reasons for enrolling in learning programs. Some join for professional reasons, while others have personal or social reasons. Therefore, adults learn what they consider important to them. When adults recognize the need to learn something, they become more capable of working diligently and persevering. If someone fails in one of these programs, it means that the program does not meet their needs (Zaytoun, 2004).
- Adults are social beings. They want to interact with other participants present in the training room. They want to engage in conversations with them, not just listen to the trainer. They enjoy laughter and having a good time with others. There is no need to train them in a dry and serious manner.

Designers of adult education should adopt a constructivist approach because it provides a suitable framework for adapting instructional design elements to the circumstances, contexts, and diverse cultural backgrounds of adults. Adults have their characteristics, and the design of adult education has constructivist principles that influence the elements of instructional design (Zaytoun, 2004). There are two approaches to constructivism: the cognitive

approach, which focuses on the learner's mental processes (Joshua & Melissa, 2018), and the cultural and social approach, which focuses on learners' participation in social, cultural, and historical practices within a specific context (Joshua & Melissa, 2018). These two approaches, cognitive and socio-cultural, complement each other, and constructivism is an entity in which these two approaches interact (Zaytoun, 2004). Training methods also vary, some requiring minimal guidance from the trainer, while others depend on the personal skills and abilities of the trainee and do not require any intervention from the trainer (Al-Kholy, 2015). Constructivism is based on the idea of deep and lifelong learning through natural and spontaneous interaction. Instead of viewing learning as a process of knowledge transfer primarily conducted by the teacher, learning is seen as a process of construction in which the learner plays a major role (Al-Abdulkareem, 2011).

Constructivism theory is based on several assumptions, including that constructivism emphasizes the construction of knowledge rather than its transmission, so that the learner creates new cognitive structures that organize and interpret their experiences with the external world, and that learning is an active process, meaning that the learner exerts mental effort in the learning process to discover knowledge by themselves. This active process is the responsibility of the learner and not the teacher's responsibility. Conceptual growth occurs through negotiation of meaning and changing our internal representations through cooperative learning, meaning that individuals do not build their knowledge of the external world solely through their activities, but knowledge is also constructed through social negotiation with others based on their existing cognitive system. Pre-existing knowledge of the learner is a fundamental condition for meaningful learning, as the interaction between new knowledge and the learner's pre-existing knowledge is one of the important components of meaningful learning. Learning should occur through authentic tasks, so when learners are faced with real problems or tasks, it helps them construct meaning from what they have learned and develops their confidence in their ability to solve the problems they encounter (Zaytoun, 2004).

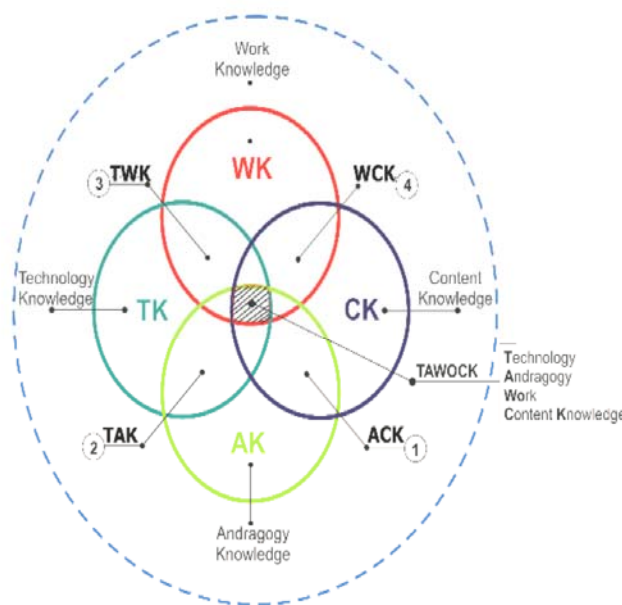
The clear shortcomings in in-service training opportunities for teachers are an indication of the weakness in the design of training programs according to the constructivist approach, which has made teachers – despite all the changes that occur in their various specialties – not receive significant training. Most of them practice the profession based on information and learning methods they acquired during their university studies, reflecting the difficult reality experienced by teachers (Ibrahim, 2018). Therefore, Zaytoun (2004) identified five principles that reflect constructivist values and influence the design of education, and these principles are attention to the learner's entity regarding what they learn, as the teacher is not the sole source of learning; providing a learning context that supports both learner self-organization and their principles; incorporating the reasons and justifications for learning in the activities that learners engage in; self-regulated learning and the learner's responsibility for scientific growth and self-monitoring; and focusing on integrating the learner into intentional and organized learning processes.

With the development of technology, training methods have multiplied, and electronic training has imposed a new reality on all elements of the training system in most countries of the world. It has brought about radical changes in the nature, content, and procedures of the training process, and different roles and tasks have emerged for both the trainer and the trainee. Employing electronic training can reduce the obstacles to traditional training. To provide more interactive tools and programs (Saraya, 2012). However, it is important to view electronic training as a response to an actual need, and not a reaction to an existing problem or lack of performance, and this requires that the development of the electronic training curriculum be preceded by an integrated analysis of information and identification of training needs (Fadil, 2019). This can be applied by using one of the training models that act as an organizing framework that helps achieve the goal of training. Examples include the Kolb model, which relies on forming knowledge through experience (Al-Qahtani et al., 2021), or the GROW model, which helps to solve problems. Problems, using time, focusing effort, and making good decisions. It consists of (Goals), which means defining short- and long-term goals to be reached, (Reality), which means knowing the current situation and discovering facts, and (Options), which means identifying obstacles that prevent reaching the goal and finding... Ways to solve it, either (Will) means making plans that need to be done (Wilson, 2020), or other multiple training models.

Computer teachers should be trained more effectively, so that they teacher understands the dimensions of the teaching process appropriately for the knowledge content they will present and how to integrate it with technology (Al-Husseini, 2021); Training should be built according to the needs of computer teachers, as it is education for work, and it has special needs, needs at the andragogy level, which means the level of adult education, and this level requires that the trainer carry out competency-based and work-oriented training, and use appropriate methods for adult education. (Arifin et al., 2020), The accumulated experiences of computer teachers should also be taken into account (Zaytoun, 2004), and the training program should be designed using all technological resources available to the computer teacher, and based on the availability of human interaction and various training materials

(Ghanem & Hassouna, 2016). Therefore, it is a good idea to follow the TAWOCK model in providing such training programs. The TAWOCK model combines the requirements of training provided to adults, develops their independence, simulates their level of maturity, directs them toward work, and also lays the foundation for providing electronic training based on technical knowledge (Arifin et al., 2020).

Therefore, this study relies on the TAWOCK model (Technology-Adapted Work Context); due to its ability to effectively integrate technology into education and professional training (Arifin et al., 2020). Engl and Nerdel (2021) also emphasized the importance of using learning theories and digital teaching models in vocational education, including the TAWOCK model, which is based on adapting the TPACK model (Technological Pedagogical Content Knowledge) for vocational education. It is based on andragogy and work knowledge; it provides better educational conditions in receiving knowledge and enhances close relationships between teachers and students during the learning process (Arifin et al., 2020). Vocational education is education for work, and vocational education needs are different. The TPACK model lacks discipline when applied in the professional field, as it focuses on technological knowledge, pedagogical knowledge, and content knowledge, which are integrated into the learning context. However, work goals or experience do not emerge when this concept is applied in vocational education. Therefore, the concept of work can be used in vocational education, along with an appropriate pedagogical learning approach to apply to adult professionals (Arifin et al., 2020). The TAWOCK model is illustrated below (Figure 1).



Source (Arifin et. al., 2020 A, 446)

TK	Technical Knowledge: How to use technology as a tool to support education.
AK	Andragogical Knowledge: The method by which the trainer conducts competency-based and work-oriented training using adult learning techniques.
CK	Content Knowledge: An important point that must be learned is understanding the content of the learning.
WK	Work Knowledge: It refers to the type of work that needs to be carried out.
ACK	Knowledge of Adult Instructional Strategies for Content: It is knowledge about how to represent and formulate the subject matter in a way that facilitates understanding for adults.
TAK	Technical Knowledge of Adult Instructional Strategies: It is knowledge about the technology that can be used to facilitate adult learning.
TWK	Work-Related Technical Knowledge: It is knowledge about how to leverage technology in the workplace and support knowledge building.
WCK	Work-Related Content Knowledge: It is knowledge about how to create work-related content.
TAWOCK	Technical Knowledge of Adult Instructional Strategies for Work Content: It is knowledge about how to facilitate learning for adults with specific competencies and skills through adult instructional methods and using technology.

Figure 1. TAWOCK model

The TAWOCK model works at the middle level according to the learning levels shown in the figure below (Figure 2).

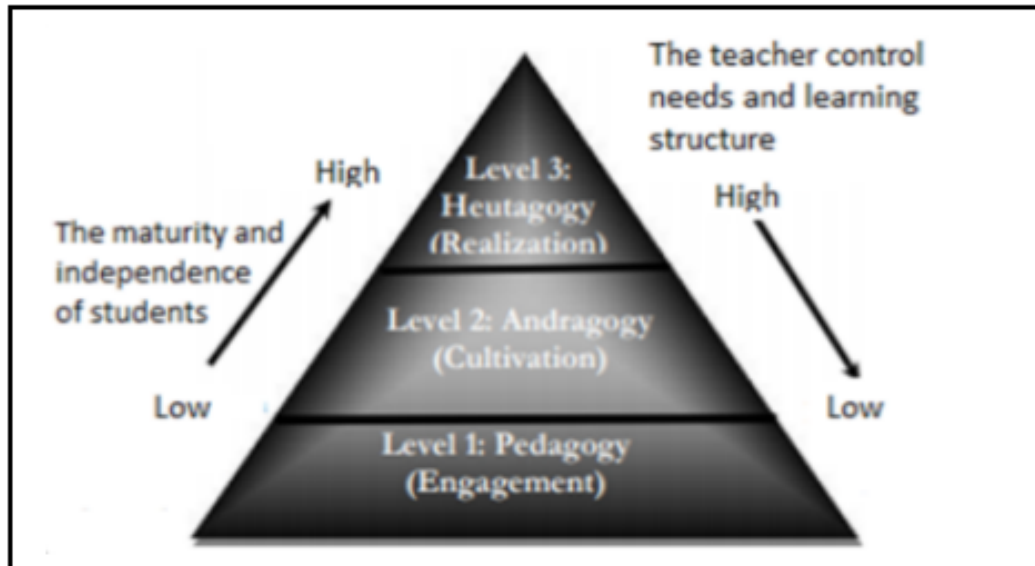


Figure 2. Levels of Learning between Pedagogy, Andragogy, and Heutagogy

In the field of pedagogy, it is recommended to adopt a three-level learning approach (Arifin et al., 2020):

- Pedagogy Level: This level refers to educational participation, and it represents the lowest or fundamental level of the educational approach. At this level, students are participants who follow the will of the teachers. In the field of pedagogy, it is considered that this level lacks the presence of freedom in developing into a mature, independent, firm, and procedural individual, where the student feels unproductive.
- Andragogy Level: This level emphasizes maturity and independence in learning. It is suitable for adult education.
- Heutagogy Level: This level, also known as self-determined learning, is the highest level that goes beyond the demands of adults by being part of life.

To align with the requirements of 21st-century learning, specifically in the context of technology and knowledge, the TAWOCK model (Technology and Work Oriented Content Knowledge) has been adapted to provide knowledge in the field of education and vocational training using technology. A component related to work values and work objectives was added to the model (Arifin et al., 2020). Vocational education focuses on developing competencies according to the required work (Arifin et al., 2020). Therefore, a study conducted by Warju et al. (2020) highlighted the importance of using the TAWOCK model in professional fields. The model is suitable for vocational learning through the use of technology, as it aims to develop the capabilities of students and trainees to become skilled workers. Vocational education is education for work, and it requires an educational approach that can professionally showcase individual capabilities and then develop the person's skills and competencies according to the needs of the workplace (Arifin et al., 2020). This is achieved by adding the work domain and expanding the concept of andragogy, which is a characteristic of the new model for vocational education and training. At the same time, other concepts such as technological knowledge and content knowledge remain unchanged (Arifin et al., 2020).

The TAWOCK model consists of four main elements necessary for learning in vocational education and training (Arifin et al., 2020):

- A. Technology Knowledge (TK): This refers to how to use technology as a tool to support learning.
- B. Andragogy Knowledge (AK): This refers to knowledge of appropriate methods and strategies for teaching adults. It is how teachers deliver competency-based and work-oriented educational materials. It includes the ability to manage learning theoretically and practice it towards maturity and independence.
- C. Content Knowledge (CK): This is an important point that must be learned. It refers to the knowledge obtained from educational curricula in the subject areas and the content of the subject.
- D. Work Knowledge (WK): This refers to knowledge of the type of work to be performed and the required

competencies.

The Intersectional Model includes the following elements that produce other elements contributing to the knowledge of how to develop specific competencies and skills through the use of technology and support knowledge building (Arifin et al., 2020):

E. Andragogy Content Knowledge (ACK): Knowledge about how to represent and formulate content that facilitates understanding for adults.

F. Technology Andragogy Knowledge (TAK): Knowledge of technologies that can assist in teaching adults.

G. Technology Work Knowledge (TWK): Knowledge of how to leverage technology in the workplace and support knowledge building.

H. Work Content Knowledge (WCK): Knowledge of how to create work-related content.

I. Technology Andragogy Work Content Knowledge (TAWOCK): Knowledge of how to facilitate adult learning of specific competencies and skills through andragogy methods and the use of technology.

The provision of training programs for computer teachers based on the aforementioned foundations can yield several benefits for both the teachers themselves and the overall learning process. A study conducted by Mohamed and Abo Zeed (2017) demonstrated the efficiency and effectiveness of electronic training programs, highlighting their significant impact on the development of teachers' skills. Ibrahim (2018) mentioned several benefits, including stimulating trainees' interest and attention, facilitating easy learning, and long-term retention of various skills. Additionally, electronic training saves time and effort for both trainers and trainees, creates a positive psychological and educational atmosphere in the virtual classroom, fosters continuous thinking among trainees, enhances their self-activity, and satisfies their inclinations.

A study by Al-Shammari (2017) revealed the superiority of online electronic training environments in teacher training. Teachers enhance their knowledge through their actions and interactions in a social context, which subsequently affects their performance levels in terms of skills. The electronic training environment also assists teachers in organizing their experiences, problem-solving, and understanding what is suitable for their academic achievement. Moreover, an electronic training environment that relies on the actual application of skills will undoubtedly facilitate teachers' performance of these skills in similar situations due to the prolonged impact of learning, also known as generalization and response facilitation, where learned responses are emitted to a new stimulus similar to the previous one.

Based on the findings of a study by Alqahtani (2023) on the impact of the TAWOCK model-based training program for teaching computational thinking skills on self-efficacy and improvement of teaching practices among computer teachers, a proposal has been made to provide electronic training for computer teachers according to a modern TAWOCK model.

2. Methodology

This study utilized the analytical approach by analyzing scientific papers on the TAWOCK (Technology Andragogy Work Content Knowledge) model and its significance in vocational education.

3. Results

Based on the analysis of papers discussing the importance of using the TAWOCK (Technology Andragogy Work Content Knowledge) model in vocational education, and considering its significance for teachers in general and computer teachers in particular, to keep up with the rapid technological advancements and effectively transfer them to their students, the following proposal has been suggested for the electronic training of computer teachers:

A Proposed Vision for Electronic Training of Computer Teachers based on the TAWOCK Model

Introduction:

Teachers play a crucial role in the success of the educational process, achieving its goals, and contributing to social and economic progress. Therefore, it is essential to focus on their continuous training and support their professional development to keep pace with the latest educational methods and practices.

With the advancement of technology in the modern era, permeating all aspects of life, including the educational field, and considering the importance of utilizing technology in training to overcome challenges associated with traditional training methods such as spatial limitations and high costs, electronic training has emerged as a highly sought-after approach that utilizes modern technology as a tool for teaching and learning, similar to traditional face-to-face training.

To ensure the delivery of high-quality electronic training for computer teachers, tailored to their capabilities and the nature of their noble profession, and to achieve the desired training outcomes, the following proposed vision for electronic training of computer teachers based on the TAWOCK model is presented. This vision includes the following key points:

- Foundations of the proposed vision.
- General objectives of the proposed vision.
- Justifications for the proposed vision.
- Implementation stages of the proposed vision.
- Requirements for implementing the proposed vision.
- Challenges in implementing the proposed vision.
- Suggestions to overcome the challenges.

Proposed Vision Foundations:

This proposed vision is based on several foundations and principles that adopt the philosophy of visualization, which can be summarized as follows:

- The Saudi Vision 2030, which set several goals for continuing investment in education and training, including: providing the necessary skills and knowledge to the Kingdom's citizens for future jobs, such as 21st-century skills.
- The New Computer Curriculum document and its emphasis on the importance of professional development programs for teachers during service to ensure the appropriate implementation of the curriculum.
- The requirement of professional licenses for teachers and those interested in practicing the teaching profession in both the public and private sectors in the Kingdom of Saudi Arabia. The Evaluation and Training Organization in the Kingdom has also defined the standards for a qualified computer teacher, which requires teachers to continuously renew their knowledge, skills, and competencies and focus on professional development throughout their careers.
- The educational policy in the Kingdom of Saudi Arabia, focuses on teacher training and recognizes the rights of teachers to training before and during service.
- The TAWOCK model, which is considered the most suitable option for professional learning through the use of technology. It works on developing individuals' skills and competencies according to the needs of the workplace.

General Objectives of the Proposed Vision:

The general objectives of the proposed vision are as follows:

- Enhancing the efficiency and effectiveness of the training programs provided to computer teachers.
- Reducing the high cost of traditional training through optimal investment in modern technologies, capabilities, programs, and facilities.
- Providing electronic training programs for computer teachers with the highest level of effectiveness, taking into account the characteristics of adult learners and constructive thinking.
- Implementing the TAWOCK model in a manner that suits the nature and characteristics of Saudi society, as well as the infrastructure of modern technologies, programs, digital tools, and communication networks.
- Providing a set of recommendations that help achieve optimal utilization of electronic training programs provided to computer teachers.
- Equipping computer teachers with modern computer skills suitable for technological advancements.
- Providing a set of recommendations to overcome the challenges of online training.

Justifications for the Proposed Vision:

Some of the prominent reasons and justifications for the proposed vision are as follows:

- Supporting the digital transformation plans of the Kingdom of Saudi Arabia to enable the country to seize the opportunities available in the digital age and achieve economic sustainability to improve the quality of life. Digital transformation is one of the key pillars to achieve the vision of Saudi Arabia 2030.

- The requirements of the 21st century for preparing a generation enhanced with knowledge and skills, such as learning and creativity skills, digital literacy skills, professional and life skills, which education seeks to achieve by qualifying and training teachers on methods to develop these skills in students.
- The developments occurring in educational curricula, content, and teaching methods necessitate the continuous development and training of computer teachers on modern teaching methods.
- Overcoming many difficulties that prevent the utilization of traditional training programs, including the significant increase in the number of computer teachers who are willing to be trained, making training institutions unable to provide training for these numbers.
- The geographical imbalance of training institutions, where some areas have centers while other regions lack training centers, forcing people from remote areas to migrate to cities for training purposes.
- Shortcomings in providing effective and high-quality electronic training programs for computer teachers, as revealed by some previous studies.

Stages of implementing the proposed vision:

Since the proposed vision involves designing electronic training programs and how to deliver them, the instructional design process can be followed using the general ADDIE Model (Analysis, Design, Development, Implementation, and Evaluation) as an organized framework for the process, as follows:

First: Analysis Stage:

In this stage, the following is done:

- Determine the overall goal of the training program: This involves formulating the overall goal of the electronic training program to clarify the flow of the remaining processes and stages.
- Identify the target audience: Considering their specialization, academic background, region, and the societal environment they work in.
- Analyze the characteristics of the target audience: This stage takes into account the fundamental principles of adult learning, including self-concept and autonomy, prior experiences of the teachers, the desire to communicate with others, readiness for learning, self-motivation for learning, and other factors that align with the electronic training program.
- Assess readiness: Verify the availability of the necessary technological resources, such as applications and websites, to be accessible for use by all participants in the training program. Also, provide the necessary human resources to support the training process.
- Assess needs: Identify the gap between the current status of computer teachers and the desired situation by reviewing the results of previous studies or conducting a survey that reveals the training needs of computer teachers.
- Content analysis: In this step, the main and subtopics of the training program are determined.

Second: Design Stage:

The proposed vision is based on the TAWOCK model illustrated in the following diagram:

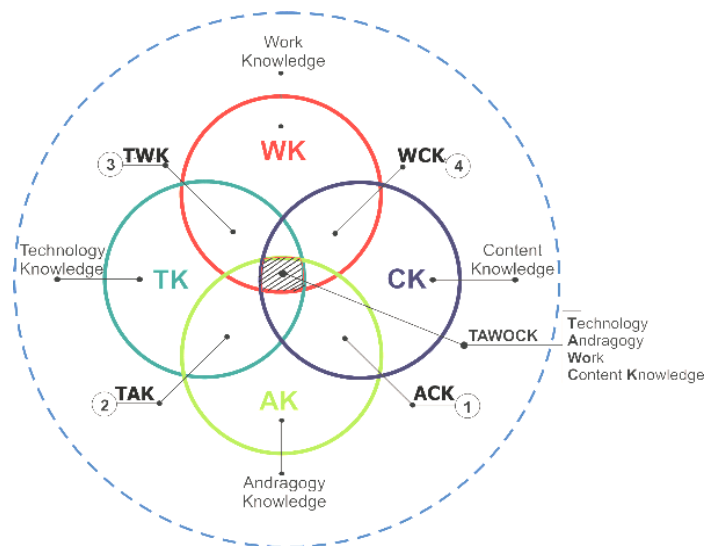


Figure 3. TAWOCK Model.

Source: Arifin et al., 2020, p. 446.

The training program has been designed according to the model, utilizing the techniques outlined in the table below or similar ones:

Table 1. Techniques that the training program will be designed

Symbol	Definition	Implementation tips
TK	Technology Knowledge How to use technology as a tool to support education.	<ul style="list-style-type: none"> - Ensure the availability of tools, materials, and devices necessary to implement the training program. - Choose programs, applications, and digital tools in training activities that are compatible with the content of the training program and the specified time for the training activity. - Select programs, applications, and digital tools that are suitable for the capabilities and skills of the teachers in using them. - Ensure that the appropriate program or application for implementing the training program is available to all teachers. - Use one of the virtual classroom platforms (Microsoft Teams - Blackboard - Zoom - Coursera - Google Classroom or others) to create a virtual classroom where the training program is presented. - Use QR codes or links during the presentation of the training program for easy access for teachers to the necessary digital applications and tools to participate in the training activity.
AK	Andragogy Knowledge The method by which the trainer conducts competency-based and work-oriented training, using adult learning methods.	<ul style="list-style-type: none"> - Diversify examples and activities as much as possible. - Consider the individual differences among teachers and their training needs. - Activate the role of teachers in the program, so that the trainer is a coordinator and manager of dialogue and discussion within the classroom. - Diversify training strategies to allow teachers to interact with other participants in the training room and speak with them, not just listen to the trainer; there is no need for them to be trained in a dry and serious manner. - Diversify the activities used in the training program, between individual and group activities, as well as pair activities where each pair of teachers works together. - Diversify the training methods used in the training program to suit the content nature, activity type, and characteristics of teachers' learning. - Use evaluation methods that suit teachers and align with the training program. - Self-motivated learning should be encouraged, while also providing incentives as they are important for all learners, regardless of age. - Take into account the experiences and expertise of teachers, as they have a wealth of experiences that must be considered and used to develop their self-concept by respecting their independence and opinions. - Encourage teachers to exchange experiences and expertise among themselves. - Help teachers break the ice during the training program. - Develop effective dialogue skills among teachers.

Symbol	Definition	Implementation tips
CK	<p>Content Knowledge An important point to learn is understanding the content of learning.</p>	<ul style="list-style-type: none"> - Divide teachers into groups to provide opportunities for trainees to discuss among themselves. - Allow teachers to express their opinions and criticisms, which helps develop their self-concept as mature individuals. - Proper preparation and thorough reading of the training program and examining all its contents. - Do not skip any step or stage in the program without ensuring the minimum level of proficiency, through formative assessment during the training process. - Dive deep into the specialized content by encouraging the teacher to reflect and retrieve their previous knowledge.
WK	<p>Work Knowledge The type of work that needs to be done.</p>	<ul style="list-style-type: none"> - Pay attention to constantly updating and developing the content of training programs. - Developing the correct attitudes among teachers towards professional work (teaching). - Measuring the effectiveness of training and the performance of teachers in practical skills. - Practical training of acquired skills, as it is one of the most important training methods directed towards work, as practical training is one of the main reasons for developing and improving cognitive and scientific aspects and bringing about positive changes in behavioral patterns.
ACK	<p>Andragogy Content Knowledge knowledge about how to represent and formulate the subject in a way that makes it easy for adults to understand.</p>	<ul style="list-style-type: none"> - Providing teachers with the opportunity to reflect on their teaching practices. - Always present the scientific material for the training activity after discussing it with the teachers to understand their previous knowledge. - Encourage teachers to engage in cooperative work. - Apply practical skills in front of teachers. - Use some games (such as crossword puzzles) to stimulate teachers and arouse their motivation towards learning, by breaking the routine and changing the training method in a serious and dry manner. - Condense the execution time for a step or stage if the teachers are capable and knowledgeable about its content; respecting their potential and experiences. - Encourage teachers to exchange their experiences and knowledge with others. - Using storytelling provides an opportunity for teachers to collaborate, be creative, exchange experiences, and share knowledge among themselves, which will stimulate their readiness to learn. - Using the Six Thinking Hats encourages teachers to engage in self-directed learning by researching information from different sources. - Using concept maps to stimulate teachers and arouse their motivation towards learning, by breaking the routine and changing the training method in a serious and dry manner, providing them with the opportunity for creative thinking, showcasing their artistic sense, and allowing teachers to explain their plans and discuss their colleagues' plans.
TAK	<p>Technology Andragogy Knowledge knowledge of technology that can help in teaching adults.</p>	<ul style="list-style-type: none"> - Prepare training materials and use devices, programs, or applications that are suitable for the characteristics of adult learners. - Activate the use of technology in a way that suits the training of teachers. - When using some applications (such as electronic walls, blogs, websites, and internet pages), it is preferable to allow commenting on posts, allowing teachers to benefit from the experiences of others and build on their ideas. - Prepare assessment tools using Google Forms, with the possibility of sending a copy of the teacher's answers via email, to help her monitor her progress in the training program. - Reviewing teachers' answers in assessments helps the trainer understand their cognitive level in the program's subject, thus enabling her to provide appropriate incentives for them. - Use mind mapping software to develop effective dialogue among teachers through communication in the training room. - Prepare training activities based on electronic games, whether using websites, programs, or mobile applications (examples include Nearpod), to stimulate teachers and arouse their motivation towards learning, by breaking the routine and changing the training method in a serious and dry manner. - Using electronic games (such as memory test games) contributes to stimulating competition among teachers and motivating them towards learning. - Using programs that allow drawing online provides teachers with the opportunity to develop their creative thinking. - Allowing the option to like posts on the electronic wall helps in motivating teachers toward each other. - Showing videos allows teachers to benefit from the experiences of others and build on their ideas, allowing them to express their opinions and criticisms, which develops their self-concept as mature individuals.

Symbol	Definition	Implementation tips
TWK	Technology Work Knowledge knowledge about how to benefit from technology in the workplace and support knowledge building.	<ul style="list-style-type: none"> – Using the electronic bulletin board to provide teachers with the opportunity to express the challenges they face in teaching and exchange experiences with other teachers. – Using brainstorming software to help the teacher apply the knowledge she has acquired if she faces a problem in the future. – Using task organization applications to allow teachers to reflect on their achievements in solving the problems they faced while teaching, motivating them to be prepared for learning. – Using electronic games (such as memory test games, and simulation games) contributes to deepening their teaching practices, in terms of the teacher's reflection and retrieval of her previous experience to solve the game. – Sharing files using cloud computing services like Google Drive provides teachers with the opportunity to build a rich source of lesson plans that benefits all teachers throughout their professional journey. This encourages the exchange of experiences, experiments, and creative ideas among teachers, guiding their learning toward action.
WCK	Work Content Knowledge knowledge about how to create work content.	<ul style="list-style-type: none"> – Providing teachers with the opportunity to apply the knowledge they have acquired promptly. – Creating a training environment that encourages teachers to take initiative and responsibility. – Guiding teachers' learning towards action by allowing them to reflect on their teaching practices. – Allowing teachers to participate in teaching development by building a guide to support teachers in teaching according to the training program's theme. This direction towards action benefits all teachers throughout their professional journey, encouraging the exchange of experiences and experiments among them. – Allowing teachers to attend practical lessons using teaching according to the training program's theme benefits all teachers throughout their professional journey, encouraging the exchange of experiences and experiments among them, and guiding their learning towards action.
TAWOCK	Technology Andragogy Work Content Knowledge knowledge of how to facilitate learning for adults with specific competencies and skills through adult education methods and using technology.	<ul style="list-style-type: none"> – Using electronic whiteboards provides teachers with the opportunity to participate by adding their previous knowledge, sharing their experiences, and providing their definitions of each concept. This helps develop their self-concept and motivates them to learn during the training program. – Using electronic games (e.g., simulation games) that match the maturity level of teachers and are related to the training program's theme stimulates teachers' motivation towards learning by breaking the routine and changing the training method from a serious and dry style. – Using programs that allow online drawing to enable teachers to draw diagrams and concept maps in the training program's theme, explain their diagrams, discuss their colleagues' diagrams, and enhance effective dialogue among teachers through communication in the training room. – Using puzzle game applications in the training program's theme stimulates teachers' readiness for learning, and fosters competition and challenge among them. – Dividing teachers into groups in the Microsoft Teams program to facilitate collaboration, exchange of experiences, knowledge, and effective dialogue among teachers through communication in the training room. – Creating unit review activities using Google Forms to guide teachers' learning towards action by allowing them to reflect on how they have benefited from the unit in their teaching. – Allowing different groups to present lessons related to the training program's theme in the Microsoft Teams program, encouraging teachers to exchange experiences and experiments and guiding their learning towards action. – Providing teachers with the opportunity to apply the knowledge they have acquired by presenting a lesson from the subjects they teach, according to the training program's theme, using available digital programs, applications, and tools. – Using voting applications and websites when needed to determine the extent of the spread of a particular phenomenon or a specific proposal, which helps align the perspectives of teachers and guide their learning toward action.

As follows in this stage:

- Setting specific objectives: Detailed objectives are formulated procedurally and behaviorally that can be achieved and evaluated.
- Selection and organization of content: Content is selected and distributed across training sessions according to the specified program timeline.
- Determining training methods: Training methods that align with the nature of the content, type of activity,

and the characteristics of computer science teachers are selected. Some proposed training methods include:

Table 2. Proposed of training methods

- Dialogue	- Presentation	- Observation
- Discussion	- Cooperative learning	- Critical thinking
- Reflective thinking	- Creative thinking	- Self-directed learning
- Brainstorming	- Concept mapping	- Practical application
- Summarization	- Exit card	- Microteaching
- Games	- Problem-solving	- Providing feedback
- Workshops	- Abstraction and representation (modeling)	- Self-assessment

- Determining training tools and techniques: Programs, applications, and internet sites are selected to execute training activities that align with the content, activity type, and characteristics of computer science teachers. These resources can be provided by the training organization along with necessary technical support.
- Identifying assessment methods: Assessing methods (pre-assessment, formative assessment, summative assessment) are defined in the training program, and tools are designed to align with the characteristics of computer science teachers, the nature of the training program, and its content.

Third: Development stage:

In this stage, the training kit is prepared including content, training activities, and assessment methods. It is advisable to:

Table 3. Training program components

Training Kit Components	Components of the Trainer’s Guide	Components of the Trainee’s Guide:
- Introduction	- Guide Introduction	- Guide Introduction
- Training Program Philosophy	- Overview of the Training Program	- General Objective of the Training Program
- Foundations and Principles of the Training Programme	- Topic	- Detailed Objectives of the Training Program
- General Objective of the Training Program	- Training Program Philosophy	- Training Program Content
- Specific Objectives of the Training Program	- Foundations and Principles of the Training Program	- Training Program Environment Specifications
- Target Audience for the Training Program	- General Objective of the Training Program	- Equipment and Supplies for Implementing the Training Program
- Duration of the Training Program	- Specific Objectives of the Training Program	- Training Tools and Techniques for the Training Program
- Training Program Content	- Target Audience for the Training Program	- Training Program Plan
- Training Environment Specifications for the Training Program	- Training Program Content	- General Guidelines for the Trainee
- Equipment and Supplies for Implementing the Training Program	- Training Environment Specifications for the Training Program	- Instructions on Participation, Communication, and Interaction
- Training Activities Used in the Training Program	- Equipment and Supplies for Implementing the Training Program	- Self-Assessment Tools and Reflection Cards
- Training Methods Used in the Training Program	- Training Activities Used in the Training Program	- Teaching Methods and Proposed Evaluation Techniques for Practical Application in the Training Program Subject
- Training Tools and Techniques for the Training Program	- Training Methods Used in the Training Program	- Supplementary Materials
- Training Program Plan	- Training Tools and Techniques for the Training Program	- References
- Evaluation Methods	- Training Program Plan	
- General Guidelines	- Evaluation Methods	
- Training Program Units	- General Guidelines for the Trainer	
- References	- Training Program Unit Activities	
- Appendices	- Some Challenges That the Trainer May Face and Ways to Overcome Them	
	- Training Evaluation	
	- Trainer Self-Assessment	
	- Enrichment Materials	
	- References	

Fourth: Implementation Stage:

In this stage, the actual implementation of the program takes place, starting with training the target group within the specified timeframe of the training program, using the training methods, tools, and techniques identified for implementing the training activities.

Fifth: Evaluation Stage:

In this final stage, the evaluation process is carried out using the evaluation methods specified in the training program and the evaluation tools designed in the training program.

The training program can also be evaluated using the Kirkpatrick Model for evaluating training programs, which is based on four steps as follows:

- Step One: Reaction... How much did the participants like the program?
- Step Two: Learning... What facts, principles, and methods have been learned?
- Step Three: Behavior... What changes have occurred in work behavior as a result of training?
- Step Four: Results... What are the tangible results of the training program in areas such as cost reduction, quality improvement, and productivity enhancement... etc.?

These four steps emphasize the importance of directing training toward work.

As for the trainer, she should conduct a self-assessment aimed at helping her identify her training needs for continuous improvement of her relevant capabilities and training skills related to the training process dimensions.

Requirements for Implementing the Proposed Concept:

To achieve effectiveness and efficiency from the proposed concept, several measures are required, including:

- Support and endorsement of senior leadership in the Ministry of Education and educational institutions in providing necessary facilitations to adopt the e-training model for computer teachers.
- Provision of technical equipment, digital programs and tools, and necessary technical support to achieve the effectiveness of e-training.
- Attracting experienced individuals in instructional design to design high-quality e-training programs for computer teachers.
- Focusing on adult learners' characteristics and constructive thinking when designing and delivering e-training programs.
- Compliance with legal and regulatory requirements in implementing e-training programs.
- Establishing a mechanism to evaluate and review e-training programs and periodically develop the educational material.
- Providing financial and moral incentives to outstanding trainers in delivering e-training programs for computer teachers.

Challenges in Implementing the Proposed Concept:

Some challenges that may be encountered when implementing this proposed concept include:

- Resistance to change from some individuals in the educational community in adopting the e-training model for computer teachers.
- Lack of e-training programs for computer teachers designed according to effective models, necessitating starting with designing e-training programs from scratch.
- Weak infrastructure in terms of availability of technical equipment, digital programs and tools, and necessary technical support for e-training.
- Scarcity of specialists in designing high-quality e-training programs, either due to lack of availability or lack of motivation to design high-quality e-training programs.
- Computer teachers feel isolated in this training model due to not being physically present with the trainer and their peers in one place.
- Withdrawal of some computer teachers from the e-training program due to their lack of conviction in its effectiveness.
- Disruption of internet access for some computer teachers, affecting their acquisition of specified knowledge

and skills in the e-training program as required.

Suggestions to Overcome Challenges:

In light of the aforementioned challenges, several measures are suggested to overcome these difficulties, including:

- Raising awareness in the educational community about the importance of moving towards adopting the e-training model, given its effective positive effects and its ability to overcome several challenges of traditional training.
- Utilizing local, Arab, and international experiences and models that research has revealed their effectiveness in designing and delivering e-training programs.
- Leveraging experienced individuals in instructional design, and motivating them financially and morally to design high-quality e-training programs for computer teachers.
- Diversifying methods of delivering training activities and using various communication, participation, and interaction methods during e-training that align with the nature of computer teachers as social beings who desire interaction with other participants in the training room.
- Directing training towards work, which may reduce the phenomenon of computer teachers withdrawing from the e-training program.
- Utilizing modern technologies such as recording training programs during delivery and making them available to computer teachers after training completion, allowing them to revisit training sessions where the internet connection was interrupted.

4. Conclusions

This paper aimed to expand on providing e-training programs for computer teachers in specialized topics in computer science by designing e-training programs for computer teachers according to constructivist thinking that suits the characteristics of teacher education as adult learners. This was done by presenting a proposed concept for designing and delivering e-training for computer teachers based on the TAWOCK model. This concept takes into account selecting programs, applications, and digital tools in training activities that align with the content of the training program and the specified time for training activities, along with teachers' capabilities and skills in using them. It also diversifies examples and training activities, and training strategies in an e-training environment that allows teachers to communicate with other participants in the training room. It considers teachers' experiences and experiments. Presenting e-training programs for computer teachers according to this concept will ensure exchange experiences among them, encourage cooperative work, and apply practical skills. This study recommended using this proposed conceptualization for designing and delivering e-training for computer science teachers, and suggests to do other studies using this model in training teachers in many topics of computer science, and do other studies by using this model in training of teachers in other specialists.

Acknowledgments

Not applicable.

Authors' contributions

RQ and AM conceptualized this manuscript and conducted the environmental scan and literature review. All authors contributed to writing the full draft, reviewing, and approving the final manuscript.

Funding

Not applicable.

Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Informed consent

Obtained.

Ethics approval

The Publication Ethics Committee of the Canadian Center of Science and Education.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

Provenance and peer review

Not commissioned; externally double-blind peer reviewed.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

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