International Journal of Early Childhood Special Education (INT-JECSE)
DOI:10.9756/INTJECSE/V14I5.1013 ISSN: 1308-5581 Vol 14, Issue 05 2022

Training needs related to computational thinking skills for secondary school computer teachers

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Abstract
The aim of the current study is to determine the training needs related to computational thinking skills for secondary school computer teachers, by identifying the availability of computer thinking skills in cognitive, skill, and teaching aspects from their point of view. The descriptive approach was used, and a questionnaire was prepared to achieve the goal of the study. The participants in this study were (165) secondary school computer teachers. The results showed that the training needs related to computational thinking skills for computer teachers in general, and their need for training in computational thinking skills for the cognitive and teaching aspects, were at a medium level. On the other hand, the need for teachers to be trained in computational thinking skills for the skill aspects was low. The results also showed that there were no statistically significant differences in the training needs related to computer thinking skills for computer teachers at the secondary stage based on the type of educational qualification and the number of years of experience.

Keywords: Computational thinking, training needs, skills, computer teachers in the secondary level

1.Introduction

There is great interest from countries to develop computer curricula to keep pace with the rapid development in the use of technology. In the United States of America, the curricula evolved from focusing on the use of information and communication technology to focusing on teaching the concepts and principles of computer science (Freudenthal et al., 2010). Bower and Falkner (2015) stated that the computer subject has become taught as computer science instead of information and communication technology. In this case, the student has turned from a consumer to a producer and innovator who understands and explains the technologies and phenomena around him/her. In Saudi Arabia, the Ministry of Education has developed the educational system through several stages; the last stage was the King Abdullah Project for the Development of Education (Ministry of Education, 2008). A budget of $2.4 billion was allocated for this project (Meemar, 2014). One of the most important objectives of the project was to train and educate students according to the skills and the capabilities required in the twenty-first century, which will help them develop and live as productive citizens capable of interacting with the world positively (Tatweer, 2011).

The implementation of the King Abdullah Project for the Development of Education required the design of computer and information technology curricula that are able to meet the social and cultural needs of the Kingdom of Saudi Arabia. Therefore, the computer and information technology curricula depended on the standards of Computer Science Teachers Association (CSTA K-12) (Computer Curriculum Document for Secondary School, 2013). The primary objective of setting these standards was to produce well-educated citizens. These citizens should have a clear understanding of computer science principles and practices (Deborah et al., 2011). The Computer Science Standards according to CSTA K-12 contain five complementary and basic standards: Computational thinking; cooperative education; computing and programming practice; computers and communications; and societal, global and ethical aspects. In this study, computational thinking (CT) is a basic skill for all. On the other hand, as declared by the National Research Council (NRC) (2010), the CT is a set of cognitive skills that a person must possess in order to live in modern society. There is a lot of research that proves that the principles of CT are applicable globally and in all disciplines (Barr, Harrison, &Conery, 2011). CT focuses on the set of abilities and skills needed to solve complex problems with the help of technology. Hence, it must be emphasized that individuals who have high levels of CT have high abilities to creatively reach solutions to problems with the help of modern technology. Furthermore, knowledge of CT enables individuals to solve complex

problems, work with computer systems, and understand the strengths and weaknesses of complex relationships in the modern age.

When developing curricula, attention must be paid to all the elements and factors affecting it in order to achieve the desired development. For example, attention should be given to school buildings, educational technologies, and the teacher, who is the main tool in the educational process. The teacher needs continuous training and development as his/her roles change in the developed curriculum. Al-Dakhil (2013) stresses the importance of identifying training needs as a basis for any training activity, as accuracy and objectivity in determining them lead to achieving the basic goals that the educational institution wants to reach.

Given the importance of identifying training needs at the beginning of training planning, and the changing job skills associated with training, the current study seeks to identify the training needs associated with computational thinking skills on which educational supervisors and trainers rely in training teachers.

1.1.Study Problem

The problem of this study was represented in the main question, *what are the training needs related to computer thinking skills for computer teachers at the secondary level?*

From this main question, the following sub-questions are derived:

1. What are the training needs of computer teachers in the cognitive aspects related to computer thinking skills?
2. What are the training needs of computer teachers in the skill aspects related to computational thinking?
3. What are the training needs of computer teachers in the teaching aspects related to computer thinking skills?
4. Are there differences in the training needs related to computer thinking skills for computer teachers at the secondary level due to the type of educational qualification (educational and non-educational).
5. Are there differences in the training needs related to computer thinking skills for computer teachers at the secondary level due to their years of teachingexperience?

1.2.Study hypotheses

1. There are no statistically significant differences at the significance level ($\alpha = 0.05$) in the training needs associated with computer thinking skills for computer teachers in secondary schools due to the type of educational qualification (educational and non-educational).
2. There are no statistically significant differences at the significance level ($\alpha = 0.05$) in the training needs associated with computer thinking skills for secondary school computer teachers due to their years of teachingexperience.

1.3.Study Objectives

The current study sought to:

1. Determine the training needs of computer teachers from the cognitive aspects related to computer thinking skills.
2. Determine the training needs of computer teachers from the skill aspects related to computational thinking.
3. Determine the training needs of computer teachers from the teaching aspects related to computer thinking skills.
4. Determine whether there are differences in the training needs related to computer thinking skills for secondary school computer teachers due to the type of educational qualification (educational and non-educational).
5. Determine whether there are differences in the training needs related to computer thinking skills for secondary school computer teachers due to the number of years of teaching experience.

1.4.Study importance

The results of this study might contribute to:

1. Developing training programs related to computer thinking (CT) skills.
2. Helping educational supervisors and trainers to identify training needs to develop the CT skills for secondary school computer teachers.
3. Raising the efficiency of teachers who will be trained in the CT skills in teaching these skills.

1.5.Study Delimitations

This study was applied to a sample of secondary school computer teachers in the Eastern Province (Dammam - Khobar - Dhahran - Qatif - RasTanura - Abqaiq - Jubail - Nairiyah - Khafji) in the second semester of the academic year 2018. The study was limited to training needs that enable teachers to use the CT skills in the educational process.

1.6.Study Terms

Training needs: The researchers defined these operationally as a set of knowledge and skills that computer teachers need in the field of using computer thinking skills in the teaching process based on their previous knowledge and experience.

Computational Thinking (CT): The researchers defined it operationally as a basic skill of the 21st century that makes the computer teacher simulate the computer in its way of processing data. CT includes many sub-skills such as: analysis, criticism, innovation, abstraction, evaluation, generalization, and writing algorithms that enable the teacher to solve problems, design systems, and perform other functions using the best available techniques.

2.Theoretical Framework

2.1.First Axis: Training Needs

El HadidyandDahesh (2013) defined training needs as the information, skills, and attitudes that are intended to be developed in the individual; it includes the changes that must be made in teachers in order to meet the work requirements and face the problems that occur during their work. Al-Ali (2016) also defined it as identifying the training needs in order to raise the level of teachers' adequacy, skills, and knowledge that should be provided to them to bring about the changes required by job performance. Abu Al-Nasr (2016) added that it is a set of changes related to the knowledge, skills, performance, behavior, and attitudes of the individual that must be made in order to enable this individual to perform his/her current work more efficiently, or to make him/her fit for a higher level job.

Through the previous definitions, the training needs of computer teachers includevarious knowledge such as: information, skills, and trends that are intended to be developed, modified, or changed by computer teachers, in order to practice computer thinking skills in the classroom.

2.1.1.The importance of identifying training needs

Mimar (2010) identified the importance of training needs in the training process, including:

1. It is considered a basic pillar upon which the training plan is built, as it provides important information for the program planning process.
2. It leads to the precise definition and formulation of the objectives of the training programs.
3. It makes results central for directing the process of designing training programs.
4. It determines the target group of the training.
5. It reduces wastage of training.

2.1.2.Types of training needs

Training needs differ according to the organizations, their employees, and the nature of the work. Abu Al-Nasr (2016) classified training needs into two main categories in light of the time period:

1. Long-term and short-term training needs: The long-term compares the level of performance required of the individual with the level of desired performance in the future, while the short-term compares the level of performance required of the individual with the level of his/her current performance. The difference between the types is in the level of performance, which represents the long-term and short-term training need, respectively.
2. Current and future training needs: the first represents the needs of the workers at the present time, and the second is their needs in the future according to future plans for change.

The current study is concerned with identifying training needs in three aspects: (the cognitive side - the skill side - the teaching side).

2.1.3.Methods for identifying training needs

Abu Al-Nasr (2016) believes that among the most famous models and methods for determining training needs are the following:

1. SWOT Analysis: This model focuses on collecting data and information on four elements, and then it is possible to identify and analyze the training needs of employees in the organization. These items are:
   - Strengths in the organization: training on how to strengthen them.
   - Weaknesses in the organization: training to reduce or eliminate them.
   - Identifying opportunities: training on how to take advantage of them.
   - Identify threats: training on how to deal with current ones and avoid future ones.
2. Internal data analysis: information in this model is collected from several sources, which are as follows:
   - The organization's mission, objectives, and action plan.
   - The stock of manpower and its demographic data.

- Skills stock, meaning how many holders of this skill are in the workplace, and what are their levels?

- Input from managers and supervisors in the changes occurring or expected.

- Indicators of the organization's environment, such as: productivity, absences, and beneficiary interaction.

- Financial, marketing, and productivity information.

The questionnaire tool, which is an indirect quantitative tool,was used to collect information to determine the training needs according to the objectives of the study.

2.2.The second axis: computational thinking

According to Papert(1996) the term Computational Thinking (CT) is a way of formulating ideas, and using computers to solve problems. This would allow people to analyze problems better, and explain solutions more accurately. CT can play an important role in helping people understand how, when, and where these techniques can be used to help solve problems. However, some think it is only using computers or technology to solve problems. Mishra and Yadav (2013) mentioned that CT has a broader concept than just the interaction between digital devices and individuals. CT can move learners from simple users of technology to people who are able to produce new ways of expression, design tools, and come up with creative solutions.

2.2.1.Characteristics of CT:

Wing (2006) identified the main characteristics of CT as follows:

1. CT focuses on conceptualizing, notprogramming: Computer science is not only concerned with being able to program a computer but requires thinking at multiple levels of abstraction as well.
2. CTis a key fundamental, not rote skill: A key skill is a skill that every person must master in order to be able to survive in contemporary society, while a routine skill is a skill that is automated.
3. CT is a way that humans, not computers, think: CT expresses a way in which humans solve problems and does not mean that humans try to think the way that a computer does. Computers are not as skillful and imaginative as humans, but as humans use computers they are able to enhance their ability to solve problems better.
4. CTcomplements mathematical and engineering thinking: Computer science is fundamentally based on mathematical thinking and engineering thinking in that it includes building systems that interact with real life, and the limitations imposed on computers force computer scientists to innovate. Automation can think computationally, not just mathematically. With the possibility of building virtual worlds, computer scientists can engineer virtual systems, not just the physical world.
5. CT focuses on ideas,not just artifacts:CT focuses not only on the software and hardware that is produced, but also on the computational concepts that are used to deal with and solve problems, manage our daily lives, and communicate and interact with others.
6. CT is useful to anyone, anywhere.

2.2.2.Computational thinking skills

Several studies (Angeli et al., 2016; Voogt et al., 2015; Peters-Burton et al., 2015) mentioned that CT skills include five basic skills:

1. Algorithms: This is a set of sequential steps to solve a problem without ambiguity. It consists of two skills, the sequence skill, which puts actions in a correct sequence, and the flow control skill that arranges the execution of actions, such as: conditional IF and GO TO. A flowchart is also a graphic representation of a solution algorithm that shows the method of sequencing the solution and understanding the algorithm.
2. Abstraction: Abstraction means focusing on the main problem, leaving out unimportant details and information. Abstractions are often used in simulation and modeling software, where the focus is only on basic operations and the details are left out as unimportant. Wing andStanzione (2016) mentioned that the study schedule is a good example of abstraction.
3. Decomposition: It is one of the most important computational thinking skills. Decomposition is defined as a way of thinking about the parts that make up problems, algorithms, tools, processes, and different computer systems, which helps the individual to understand the parts and components they contain. Additionally, decomposition makes complex problems easier to solve.
4. Generalization: Generalization is one of the most important computational thinking skills. Generalization involves taking advantage of all the processes that are used to solve a particular problem, and applying that solution to a variety of different problems. New problems are quickly resolved based on previous problems that the individual has worked on.

5. Evaluation: It is the process that aims to ensure the efficiency, validity, and effectiveness of the solution steps to reach the desired result in light of a set of multiple criteria, such as: if it is fast enough, if it is economical in the use of resources, or if it is easy to use.

2.2.3.Difficulties and challenges of teaching CT

CT has faced many challenges and difficulties, which are: The students' belief that CT represents training in the skills of using technology (BCS, 2010). Poor infrastructure is another challenge as it prevents the provision of some of the necessary tools or technologies (Lee et al., 2011). Wing and Stanzione(2016) mentioned that the biggest challenge is to find teachers who are able to teach CT skills with high efficiency. Educators often focus on the technology used to learn physical and software computing rather than providing deep learning opportunities for computational thinking (Battig, 2010; Lee et al., 2011). Although programming is still part of the curriculum, it should be used as a tool for skill development, discovery of ideas, and new concepts of computational thinking (Webb, 2013).

The absence of professional development for teachers will reduce their efficiency when providing the lessons of the developed curricula and cause a gap between teachers and the developed curricula. This may discourage teachers, and create negative attitudes towards this topic (BCS, 2010). Bearing in mind that the professional development of teachers needs to be more than just adequate, teachers' manuals must include the CTskills and the way they are used with all subjects because teachers need high-quality resources and lesson plans to activate the CT in their students (Barr & Stephenson, 2011; Black et al., 2013).

3.Previous Studies

3.1.Studies related to training needs

Al-Amri's study (2015) aimed to identify the training needs for the use of e-learning applications related to the design of educational content and the use of e-learning techniques. The descriptive approach was used in the study, and a questionnaire was used to achieve the study's goal. The results of the study concluded that the sample members agreed to a large extent on the training needs for the use of e-learning applications in the use of electronic technology means, as well as in the use of teaching methods in the e-learning environment.

Al-Maliki's study (2013) aimed to determine the training needs of computer teachers for the intermediate stage in e-learning, and in teaching methods appropriate to the computer. The descriptive approach was used. To achieve the goal of the study, a questionnaire tool was used, and it was applied to computer parameters in Riyadh. The researcher reached results, the most prominent of which was the necessary need to conduct training courses for computer teachers in the field of using educational technologies.Theresearcher showed that knowledge of modern educational technologies is one of the most important training needs for computer teachers in the field of using modern educational techniques to achieve goals.

Doukakis et al. (2013) conducted a descriptive study, the main objective of which was to determine the training needs of computer teachers in secondary schools in Greece. The study was applied to a sample of (1127) computer teachers, and a questionnaire was used, which included (3) areas: the cognitive field, the educational field, and the content management field. The study reached two results: the training needs of computer teachers in the field of content management were at a high level, and the training needs of computer teachers in the cognitive and educational fields were at an average level.

3.2.Studies related to computational thinking

The study of Alfayezand Lambert (2019) aimed to explore the level of mastery of the concepts of Saudi computer teachers of computer thinking skills. To study this topic, a quantitative research study was conducted with (55) computer teachers in Riyadh, and a questionnaire tool was used. The results of the study revealed that most of the computer teachers have a low theoretical level of computational thinking. Also, some teachers have misconceptions about the exact nature of computational thinking. The results also indicated that computer teachers actually needed more training on the meaning of CT and how to teach this subject.

The study ofGunbatarandBakirci (2019) aimed to study trends towards teaching science, technology, engineering and mathematics (STEM) with CT for pre-service primary teachers. The study followed the method of a correlative survey. and the study sample consisted of (440) pre-service teachers in Turkey. A questionnaire was used to collect and measure data. The results showed that CT skills help pre-service teachers in understanding and teaching STEM; CT skills are important in teaching all fields, especially STEM.

To explore and understand the perceptions of working teachers about CT, the study of Wu et al. (2018) came with the aim of benefiting from this perception in developing CT for teachers. In other words, the study aimed to explore the most important needs of (in-service) computing teachers to increase their competence in CT and its applications. The quasi-experimental approach was used for the study, and (36) teachers participated in the study sample: (27) males, and (9) females from (19) schools in Singapore. The questionnaire was used to measure and collect data, and the results of the study were that integrating CT into the traditional curricula increases the teacher's motivation and self-confidence, and this contributes positively to the teacher's professional development.

4.Methodology

4.1.Study Approach:

Based on the nature and objectives of this study, the descriptive approach was used for its relevance to the nature of the study.This approach relies on studying the current reality as it is in reality. Through the descriptive approach, it is possible to collect information and data on the problem of the current study to determine the nature of the existing situation, and the extent of the need to make changes in line with the challenges shown by the data.

4.2.Study sample:

The study sample consisted of (165) teachers. Table 1 shows the characteristics of the sample.

Table 1
Distribution of the study sample according to the variables

Variable	Categories	Frequency	%
Educational qualification	Educational	144	87.3
	Non-educational	21	12.7
	Total	165	100
Academic Degree	Bachelor	138	83.6
	Masters	27	16.4
	Total	165	100
Experience years	From 1 to 5 years	21	12.72
	From 6 to 10 years	51	30.90
	From 11 to 15 years	33	20
	From 16 to more	60	36.36
	Total	165	100

4.3.Study tool:

The questionnaire was used as a tool for this study, due to its relevance to the subject and objectives of the study. The current study sought to determine the training needs associated with the CT skills for computer teachers at the secondary level, based on the reality of their possession of information on cognitive aspects, skill aspects, and teaching aspects of computer thinking.

The questionnaire in its final form, which was presented to teachers, consisted of two parts:

The first section relates to the primary data of the study sample members (type of qualification - academic degree - years of experience).

The second section relates to the three aspects of the training needs related to the CT skills (cognitive aspects - skill aspects - teaching aspects), and it consists of (58) phrases divided into three aspects:

a. Cognitive aspects (17) items.
b. Skill aspects (17) items.
c. Teaching aspects (24) items.

To answer the questionnaire, a five-point Likert scale was used to measure the response, which consists of: very high = 5 points, high = 4 points, medium = 3 points, low = 2 points, very low = 1 points.

4.4.Psychometric properties of the study tool:

4.4.1.First: Validity of the study tool

*Face validity:*To verify the validity of the study tool, an initial copy of the questionnaire was presented to arbitrators specialized in the field of curricula and computer teaching methods, and educational supervisors in the Ministry of Education. The opinions and suggestions of the arbitrators were taken into

consideration, which consisted of adding some phrases, deleting some, modifying some, merging some, and transferring some phrases from one field to another.

*Internal consistency:*The internal consistency validity was calculated by calculating the Pearson correlation coefficient between each statement and the domain to which it belongs. It became clear that the correlation coefficients between each phrase and the total sum of the phrases of the domain are statistically significant at the level (0.01), which confirms the high internal consistency between the questionnaire phrases.

4.4.2.Second: reliability of the study tool

To check the reliability, the researcher calculated Cronbach's alpha coefficient for each domain, and for the whole questionnaire.

Table 2
Cronbach's alpha coefficient for the study tool

Domains	Cronbach's alpha coefficient
Cognitive domain of computational thinking	0.966
Skill domain of computational thinking	0.963
Teaching domain of computational thinking	0.970
Total	0.977

Table 2 shows that the value of Cronbach's alpha for total domains is (0.977), and the reliability coefficients for all domains range between (0.963 - 0.970), which indicates the reliability of the results that can be produced by the study tool. Thus, the questionnaire in its final form is valid for field application.

4.5.Statistical methods

To answer the questions of the current study, the following statistical methods were used:

1. Frequencies and percentages.
2. Mean andstandard deviations.
4.Cronbach's alpha reliability coefficient.
5. Pearson correlation coefficient.
6. The Mann-Whitney test.
7. One Way ANOVA Test.

5.Results& Discussion

5.1.First: Results related to the study questions

The first question: What are the training needs of computer teachers in the cognitive aspects related to computational thinking skills?

To identify the training needs of computer teachers from the cognitive aspects related to computational thinking skills; frequencies, percentages, means, and standard deviation were calculated for the responses of the study sample members. The means of the axis phrases ranged between (2.73 - 4.00) out of (5.00) degrees. The previous result indicates that the responses of the study sample members about teachers' knowledge of the cognitive aspects related to computational thinking skills range between (medium - high).

The whole mean scores of the axis phrases was (3.23) with a standard deviation of (0.87). This result indicates that the sample members had a mediumdegreeknowledge of the cognitive aspects related to computational thinking skills. The reason for this result is due to the novelty of the concept and the lack of direct reference to it in computer curricula, whether the student's textbook or the teacher's textbook. By looking inversely to this result, the degree of training needs for computer teachers can be estimated from the cognitive aspects related to computational thinking skills, which refer to training needs to a medium degree also at the level of the total degree of cognitive aspects.

The second question: What are the training needs of computer teachers in the skill aspects related to computational thinking?

To identify the training needs of computer teachers from the skill aspects related to computer thinking skills, frequencies, percentages, means, and standard deviation were calculated for the responses of the study sample members. The means of the axis phrases ranged between (2.98 - 4.35) out of (5.00) degrees. The previous result indicates that the responses of the study sample members about the skill aspects related to computational thinking skills range from (medium - very high).

The whole mean scores of the axis phrases was (3.62) with a standard deviation of (0.72). This result indicates that the sample members had a high degree knowledge of the cognitive aspects related to computational thinking skills. This result may be attributed to the nature of the academic specialization of the sample members and to their continuous practice of these skills. This result indicates that the sample members have a high degree of knowledge of the skill aspects associated with computational thinking skills. By looking inversely to this result, it is possible to estimate the degree of training needs for computer teachers from the skill aspects related to computational thinking skills, which indicates a low degree of training needs also at the level of the total degree of the skill aspects.

The third question: What are the training needs of computer teachers in the teaching aspects related to computer thinking skills?

To identify the training needs of computer teachers from the teaching aspects related to computer thinking skills, frequencies, percentages, means, and standard deviation were calculated for the responses of the study sample members. The means of the axis phrases ranged between (2.75 and 3.53) out of (5.00) degrees. The previous result indicates that the responses of the study sample members about the teaching aspects related to computational thinking skills range between (medium - high).

The whole mean scores of the axis phrases was (3.12) with a standard deviation of (0.94). This result indicates that the sample members had a medium degree knowledge of the teaching aspects related to computational thinking skills. This result may be attributed to the nature of the sample members' work. By looking inversely to this result, the degree of training needs for computer teachers can be estimated from the teaching aspects related to computational thinking skills, which refer to training needs to a medium degree also at the level of the total degree of the teaching aspects.

The main question: What are the training needs related to computer thinking skills for computer teachers at the secondary level?

Table 3 shows that the training needs related to computer thinking skills for computer teachers at the secondary level include three dimensions, respectively (skill aspects - cognitive aspects - teaching aspects). The first axis came with a "high" degree of knowledge, which is the axis (skillful aspects), while the two axes (cognitive aspects - teaching aspects) came with a "medium" degree of knowledge, where the arithmetic averages of the axes ranged between (3.12 - 3.62). That is, the sample's knowledge of the computer thinking skills of computer teachers at the secondary level ranges between (medium - high).

Table 3
Means and standard deviations of training needs related to computer thinking skills for secondary school computer teachers

Training needs	Mean	SD	Order
Cognitive aspects	3.23	0.87	2
Skill aspects	3.62	0.72	1
Teaching aspects	3.12	0.94	3

5.1.1.Discuss the results related to the study questions

The results of the current study agree with the results of Sands, Yadav, and Good (2018), which concluded that teachers need training courses regarding computational thinking skills. Many teachers do not precisely know these skills and do not know how to integrate these skills into curricula. Regarding digital technology, the results of this study agree with the results of Bower and Falkner (2015), which concluded that teachers need more education in the field of digital technology and how to integrate it into the subjects and classrooms because teachers do not have a clear view of computational thinking, digital technology, and techniques that can be used to develop computational thinking.In addition, the results agree with the results of the Lundholm's study (2015), which concluded that the teacher is the most important factor in students' acquisition of computational thinking skills. Therefore, focus should be placed on training and educating the teacher on this kind of thinking.Regarding self-development, the results of the current study agree with the results of Sentance and Csizmadia (2017), which found that teachers working in the field of computer teaching need to develop themselves to be able to teach any new subject to their students. About the computational thinking, teachers need to learn the basics of programming, algorithms, etc. that make up the basics of computational thinking.Furthermore, the current study agrees with the study of Bower et al. (2017), which found that teachers' computational thinking, pedagogical abilities, awareness of technological issues, and self-confidence can be improved in a relatively short period of time through purposeful education and vocational training. This means that the required support is more training and

provision of computational thinking education requirements. The results of this study also agree with the study of Adler and Kim (2018), which concluded that teachers need to increase their awareness and develop them professionally in the field of computational thinking.Moreover, the findings of this study is supported by the results of the study of Aljuwayid and Alebaikan (2018), which concluded that female computer teachers are unable to teach computer thinking skills without attending training programs.

5.2.Second: the results related to the hypotheses of the study

The first hypothesis: There are no statistically significant differences at the significance level (α = 0.05) in the training needs associated with computer thinking skills for computer teachers in secondary schools due to the type of educational qualification (educational and non-educational).

To verify the validity of this hypothesis, the Mann-Whitney test was used (see Table 4).

Table 4
The results of the Mann-Whitney test

Dimensions	Educationaltype	n	Order mean	Order total	U	Z	P
Cognitive training needs	Educational	144	82.19	11835	1395	0.573	0.567
	Non-educational	21	88.57	1860			
Skill training needs	Educational	144	81.84	11785.5	1354	0.815	0.415
	Non-educational	21	90.93	1909.5			
Teaching training needs	Educational	144	82.19	11835	1395	0.572	0.567
	Non-educational	21	88.57	1860			
Total degree of training needs	Educational	144	82.00	11808	1368	0.704	0.481
	Non-educational	21	89.86	1887			

Table 4 indicates that there are no statistically significant differences at the level of significance (α = 0.05) between the average responses of the study sample members about the total degree of training needs related to computer thinking skills for computer teachers at the secondary level due to the type of academic qualification and its sub-dimensions represented in (cognitive aspects - skill aspects - teaching aspects). The value of the significance level for the dimensions, respectively (0.567, 0.415, 0.567), and for the total degree was (0.481), all of which are non-statistically significant values at the significance level (0.05).

The previous result indicates the convergence of the training needs of the study sample according to their type of educational qualification (educational and non-educational). The reason for this result may be due to the need for all teachers, regardless of their academic qualifications, to train in computational thinking skills due to the rapid development in educational uses of computational thinking. These uses make there a constant need to enhance and develop teachers' skills in these aspects, which may contribute to improving students' academic achievement.

The second hypothesis: There are no statistically significant differences at the significance level (α = 0.05) in the training needs associated with computer thinking skills for secondary school computer teachers due to their years of experience.

To verify the validity of this hypothesis, a one-way analysis of variance (One Way ANOVA) was used (see Table 5).

Table 5
One Way ANOVA Results

Dimensions	Groups	SS	df	MS	F	P
Cognitive training needs	Between groups	1.518	3	0.506	1.465	0.225
	Within groups	69.731	161	0.345		

	Total	71.249	164			
Skill training needs	Between groups	1.205	3	0.402	1.307	0.273
	Within groups	62.055	161	0.307		
	Total	63.260	164			
Teaching training needs	Between groups	1.179	3	0.393	1.168	0.323
	Within groups	67.956	161	0.336		
	Total	69.135	164			
Total degree of training needs	Between groups	1.556	3	0.519	1.683	0.172
	Within groups	62.253	161	0.308		
	Total	63.809	164			

Table 5 indicates that there are no statistically significant differences at the significance level (α = 0.05) between the average responses of the study sample members about the total degree of training needs related to computer thinking skills for secondary school computer teachers due to their years of experience and its sub-dimensions represented in (cognitive aspects - skill aspects - teaching aspects). The value of the significance level for the dimensions respectively reached (0,225, 0.273, 0.323), and for the total degree (0.172), so all aspects are non-statistically significant values at the significance level (0.05).

The previous result indicates the convergence of the training needs of the research personnel according to the number of years of experience (from 1 to 6 years - from 7 to 10 years - from 11 to 15 years - more than 15 years). This result may be due to the need for all teachers of different years of experience to train in computational thinking skills due to the rapid development in educational uses of computational thinking. These uses make there a constant need to enhance and develop teachers' skills in these aspects, which may contribute to improving students' academic achievement.

6.Study Recommendations

Considering the results of the current research, the researchers recommend the following:

1- Training courses and workshops for computer teachers regarding computer thinking skills in its various aspects. The results revealed that the training needs related to computational thinking skills came to a medium degree.

2- Physical and moral motivation for computer teachers to develop computer thinking skills in order to enhance those skills for them, and to encourage other teachers to develop them.

3- Awareness of computer teachers of the benefits and characteristics of computational thinking, as the results showed that teachers have a medium degree of knowledge of the benefits and characteristics of computational thinking.

4- Continuous awareness of computer teachers about the concepts of computational thinking such as abstraction, division, and generalization, herethe results showed that there is a moderate degree of knowledge among computer teachers that (abstract - division - generalization) is one of the concepts of computational thinking.

5- Training courses and workshops for computer teachers on the applications of computer thinking skills in (visual programming, application design and programming, game design, robot programming, course topics, story design). The results revealed that there is a medium degree of agreement among the study members of computer teachers to apply computational thinking skills in those areas.

6- Directing computer teachers to use appropriate assessment methods for computational thinking, where the results showed that there is a medium degree of agreement among teachers to use appropriate assessment methods for computational thinking.

7- Training courses and workshops for computer teachers on designing learning environments suitable for teaching computational thinking. The results revealed that there is a moderate degree of approval among the study members on their design of such environments.

8- Continuous awareness of teachers about the characteristics of teachers related to teaching computational thinking, where the results showed that there is a medium degree of agreement among the study members on their knowledge of these characteristics.
9- Benefiting from local and international experiences about the strategies and techniques used to develop computer thinking skills such as (virtual reality technology - augmented reality technology - social applications technology - the flipped classroom strategy - cognitive journeys strategy), where it showed that there is a medium degree of approval among the study members to use those strategies and techniques.

7.Research Suggestions

In light of the results that have been reached, the researcher presents some suggestions that he hopes will contribute to enriching the educational field.
1- Conducting a study that deals with the training needs related to computational thinking skills for computer teachers in other levels and in other regions.
2- Conducting comparative research dealing with the training needs related to computational thinking skills for computer teachers in private and public schools.
3- Conducting a study that deals with the difficulties that computer teachers face in teaching computational thinking skills to secondary school students.
4- Conducting research that deals with a proposed conception to develop the computational thinking skills of computer teachers at the secondary stage.

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