

Changing the Educational Epistemologies of Computer Science Teachers - A Case Study of the Kingdom of Saudi Arabia

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Abstract—This paper explores the attitudes of Computer Science (CS) teachers in the Kingdom of Saudi Arabia (KSA) who are confronted by the Saudi Teaching Competencies Standards (STCS). The STCS is a response to a substantial need to develop both subject-specific pedagogical ability as well as teachers subject area knowledge. The Ministry of Education in the KSA is encouraging teachers to improve their practices to achieve the new quality requirements for education. This paper presents the results of an investigation of CS teachers' views on educational belief changes in the KSA schools. The paper addresses how and why CS teachers adopt new educational beliefs in their teaching. The paper presents the results of the investigation of the CS teachers views on educational belief changes in the KSA schools and the STCS policy document guidelines. Research in the area of changing educational epistemology in teaching CS identifies six factors that influence teachers, these are personal pedagogical beliefs, peer learning, curriculum, self-directed learning, student feedback and the STCS. A mixed method study approach was adopted in this work. Content analysis has been applied to the interview transcript and thematic coding analysis to the government policy document (STCS). The results provide a valuable case study in the KSA and emphasize the weak relationship between educational epistemology change and the STCS norms. The findings show that the STCS should provide stronger guidance for CS teachers to keep changing beliefs in teaching CS. The STCS should offer supporting official resources to CS teachers to help them in changing their beliefs in regard to teaching CS.

I. INTRODUCTION

Research on personal epistemology (beliefs about knowledge) have been explored extensively by Perry (1970) at Harvard University. Based on Perry's research, Hofer later established four main stages of epistemological development [2]. These are designated as binary, multi, relativist and committed relativist. It is clear that the dominant educational epistemology is changing. Tedre and Pajunen [4] opine that the educational epistemology in Computer Science (CS) education should be evaluated by reflecting on the degree to which they depend on particular individual computer scientists in terms of subjectivity and objectivity. In the context of this work the computer education epistemology refers to changes in beliefs regarding CS teachers practices, in terms of their teaching methods.

A belief that has numerous connections to different beliefs is thought to be "core" and the core belief is the hardest to change, as the associations with different convictions

need also to be addressed [1]. According to Hermans et al., [5] teachers' belief frameworks contain a multitude of overlapping interesting beliefs such as generalizations, views, values, and expectations. The ability to understand the fundamental causes of teachers' belief on changing educational epistemology develops arbitration, to address such change, is meaningful to a range of researchers involved in the study of teachers' changing beliefs. There are two most widely examined theories or models in the changing belief. These are the Theory of Reasoned Action [7] and Theory of Planned Behavior [6]. It names the Reasoned Action Approach that declares a function of behavioral expectations that are, in turn, a function of belief and subjective standard. The model is illustrated in Figure 1.

CS is a rapidly evolving field rendering the development of teaching and learning of CS imperative. The new invention in technology implies a need explain the concept behind it and how it was programmed. It is now understood that teachers' learning plays an important role in their teaching in order to deliver the knowledge. There is a substantial need to develop subject-specific pedagogy. The Ministry of Education in the Kingdom of Saudi Arabia (KSA) monitor teachers' competency development through the Saudi Teachers Competencies Standards (STCS), with the aim of improving teachers' practices in line with the quality requirements for education.

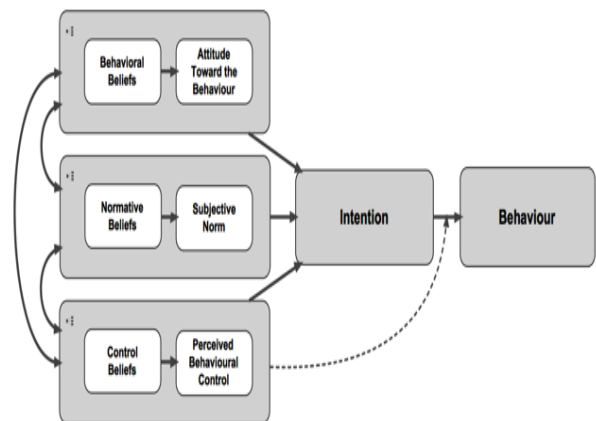


Fig. 1. The Reasoned Action Approach

This paper presents the results of an investigation of CS teachers' views on educational belief changes in the KSA schools and the STCS policy document guidelines. The paper addresses how and why teachers adopt an educational belief in their teaching from two perspectives; the CS teachers and the STCS point of view.

II. EDUCATION IN KSA

The formal educational system in the KSA is structured in an ascending order of four educational levels elementary, intermediate, secondary and tertiary education. The authority in the KSA allows enrollment of children, three to five years of age, into kindergarten which serves as an earliest stage of elementary, though this is optional. Three of the levels, elementary, intermediate and secondary, are compulsory while tertiary, i.e., university is optional. Specialization begins in secondary school, students can choose technical, vocational, and public study. The KSA has about 40 universities, more than 110 colleges and approximately 650,000 teachers. The population of the KSA is around 30,500,000 where quarter of them are students. By implication the ratio of student to teacher is 1:11 while in the US, for example, the ratio is 1:15 [33].

CS subjects are in both intermediate and secondary schools. The CS curriculum for K7-9 aims to address students with general information about CS and how to use it. The CS curriculum for K10-12 is based on the Computer Science Teachers Association standard (CSTA K-12). This curriculum emphasizes three topics contemporary applications, programming, and digital citizen. These subjects in K7-12 are evaluated in the mandatory test. There are more than 12000 CS teachers in the KSA schools. These CS teachers graduated from the CS Colleges; students must complete the maximum of 137 credit in CS core and 18 credit in a topic of their choices. CS teachers need to take the Education Diploma which is 30 credits. Also, CS teachers must pass the National Computer Teacher Exam (NCTE), the exam test CS concepts and necessary teaching abilities [9].

A. Saudi Arabia Vision 2030 in Education

The achievements of the KSA have recently taken shape at various levels, notably the launch of the Kingdom's Vision 2030 [34], which has three pillars: a vibrant society, a thriving economy, an ambitious homeland. The educational system outlined within the vision has been evaluated to determine the path of educational development, in which it suggests the philosophy of the curriculum and its policies, its objectives, ways to develop it, mechanism to activate it, and improve the teaching using methods that make a learner the focus of the educational process. A main focus is building the skills of teachers, trusting them, and building their spirit of creativity. Through this perspective, the KSA is keen to develop teachers that are identified as one of the pillars of the educational system. One way of achieving this is the Saudi Teachers Competencies Standards (STCS) [34] which states that

We will prepare a modern curriculum focused on rigorous standards in literacy, numeracy, skills and character development. We will track progress and publish a sophisticated range of education outcomes, showing year-on-year improvements.

In the beginning of 2016, the National Transformation Program (NTP) 2020 started with the Ministry of Education initiating transformation of the educational sector. Challenges in education were identified, the general objectives of education were improved, and performance measurement indicators were developed. The KSA educational transformation program has the following new goals:

- Improving recruitment, training and development of teachers.
- Improving the learning environment to stimulate creativity and innovation.
- Improving curricula and teaching methods.
- Improving students' values and core skills.
- Development of financing methods and improvements in financial efficiency.
- Educating students to address national development requirements and labor market demands.
- Increasing private sector participation in the Education Sector.

B. The Saudi Teachers Competency Standards

The Saudi Teaching Competency Standards (STCS) [28] has been recently adopted in the KSA. The Public Education Evaluation Commission (PEEC) controls and evaluates all elements of the educational process and teachers are one of them. The standard requires all teachers to develop knowledge, teaching and practice [8], [9]. The STCS document is structured in three stages. The first stage describes the role of teachers and how they are important to achieve the goals, the second is how the standard is built, and the third stage describes how STCS will applied and evaluated. In order to improve teacher's abilities and skills the STCS adjusts teachers' career paths, encourages development of skills and creativity, enriches scientific thought and research, and practical application of professional standards in different educational disciplines. The standard is formulated in the light of instructive research that indicates the importance of persuasive educators who animate deep-rooted learners. The Ministry of Education, throughout this resourcefulness, expects to expand teacher's educational practices. The standard is based on the assumption that quality of learning depends on excellence of teaching and that superiority in teaching requires high levels of specific knowledge and skills. The STCS consists of three overlapping and interrelated areas, see Figure 2:

- Professional Teaching:
 - The Islamic values and the Saudi culture.
 - Professional communication with society and educators.
- Professional Knowledge:
 - The students and how to teach them.



Fig. 2. The STCS

- content of the specialization and curriculum.
- The teaching methods.
- Professional Practice:
 - Planning the teaching.
 - Designing an interactive learning environment.
 - Evaluating students.

The STCS is a national standard particularly for the Saudi cultural context, developed in light of the latest research in this filed.

CS teachers are graduated from the CS Colleges; students must complete the maximum of 137 credit in CS core and 18 credit in a topic of their choices. In addition, they need to take the Education Diploma which is 30 credits and pass the National Computer Teacher Exam (NCTE). The exam tests both CS concepts and necessary teaching abilities [9].

III. METHOD

In this study, the researchers aim to understand the changing educational epistemology of CS teachers. The work draws on data from two different sources, interviews with teachers who accepted invitations for the interview, and the educational policy document of the STCS. The research was conducted using a mixed method approach where content analysis was applied to the interview data and thematic coding was applied to the policy documents.

The researchers have adopted qualitative research approaches [12] in order to go in-depth with the data to understand the different views on changing belief in education. In Europe, qualitative approaches were used most frequently between 2006 and 2008 [10]. Previous educational research in the KSA has been dominated by quantitative approaches, and the need for using qualitative approaches to fully investigate the educational context have been emphasized [11].

A. Interviews

Data was collected using individual semi-structured interviews which allow participants to go in depth in recollecting their educational beliefs and provide them with the freedom to express themselves on how they behave in their practice.

Participants were approached with the help of four supervisors of CS teachers that forwarded a link information about the project. More than 60 CS teachers registered and, and thirteen of them were interviewed.

The interviews were conducted using the WhatsApp application, a tool for sending and receiving media contents such as instant messages, photos, recordings, and voice calls [13]. In contrast to using a questionnaire, using WhatsApp allowed the researcher to pose follow up questions. The CS teachers were contacted via WhatsApp during their regular working time, this was chosen over their free time in order not to intrude into their privacy. The average time for finishing the interview was two days. Eleven participants chose to answer the interview questions by text messages while two sent recorded voice messages.

The interviews consisted of two parts; one concerned demographic data including years of teaching experience, gender, educational background, and in what educational level they were active. The other part consisted of three open-ended questions that aimed to inspire the CS teachers' thoughts. The three open ended questions were related to teachers development; these address their most prominent educational beliefs about teaching CS, their change in teaching CS from their first year until the present, and reasons for making their changes.

B. The STCS standard

The analysis of the STCS [28] was conducted by close reading of the official document in order to determine the link between the standard and teachers' changing educational epistemology.

C. Analysis method

The data, originally collected in Arabic, was analyzed by the first author. The findings and conclusions were then discussed with the other authors. The discussions were based on an English translation of the data.

The interview data was analyzed using deductive content analysis [14] to look for occurrence of categories found in previous similar studies. The method allows for identifying categories present in previous work that do not appear in this data.

The categories used for the deductive analysis were collected through a literature review of papers presenting results on teachers adopting changes in their personal epistemology or in teaching practice. The following five categories were identified:

- Personal pedagogical beliefs [15], [16], [17]
- Curriculum [15], [18], [19], [20], [21]
- Self-directed learning [22], [23], [24]
- Peer learning [9], [21], [25], [26]
- Student feedback [31], [32]

For example, helping teachers transform new knowledge into practice increases the rate of change [27], using web resources generates a positive trend in teachers teaching approaches [20], and transitions from paper-based to hands-on approaches have been successful [29].

The STCS document has been coded using thematic coding [30] to elicit the governments perspective on how increased quality of education can be achieved, i.e., how it aims to engage teachers in changing their educational epistemology and their teaching practice.

IV. RESULTS

The analyses of the data from the interviews and the STCS document were performed in relation to the focus of the research question.

1) *The Interviews*: The deductive coding of the interview data into the six categories: self-directed learning, personal pedagogical beliefs, peer learning, students feedback, curriculum, and STCS is summarized in Tables I - III. The tables also give example quotes from each category and show the number of participants expressing each standpoint (N).

a) *Self-Directed Learning*: Literature are abounding in self-directed learning as a factor influencing change in educational epistemology. Teachers engage in self-directed learning to keep with the pace of evolvement of a specific area. This is also the case for CS teachers in the KSA. A significant percentage of the participants interviewed state that self-directed learning is a strong motivation for them to adopt a change in their educational epistemology. Essentially, the CS teachers stated that they can be relevant in the CS subject only if they update their knowledge in line with the present reality.

b) *Personal Pedagogical Beliefs*: For a long time, CS teachers in the KSA have applied a specific way of teaching which the informants call "the traditional method". This is a passive method, teachers are at the center of educational instruction, students are inactive in the student-teacher in-class interaction. Participants state that they were taught in this way, but apparently the method falls short of nowadays reality. The participants state that they defined themselves as traditional at the beginning of their teaching journey and many identify themselves as constructivist right now. This is to say that CS teachers have realized, in the course of their teaching experience, the notable inefficiency of the traditional method in teaching CS, and then adopted constructivist methods of teaching CS. This means that the educational epistemology they adopted during their college studies is different from what they are practicing in classrooms nowadays.

c) *Peer Learning*: It has been found that peer learning, learning from other teachers, is one of the factors influencing teachers to make changes in educational epistemology. This is also the case of KSA CS teachers, participants stated that peer learning have essentially influenced their change of educational epistemology. Interestingly, almost all participants agreed to this factor influencing them to learn in a formal or informal ways.

d) *Student feedback*: In this study it is obvious that feedback from students is an essential influence on the teacher's potential change in their educational epistemology. The participants stated that positive feedback from students on any new teaching strategies or tools influence their

decision to adopt such strategies. This is an insight into how teachers reflect on teaching methodologies in which they believe and want to adopt. It is, therefore, essential to argue that changing educational epistemology cannot be determined singlehandedly by teachers, but that student-teacher feedback mechanism importantly play an important role in change in educational epistemology.

e) *Curriculum*: Previous studies on changing belief show that curriculum, for example requirements on attending in-service programs, is beneficial for teachers to be well adept and more easily change their educational belief after encountering new strategies in teaching practice. This is also the case of CS teachers in the KSA, the participants stated that the new curriculum leads to training and in-service programs that inspire them to change and improve their educational epistemology. Apparently, a significant percentage of the participants felt that attending in-service programs and the new CS curriculum guidelines change the way they teach the CS subject.

Interestingly, almost all participants agreed this factor influence them to learn formal or informal way.

f) *STCS*: According to this data, the STCS norms does not affect the changing beliefs in CS teachers' practices. The participants stated that the STCS will not influence them to change their practice in teaching CS because the Ministry of Education had a plan that seems non-inclusive see the Table. III. CS teachers said the STCS requires more efforts and workload in which appear impossible. The participants blame the Ministry of Education for the inadequate information and training regarding implementation of the STCS. CS teachers said the STCS is a good starting point for new teachers, but teachers who are already in teaching need more training and support. The STCS comes in the form of threat to CS teachers workspace.

It is clear that the curriculum has been undergoing rapid changes from time to time and this creates gap in between teacher's knowledge and curriculum contents in several subjects including CS. This further underscore the need to engage teachers in training and re-training in order to bridge the gap than the force over a distance called STCS.

2) *The STCS Document*: The Saudi Arabia vision 2030 has education as one of its focus to rehabilitate and revamp the educational system of the KSA. Concerning CS education, this is aims to prepare a new generation that corresponds change computer teachers at the beginning of the study called professional development of computer teachers, to keep pace with 21st century skills and to compete with the distinctive educational systems elsewhere. Teachers are the corner stone in this processes of revamping educational system as stated in the STCS document

The teachers are the most important foundations of the development of the educational system in the Kingdom of Saudi Arabia, who are able to excellence and high level to build education World-class Saudi Arabia. [27].

The target is to fulfill the vision of high quality in the educational system.

TABLE I
THE INDUCTIVE ANALYSIS OF THE INTERVIEW DATA (I-1),(N) IS THE CS TEACHERS PARTICIPANTS AGREED

| Variable | Definition | Value | Anchor samples | Encoding rules | N |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|----|
| Self-Directed Learning | It is authentic control, and access to resources" [15]. | K1: Positive change | - I only used the indoctrinated in the first year. I am using several strategies after 7 years and I expect to learn more. - I used to read from CS teacher's book to learn how I have to teach CS. | It must point the self directed learning | 5 |
| | | K2: Negative change | - in the past, it is simplified curricula but students can learn them. | It must point in the direction of "negative change" | 2 |
| | | K3: No change | - The teacher's desire to develop his tools and abilities. | No clear position | 2 |
| Personal Pedagogical Beliefs | "Personal pedagogical beliefs consist of a mixture of traditional (teacher-centric) and constructivist (student-centric) principles"[18] | K1: Positive change | - Concept maps I think it is the best way to learn and differentiated instruction, I ask each group to summarize the given part, and output in any way either conceptual map or chart organizer (VN) Or table. - The student's strategy which is to read and apply very well. - I used gamification if it is possible.. I explained the main rules of programming then students start. It is easy to connect the information sometimes with the use of open questions and sometimes brainstorming. | It must point in the direction of "student-centric" | 7 |
| | | K2: Negative change | - the lesson inside the computer lab. The best method is presentation in the smart board. Students then apply what they see. - In the teaching of practical programs, I use the method of the demonstration to explain the steps through the network and then the students apply what they had learned in the same classroom... | It must point in the direction of "teacher-centric" | 3 |
| | | K3: No change | no | No clear position | 0 |
| The Peer Learning | "Peer learning involves participants learning from and with each other in both formal and informal ways"[31]. | K1: Positive change | - The teacher's desire to develop his tools and abilities and interaction with more experienced teachers and passing different educational situations - I'm involved [in the group] and It's beneficial. - There is certainly a special group on WhatsApp for CS teachers and I am a member of the group it benefits us through sharing of experiences by colleagues regarding problems they face and how to solve them. - There is, especially in the application of Telegram. Informally, there are more than 2000 computer teachers on this, with the presence of computer supervisors from different regions. On this platform, latest courses, programs, and applications are published. Yes, I benefited on this platform through its development of teaching methods. | It must point in the direction of "positive change" | 10 |
| | | K2: Negative change | no | It must point in the direction of "negative change" | 0 |
| | | K3: No change | no | No clear position | 0 |

TABLE II
THE DEDUCTIVE ANALYSIS OF THE INTERVIEW DATA (1-2),(N) IS THE CS TEACHERS PARTICIPANTS AGREED

| Variable | Definition | Value | Anchor samples | Encoding rules | N |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|---|
| The Student feedback | "Information allowing a learner to reduce the gap between what is evident currently and what could or should be the case"[26]. | K1: Positive change | - I believe that if the student participates in the conclusion of the information, he becomes entrenched in his mind. I believe that students move and use his hand and participate with his classmate. He acquired more skills than the teacher just said. - ..Knowing the level of students so easy to deal with them. - The students must move, speak and take easily in the classroom. I see this as a successful teaching. - To keep pace with the development. Nowadays the students feel bored, strategies must be used to improve the learning process. | It must point in the direction of "positive change" | 9 |
| | | K2: Negative change | no | It must point in the direction of "negative change" | 0 |
| | | K3: No change | no | No clear position | 0 |
| The CS Curriculum | "Training through special courses, workshops, etc., given to teachers in connection with their work"[31]. | K1: Positive change | - The ministry has set up an EIN platform for teachers and students to develop skills. As well as SHAMS platform as a digital repository for all educational sources, expertise is uploaded on them to benefit the rest of the teachers in their specialization. - The teacher must be more prepared. Preparation must also be done before each class. - Teachers must develop themselves through various means, either by accompanied courses, or materials on computer - It is necessary to develop the teacher of himself in his specialization either in practice or training courses in the field. | It must point in the direction of "positive change" | 8 |
| | | K2: Negative change | - Weak supervision and educational training courses do not live up to ambition and most of them is theory. - ...But this will be achieved only if supervisors are distinguished in training (because some supervisors level without hope). | It must point in the direction of "negative change" | 2 |
| | | K3: No change | - There are training courses offered to computer teachers at the beginning of the study called professional development of computer teachers. | No clear position | 1 |

Raising educational and educational efficiency For teachers, in particular the development of their cognitive and skills.[27].

The STCS is integrating the five categories which are self-directed learning, personal pedagogical, peer learning, students' feedback and curriculum in overlapping standard. we conclude that the STCS mentioned the changing educational epistemology on all the five categories. in the discussion section the researchers explain each category from two

perspectives CS teachers and the STCS.

V. DISCUSSION

This section discusses the interviews' outcomes in relation to the STCS document regarding reasons for CS teachers to adopt changes in their educational epistemology. First, the results show that the self-directed learning helps the CS teachers to achieve more knowledge about CS teaching practices. The participants acknowledge that self-directed learning, sometimes not planned for, efficiently equip them

TABLE III
THE DEDUCTIVE ANALYSIS OF THE INTERVIEW DATA,(N) IS THE CS TEACHERS PARTICIPANTS AGREED

| Variable | Definition | Value | Anchor samples | Encoding rules | N |
|----------|------------------------------------------------------------------------------------------------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|---|
| The STCS | "The new standard in the KSA requires all teachers to develop knowledge, teaching and practice"[28]. | K1: Positive change | - I believe it is a professional path for teachers aimed at developing the teacher's professional performance and encouraging him to innovate. - I heard about it. The ministry is going to apply a test for teachers on the basis of global standards for the teacher so that the outputs are of quality so that the teacher who does not pass this license is not suitable for education | It must point in the direction of "positive change" | 3 |
| | | K2: Negative change | - There are gap between supervisors towards teachers. Which is supposed to provide nutritional feedback to the teacher to raise the efficiency and availability of courses. - I can not evaluate the teacher on the presence of one attended visit or on the test. | It must point in the direction of "negative change" | 6 |
| | | K3: No change | - I heard about it. It will start soon. - I see that the development of education is a comprehensive system and needs an integrated vision of all elements in order to achieve the desired results. - The view is good if objective and realistic. | No clear position | 2 |

in teaching and, by extension, changes their educational epistemology. Interestingly, the STCS technically and conservatively requires teachers to shoulder the responsibility of professional development in teaching, knowledge and practice. It is imperative to note that the STCS does not recommend or suggest a proper right way nor makes provision for official resources towards every teachers professional development. On the one hand, that the STCS encourages self-directed learning and any other means that the teachers choose to develop themselves personally and professionally. On the other hand, any teacher who fails to improve is vulnerable to STCS penalties in spite lack of state provision for such professional development. However, there are new steps taken by the Ministry of Education that seem a formal way of encouraging self-directed learning. Such actions are the teacher's book, a STEM centre, e-training workshops and TAMKEEN, an e-training platform.

Second, the results show that the personal pedagogical beliefs are well established among the participants, this is either because of the new CS curriculum (active learning based) or their pedagogical training programs. This is to say that the participant's pedagogy changes are functions of new the curriculum and newly self-acquired knowledge through educational training programs. The participants stated that the Ministry of Education should be responsible for teacher's professional development and some of them register their grievances towards the Ministry of Education's lack of professional training programs. Unfortunately, the STCS is silent on the additional degree certificate, but emphasize the professional certifications and total teaching experiences of teachers. This is to say that the STCS addresses the student's needs at the expense of other requirements wanted for the whole system to work well to achieve the quality of

education as set out by the STCS.

Third, peer learning is one of the most critical factors that change teacher's beliefs because they see themselves as the role model for one another. The participants stated that the peer learning among themselves is more natural and beneficial because almost all the CS teachers possess the same level of education and knowledge, except in a few cases. They sometimes meet, as CS teachers, to discuss similar course contents. In the process, lots are gained especially strategies of instruction through evaluation and reflection. Interestingly, the STCS encourages the teachers' community as one way to develop and evaluate the progress made in the teacher's professional development. It is important to say that the teachers' community as a way of learning should be given due informal or formal support through free access to a range of workshops or training programs as and when fitting.

Fourth, the student feedback mechanism has been associated with teachers' educational epistemology changes among other factors influencing teachers' changing belief. The participants acknowledged that the students' feedback mechanisms have tremendously affected their decision to change their educational belief when required or adopting new teaching practices. It shows that CS teachers in the KSA often reflect on their teaching methodology through an about teacher-student feedback mechanism, this gives room for improvement and allow teachers to change educational epistemology when student's feedback is negative. Contrarily, the STCS sees the student-teacher feedback mechanism as an element to evaluate its professional practices not as a potential factor to cause the policy change in teacher's educational belief. The differences between teacher's and STCS perception on the student-feedback mechanism suggest that

the STCS policy is a bottom-top a system that does not include the inputs of teachers during the decision making processes. This further gives credence to the argument of a force over a distance stated earlier in the paper.

Fifth, the participants stated that CS curriculum has been an inspiring entity that draws them closer to changing educational epistemology. However, the design of the CS curriculum is student-centric and has nothing to do with teachers' professional development, but it is essential for teachers to personally change its educational epistemology to keep pace with the recent growth such as new curriculum. The Ministry of Education developed CS curriculum recently and offered several training programs at the beginning of the working year and sometimes during the study year. All the training programs focus on how to teach the new CS curriculum mainly on the active learning and students-centric strategies. None of the programs is focusing on educational epistemology. Mostly, the STCS and the new curriculum appear to have overlapping goals but with different strategies towards there goals. Interestingly, both STCS and the new curriculum state professional practice about teaching plan, but STCS does not have a clear-cut role on workload and again the way the STCS presents teaching plan is beclouded with lots of misconceptions.

Sixth, the participants are not clear enough about the need for STCS, they questioned its rationale, and they considered it as a misconception of their profession. The participants stated that the STCS requires more time and effort, but in reality, there are no motivations towards such time and efforts. Meanwhile, the standard is the framework to organize the teaching and help teachers to grow in their career. The document contributes to the development of a standard professional language between teachers and educators, reflecting the professional requirements that all teachers share. The standard provides the society and its various institutions with clear national bases and rules for the teaching profession, which in turn contribute to the formation of a public social understanding of the teacher's role and role in preparing the future generation. Supporting and contributing to the development of the country and its economy.

VI. CONCLUSIONS

This research shows that STCS demands lots of things concerning teacher's professionalism to achieve quality education in the KSA. The Ministry of Education in the KSA is shoulder with the responsibility of implementing STCS and ensuring its compliance. As part of its mandate, the ministry wants teachers to scale up their efforts towards achieving the new professionalism requirements for education. The paper addresses the imperfect connection between the educational epistemology that teacher decided to change and how it is presented in the STCS. The STCS expresses clearly without a shadow of a doubt that the teachers need to involve in the training program, accept supporting program and consent to resources to develop student-centric goals. The outcomes also raise awareness about the gap that exists in implementing STCS and inform the policymakers on how to bridge the

gap. It is important to note that the study reveals that STCS is student-centric and does not influence CS teachers changing beliefs. The research also shows that CS teachers have been influenced to adopt changes in educational epistemology in teaching CS by personal pedagogical, curriculum, self-directed learning, peer learning and the students feedback. The researchers acknowledge that the number of participants was few and that a further investigation is needed, but research findings are given credence by the results of other similar research on educational epistemology. Essentially, the research provides important aspects of the issue that can be used in all Arab region.

REFERENCES

- [1] M. Eisenhart, J. Shrum, J. Harding and A. Cuthbert, "Teacher Beliefs", *Educational Policy*, vol. 2, no. 1, pp. 51-70, 1988.
- [2] B. Hofer and P. Pintrich, "The Development of Epistemological Theories: Beliefs about Knowledge and Knowing and Their Relation to Learning", *Review of Educational Research*, vol. 67, no. 1, p. 88, 1997.
- [3] V. Richardson. "The role of attitudes and beliefs in learning to teach". *Handbook of research on teacher education*, ch. 2, 1996, pp. 102D119.
- [4] M. Tedre and J. Pajunen, "An easy approach to epistemology and ontology in computing theses", *Proceedings of the 13th Koli Calling International Conference on Computing Education Research - Koli Calling '13*, 2013.
- [5] R. Hermans, J. Tondeur, J. van Braak and M. Valcke, "The impact of primary school teachers educational beliefs on the classroom use of computers", *Computers and Education*, vol. 51, no. 4, pp. 1499-1509, 2008.
- [6] I. Ajzen, "From Intentions to Actions: A Theory of Planned Behavior", *Action Control*, pp. 11-39, 1985.
- [7] I. Ajzen and M. Fishbein, "Attitudes and the Attitude-Behavior Relation: Reasoned and Automatic Processes", *European Review of Social Psychology*, vol. 11, no. 1, pp. 1-33, 2000.
- [8] F. Al-Saud and A. Alsadaawi, "Raising the Quality of Education: Developing Professional Standards for Teachers and School Leaders — The Commonwealth", *Thecommonwealth.org*, 2018. [Online]. Available: <http://thecommonwealth.org/project/raising-quality-education-developing-professional-standards-teachers-and-school-leaders>. [Accessed: 27- Mar- 2018].
- [9] F. Alghamdi, A. Pears and A. Nylén, "Teachers Perspectives on Competencies: Teaching Computer Science in Schools in the Kingdom of Saudi Arabia", Submitted to ISSEP-2018.
- [10] I. Devetak, S. Glaar and J. Vogrinc, "The Role of Qualitative Research in Science Education", *Eurasia Journal of Mathematics, Science and Technology Education*, vol. 6, no. 1, pp. 77-84, 2010.
- [11] R. Al-Abdulkareem, "Qualitative Approach", 1st ed. Rayidh: King Said University, 2012.
- [12] J. Dean, "Book Review: What is Qualitative Research? What Is Qualitative Research? Hammersley Martyn, Bloomsbury Academic, London, 2013, 14.99, 125pp.", *The Sociological Review*, vol. 61, no. 4, pp. 845-847, 2013.
- [13] "WhatsApp", *WhatsApp.com*, 2018. [Online]. Available: <https://www.whatsapp.com/>. [Accessed: 27- Mar- 2018].
- [14] P. Mayring, "Qualitative content analysis: theoretical foundation, basic procedures and software solution". *Klagenfurt*, 2014, pp. <http://nbn-resolving.de/urn:nbn:de:0168-ssor-395173>.
- [15] H. Becker, "Findings from the Teaching, Learning, and Computing Survey", *education policy analysis archives*, vol. 8, p. 51, 2000.
- [16] M. Hamilton, "Pedagogical transitions among science teachers: how does context intersect with teacher beliefs?", *Teachers and Teaching*, vol. 24, no. 2, pp. 151-165, 2017.
- [17] D. Kagan, "Implication of Research on Teacher Belief", *Educational Psychologist*, vol. 27, no. 1, pp. 65-90, 1992.
- [18] M. Lopez-Rosenfeld, "Tell Me and I Forget, Teach Me and I May Remember, Involve Me and I Learn": Changing the Approach of Teaching Computer Organization", *2017 IEEE/ACM 1st International Workshop on Software Engineering Curricula for Millennials (SECM)*, 2017.

- [19] N. Liberman, Y. Ben-David Kolikant and C. Beeri, "In-service teachers learning of a new paradigm", Proceedings of the fifth international workshop on Computing education research workshop - ICER '09, 2009.
- [20] H. Al-Rshedi, "Training program for CS female teachers parameter skills", Master Thesis, Al-Majmaha University, Riyadh, KSA, 2011.
- [21] P. Ertmer Ottenbreit-leftwich, "Teacher technology change. How knowledge, beliefs and culture intersect", CiteSeerx.ist.psu.edu, 2018.
- [22] J. Gal-Ezer and D. Harel, "What (else) should CS educators know?", Communications of the ACM, vol. 41, no. 9, pp. 77-84, 1998.
- [23] J. Harmer, "How to Teach English (Second Edition)", ELT Journal, vol. 62, no. 3, pp. 313-316, 2007.
- [24] T. Faas and C. Lin, "Self-Directed Learning in Teacher-Lead Minecraft Classrooms", Proceedings of the 2017 CHI Conference Extended Abstracts on Human Factors in Computing Systems - CHI EA '17, 2017.
- [25] K. Bailey, "The processes of innovation in language teacher development: What, why and how teachers change. Perspectives on second language teacher education", Perspectives on second language teacher education, vol., no., pp. 253-282., 1992.
- [26] J. Richards and R. Willy, "Exploring teachers beliefs and the processes of change", PAC journal, vol. 1, no. 1, pp. 41-58, 2001.
- [27] G. Fessakis and K. Tsampika, "Pedagogical Beliefs and Attitudes of Computer Science Teachers in Greece", Themes in Science and Technology Education, vol. 4, no. 2, pp. 75-88, 2011.
- [28] P. E. E. Commission, Saudi Teachers Competence Standards, The Ministry of Education, Al-Riyadh, KSA, 2016.
- [29] H. Becker, "Findings from the Teaching, Learning, and Computing Survey", education policy analysis archives, vol. 8, p. 51, 2000.
- [30] V. Braun and V. Clarke, Using thematic analysis in psychology, Qualitative research in psychology, vol. 3, no. 2, pp. 77101, 2006.
- [31] E. Souder, "Improving Teaching Effectiveness: Facilitating Student Feedback", Nurse Educator, vol. 22, no. 4, pp. 8,14, 1997.
- [32] L. Barker and J. Gruning, "The student prompt: Student feedback and change in teaching practices in postsecondary computer science", 2014 IEEE Frontiers in Education Conference (FIE) Proceedings, 2014.
- [33] G. A. Statistics. "Education and training survey in the KSA", The General Authority for Statistics, Al-Riyadh, KSA, 2017.
- [34] S. V. 2030. "Saudi Vision 2030", The Kingdom of Saudi Arabia, Al-Riyadh, KSA, 2017.