Chapter

Rethinking Innovative Learning Opportunities for Teachers in Educational Organizations toward Education 4.0

Süleyman Davut Göker and Mubeher Ürün Göker

Abstract

Teacher behaviors play a key role in forming and shaping organizational culture in schools. The current innovative and leadership-based learning objectives introduced by Education 4.0 have made the transformation obligatory from traditional classrooms of the industrial society to creation of digital classrooms. This transformation will embrace digital curriculum that might impact learning outcomes and reduce in-class management. How is it different from traditional classrooms? The spaces in a digital classroom are both digital and physical. This environment asks for future creative convergence talents, thus giving teachers new tasks to take greater ownership of change processes of their school culture. This shift also requires creation of reflective learning communities together with a redefinition of the meaning and scope of teacher supervision. This study introduces, a "Teacher Competency Development Model," in which innovative learning opportunities for teachers in educational organizations toward Education 4.0 are offered through innovative models in teacher supervision based on cognitive, reflective, and peer coaching and their utilization within the educational contexts. Within this framework, the contents and strategies of three supervision models, namely, reflective, cognitive, and peer coaching to be able to help teachers survive and cope with their adaptation to Education 4.0 will be discussed.

Keywords: redefinition of learning opportunities, teacher competency development model, Education 4.0, school culture, peer, cognitive and reflective coaching

1. Introduction

Teacher behaviors play a key role in forming and shaping organizational culture in schools. The current innovative and leadership-based learning objectives introduced by Education 4.0 have made the transformation obligatory from traditional classroom of the industrial society to creation of digital classrooms. The Fourth Industrial Revolution has taken people to an era of new social and unprecedented changes. In all sectors of all industries, today's hot issue is the Fourth Industrial Revolution. The First Industrial Revolution was based on the mechanization through the steam engine; the Second Industrial Revolution was based on mass

production through electric energy; and the Third Industrial Revolution was based on intelligence information revolution through computer and internet. And the ongoing Fourth Industrial Revolution is based on IoT, Cloud, big data, AI, and mobiles. Also, in the near future, we will meet the 5G wireless network era. The speed of 5G is 280 times faster than LTE. And in some countries, this Fourth Industrial Revolution can be called digital transformation. **Figure 1** illustrates the advent of the Fourth Industrial Revolution (IR) age.

The Fourth Industrial Revolution makes three major changes namely intellectualization of human and machine, virtualization of the real and virtual, and hyper connection of human and things. This revolution brings about changes in future society due to technological progress. Technological progress includes infinite increase in data as well as explosive growth of network. This technological progress will bring increase in value of data and according to these changes the future society will evolve toward role change between humans and machines. In particular, we need to note the increasing data value, which will become more important in the near future.

Within this framework, we need to discuss the global change trends to respond to the Fourth Industrial Revolution. First of all, adaptability is more critical to success than ever. In other words, the importance of the user experience is growing and growing. Additionally, as the amount of data increases, big data management and analytics will become more important. For example, in 2027, bitcoin and the blockchain will become very popular in the business fields. With regard to the key success factors, we need to look at three aspects: technology, industry, and society.

From a technological point of view, technology will evolve into "High Intelligence Information Tech" and "High Quality Data Infrastructure" and provide high-quality intelligent information technologies to industry. And with technological assistance, the whole industry will achieve intelligent information.

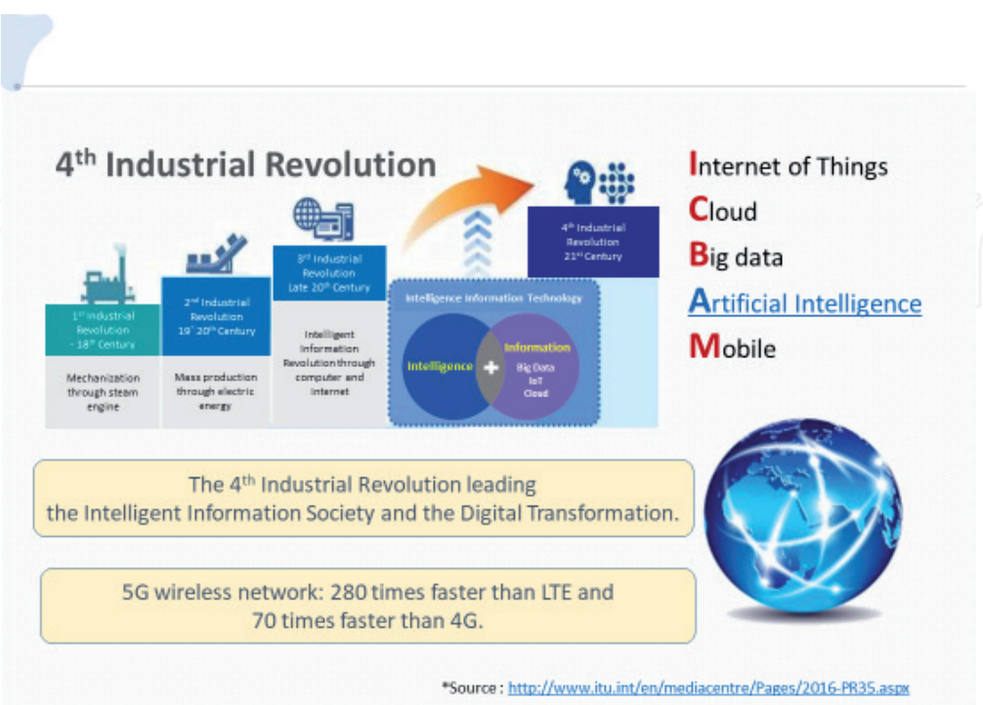

Figure 1.
The advent of the fourth industrial revolution (IR) age.

2. What Education 4.0 proposes

As far as the educational innovation in the Fourth Industrial Revolution era is concerned, these changes have accelerated many things and respective and unique skilled sets of human capital have been required by the different conditions of social economy. The important factor in the future intelligent information society is to cultivate human-tech literacy resources. The importance of development of the required skills lies in people in learning management, to develop the skills as well as knowledge abilities taking the needs of the society into consideration [1]. Leapfrog [2] called the education in this era responding to the agrarian society as Education 1.0, industrial society as Education 2.0, globalization as Education 3.0, and innovation as Education 4.0.

To be able to cultivate human-tech literacy resources in the future intelligent information society, new and creative fusion talents are required. These creative fusion talents should have the following four intelligences: context intelligence, emotional intelligence, social emotion intelligence, and physical intelligence as indicated in **Figure 2**.

As can be seen in **Figure 2**, the intelligences traditionally known as multiple intelligences within the theory of multiple intelligences developed in Gardner [3] (logical-mathematical, linguistic, bodily-kinesthetic, musical, spatial, intrapersonal, interpersonal, and naturalist intelligence) look to have been reshaped and focus has been given on social, physical, context, and emotional intelligence with a new understanding. This shift will bring many changes in learning and teaching theories currently being followed as well.

From today on, we will be discussing creative talent cultivation through fusion education together with the introduction of the importance of these four intelligences with more emphasis on various ICT-based learning models. These learning models will also replace traditionally known learning models used in different educational contexts. These various kinds of learning models are evolving based

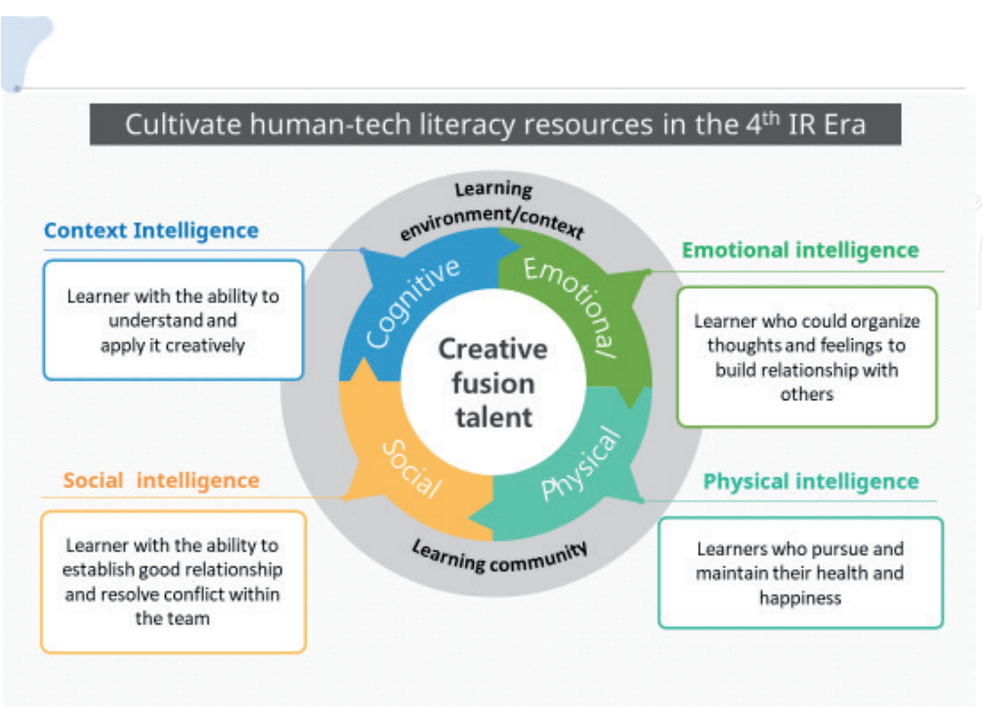

Figure 2.
Creative fusion talents for future intelligent information society.

on mobile. Particularly, in some countries, mobile has become commonplace beyond the PC. **Figure 3** describes the diversification of digital learning in the Fourth IR era.

The learning models given in **Figure 3** also include various elements of learning ecosystem to provide optimized learning system to each learner in response to the Fourth Industrial Revolution. This learning ecosystem has to be considered to promote innovative and optimized learning. This innovative and optimized learning introduces change trends of educational digital contents. Nowadays, digital content is evolving in the following six directions. 1. Interactive, 2. Characteristic, 3. Clipped (mobile-based), 4. Global, 5. Realistic (AR/VR embedded), and 6. Emotional.

Almost each of these directions gives a special focus on coding education. In the Fourth Industrial Revolution era, the importance of coding education is emphasized around the world in following ways:

1. Coding is the building block of the future.

2. Learning code is your gateway into understanding how to make the future yours.

3. The coding really determines how it will look on the screen. Learning to code will guarantee that your vision gets carried through to completion.

4. Behind code is a bunch more 1s and 0s that do the real work inside the brain of the computer. Code is a fascinating world of its own.

5. Coding will change the way you think.

6. Code will give you a fresh way to look at problems. Code is a lot like structured poetry and will change the way you see the world through computational thinking.

To sum up, the future education direction is to create a leading country of intelligence information society with creative fusion talents. This change trend also redefines the objectives of future of education in the following reflected ways:

1. Education to maximize student interest and aptitude

2. Education for thinking, problem-solving, and creativity

3. Customized education considering individual learning ability

4. Education to raise key talents in intelligence information technology

5. Education to focus on people and contribute to social integration.

From the stand point of educational innovation for the intelligent information society, the content and objectives of educational system in the world seem to move beyond rote education to realize problem-solving and critical-thinking centered education. This will require an expansion of SW/STEAM education and fulfilling computational thinking-oriented education and a reorganization of curriculum and system overall for developing autonomous competency and supporting future preparation. Establishing an adaptive learning system using intelligent information

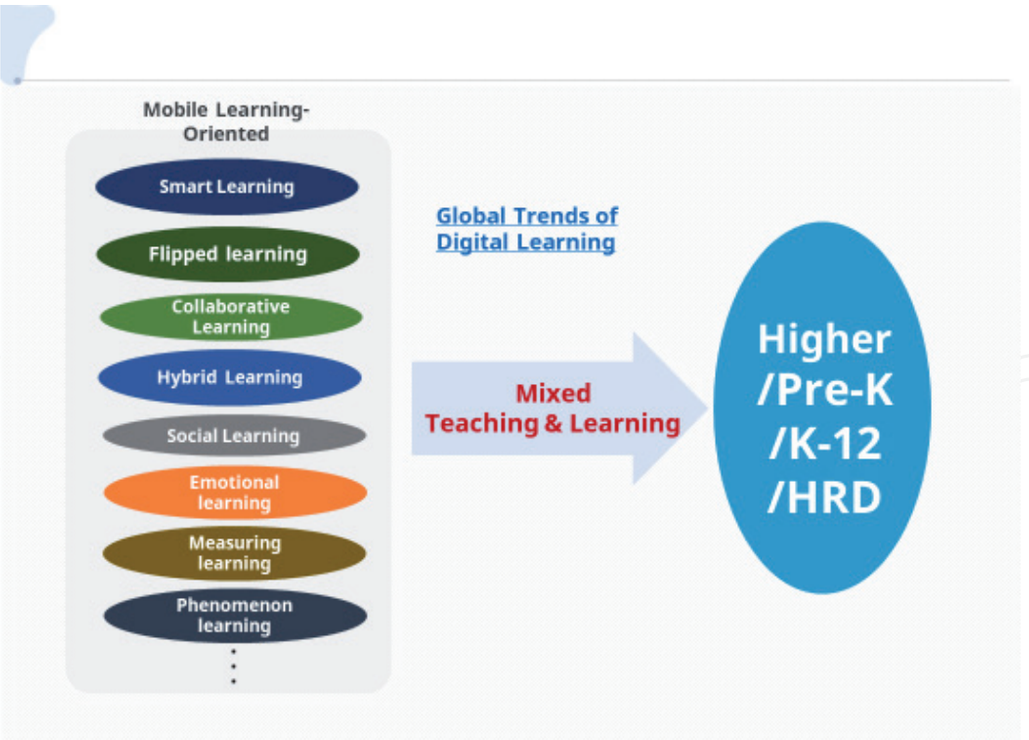

Figure 3.
Diversification of digital learning in fourth IR era.

technology will also set up an adaptive learning system by analyzing history and level to maximize learning efficacy.

These chain changes will develop intelligence learning platform to support activities for advanced learning according to individual interest and level and create a core personnel specializing in intelligent IT that is capable of leading new industries. These systems are expected to raise intelligence information talents who are good at computer science, data analytics, and SW development (foster talented children in intelligent information area).

Furthermore, these new trends will also have implications for universities. For example, industry-university-research collaboration intensive learning courses with top faculties will be opened and the quality gains of the students registered in these courses will naturally support best graduation schools in intelligence information technology area.

3. A teacher competency development program for the future

Development of direction of cloud-based intelligent personalized learning service will consider new assessments based on individual service, service beneficiary, visualized technology, AI platform technology and resource. For example, in the case of individual service, online activity, analytics, assessment/diagnosis, and so on will be implemented. These will bring new insights into the evaluation of student products and learning outcomes. Because data will be collected based on learner's use and learning activities, and analytics results are recommended for optimized personalized learning. However, older teachers will hesitate to use new learning methods or new ICT-based devices.

Above all, in order to cultivate future creative convergence talents, a teacher competency development program for the future is needed. Within this framework, we need to rethink innovative learning opportunities for teachers in educational organizations toward Education 4.0. To be able to create these

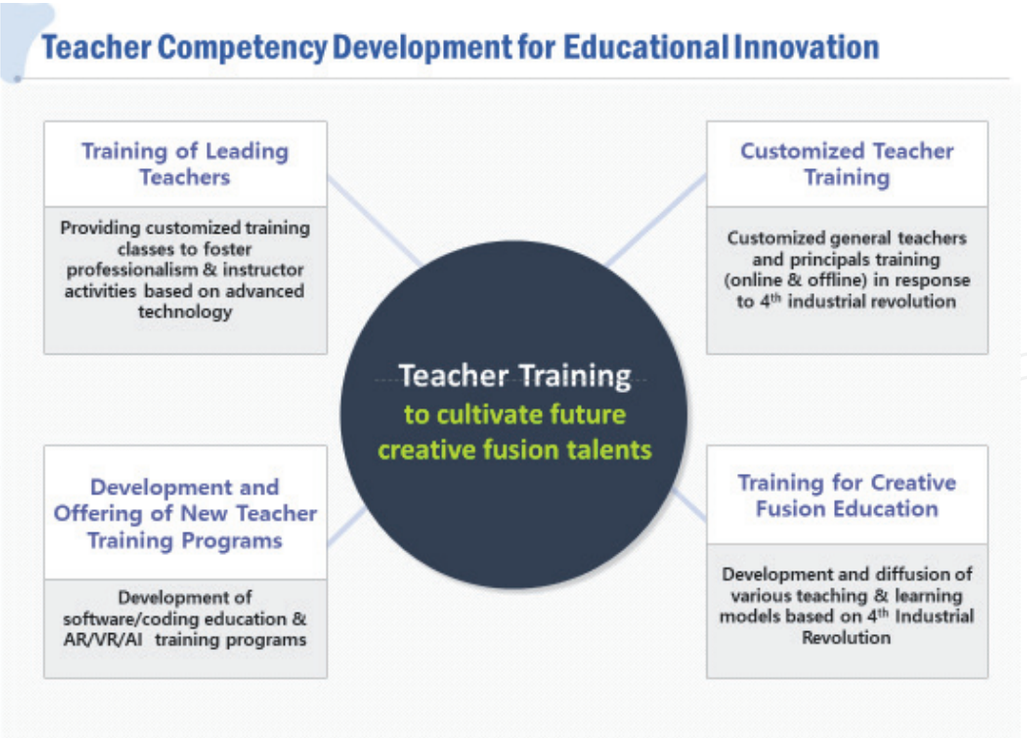

Figure 4.
Teacher competency development for educational innovation.

innovative learning environments for teachers, we should train teachers and expand infrastructure for the intelligent information society. Additionally, we should commit customized training of S/W education for teachers' continuous reinforcement of SW capacity. Doing so, we will also supply wireless internet network in all schools and develop high-tech future school model using AI, AR, and VR. The content and areas of teacher competency development are summarized in **Figure 4**.

As can be seen in **Figure 4**, this teacher competency development can be realized with "Training of Leading Teachers," "Customized Teacher Training," "Development and Offering of New Teacher Training Programs," and "Training for Creative Convergence Education."

4. Innovative teacher supervision models within the teacher competency development for educational innovation

The huge transformation in learning and teaching models, digital classroom, and educational contexts will bring a radical change in teacher behaviors. For the teachers to change, creation of reflective learning communities is required together with a redefinition of the meaning and scope of teacher supervision. Such a change would only be possible through development of new coaching skills, which would require development of reflective and cognitive skills of the teachers themselves and peer coaching environments to be able to survive and cope with their adaptation to Education 4.0 within the educational contexts. Serving teacher development and collaboration for better learning and teaching, this model will also change teacher behaviors and it will help reshaping. Within this framework, three supervision models namely, reflective, cognitive, and peer coaching to be able help teachers survive and cope with their adaptation to Education 4.0 will be discussed.

4.1 Reflective coaching (reflection: a great asset for a teacher competency development for the future)

The fourth industrial based on changes such as intellectualization of human and machine, virtualization of reality and virtual and hyper connection of human and things and its reflections on Education 4.0 are catering to the needs of the learners and teachers in "innovative era." These require changes in behaviors with certain features of connectivism, parallelism [4], and visualization. The learner's ability should be developed through this learning management for the sake of applying the new technology. According to Sinlarat [1], the learning management mentioned looks to be a new learning system, which will allow learners to grow with knowledge and skills to survive during their whole life and they will be equipped with the best of their abilities. From this perspective, Education 4.0 would be more than just an education. On the other hand, learning management is expected to cope with the changes in economic and social and environments to serve the human capital need. To be able to achieve this, a change would be needed in learning management, which requires reflection. Through reflection and reflective learning environments, teachers would have a great opportunity to self-evaluate their reflective teaching practices. Because, they can raise their professional development as long as they become more aware of their weaknesses as well as strengths in their actual teaching practices.

From this point of view, reflection could be regarded as a powerful tool to reflect and change and it could be conducted with some methods [5]. According to some scholarly works, it could be achieved through reflective practices, which would allow teachers to grow professionally [6]. Schön [7] named reflective practice as a critical process in refining a person's artistry and crafting a certain discipline. In other words, this process requires a person to see his or her experiences in practice while being observed and coached by other people. Smyth [8] maintains that there are four serial stages regarding questions, which lead a teacher to critical reflection:

1. Describing—What do I do?

2. Informing—What is the meaning of this?

3. Confronting—How did I come to be like this?

4. Constructing—In what other ways could I do it?

These types of reflective practices are utilized in both in-service and pre-service education and peer involvement and coaching are regarded as two essential parts of reflective practices observed mostly in pre-service education for teachers [9]. In this study, our focus will be on journals for individual reflective practices, collaborative learning, video or audio recordings of lessons, teacher educator's feedback, student feedback, action research, study groups for reflective practice of small groups, teacher portfolios, instructional rounds, classroom walk-throughs for school-based reflective practice, and cognitive coaching and peer coaching even though different approaches to each type of reflective practice are available.

4.1.1 Strategies to practice reflection

To have a brief understanding of the content and functions of reflective coaching, one needs to find out the reflective instruments and strategies employed

during the teacher evaluation. The preliminary stage before the reflective process is to collect data about what is actually happening in classes. There are some options to do that:

- **Reflective journals/diaries:** This could be regarded as the easiest way to initiate the reflective process because it is completely personal. Through the use of journals to create reflective learning environments, Göker [10] argues that teachers could provide other teachers with some opportunities to reflect on their actual practices. Within this framework, writing diaries is often used in various learning environments. In writing diaries, teachers would basically express his or her feelings, ideas, and reflections considering their own teaching practice. Doing so, teachers could keep notes in learning logs or personal narratives, dialog journals including various reflections providing them with a critical understanding of how they act in classes and assisting them in realizing other alternative strategies to develop their own practice.

- **Collaborative learning**: According to Brookfield [11], an ongoing communication with the peers created in mutually cooperative environment is essential. This type of collaborative work with peers is expected to contribute to development of reflective thought among teachers. Through efficient discussions, teachers could report their experiences and reframe, and check to broaden their vision about the practices. These would bring changes in teacher behaviors and the school culture could change naturally.

- **Video or audio recordings of lessons**: Recording of lessons could present quality data for the reflective practice. After watching these recordings of their own or other peer members, teachers could develop better awareness of their own teaching. Because, many things happen in classes and teachers may not be aware of what is actually happening and teachers may not normally see. Within this perspective, this type of recording could present a clearer picture about the whole process of teaching. Discussions to be made would trigger a teacher's reflective thought, reflecting on their strengths and weaknesses, thus helping them get some inspiration toward their development in their teaching.

- **Teacher educator's feedback:** This type of feedback would assist the teachers in reflecting upon their lessons, tasks, and activities in the school culture.

- **Student feedback**: Students in classes could also give more information about what is actually happening in classes. Teachers could ask their students to present information about what is going on in classes, because, students' perceptions and opinions could present a different and valuable perspective.

- **Action research**: Seeing it as a reflective process, a teacher could find out progressive responses and solutions to problems to understand his or her practice and develop the ways they address issues. This type of reflective process would help teachers to develop more awareness about what is actually happening in classes by means of defining the main problems and speculating on prospective causes and solutions. They would then attempt to initiate a proper action plan.

- **Study groups for reflective practice of small groups:** This type of formation of groups has been utilized since colonial times, the first of which was documented in America by Franklin [12]. The basic aim then was to search for better business practices. These groups were organized and utilized for teacher

development to serve the quality of teaching by means of professional reading, dialog in the 1980s [6, 13–15] (Little, 1981). To achieve their objectives, 5–10 teachers form a group to begin discussions on a defined topic or curriculum, methodology, and testing to be able to compare and review their own experiences and to seek answers to implement new things in their future teaching practices. The members highly value class observations and they come together after observation to discuss the issues targeted before. This approach is still followed during post-conference sessions of today's cognitive and peer coaching implementations.

- **Teacher portfolios:** They were first initiated and utilized professionally after the formation of a professional model for teachers by the NBPTS (The National Board for Professional Teaching Standards) seeking national certification [16]. To achieve teaching standards, experienced teachers [17] wishing to get the highest honor in teaching profession came together.

- **Instructional rounds:** These rounds have recently been initiated by City et al. [18]. They attempted to adapt and extend on health practices to be able to develop their knowledge and practices through observations, analysis, and discussions conducted with other physicians. School principals and supervisors employed a similar method to create a learning environment serving the progressive solutions to problems to improve instruction together with the teachers and develop their teaching practices. They carried out four different steps consisting of identifying a problem, observing, debriefing, and taking corrective steps [18]. Their aim was to form a reflective culture through the use of a common language among each other. Within this framework, a cultural reflective transformation was targeted to create a reflective learning environment, in which they would reshape teacher behaviors. They did it as a type of reflection-for action because they aimed to improve teaching practices within a system.

- **Classroom walk-throughs for school-based reflective practice:** Classroom walk-through, as a supervisory technique and a type of reflection on action, was first initiated in educational settings in the 1990s [19]. Supervisors visit classes to observe classes and evaluate practices of teaching and learning outcomes. Professional dialogs between supervisors and teachers consist of dialog, focus on what is actually happening in classes are highly valued [18]. Follow-up dialogs conducted in reflective in nature are expected to move teachers to achieve a certain level of reflection and collaboration to teaching practices.

4.2 Cognitive coaching

This type of coaching model was first initiated by Costa and Garmston [20] as a critical and "nonjudgmental mediation of thinking" based on constructivist learning theory. The ultimate goal is to foster a person's capacity to improve abilities of self-monitoring, self-directedness as well as those of self-modification. Planning conversation, observation, and reflecting conversation basically constitute a three-stage coaching cycle. The model described as a teacher supervision means in this study is mainly based on (a) the theories by Bandura [21] and Vygotsky [22], (b) application of the researcher's model of peer coaching [9] and model of reflective coaching [10, 23] implemented within different educational contexts, and (c) similar mentoring or coaching studies.

During the coaching process, a competent coach (mentor) is regarded as an essential figure with a capacity to: (1) create interactions with the participants giving priority to produce self-directed learning; (2) seek trust in maintaining coaching relationships; (3) evaluate and intercede the five states of mind; and finally (4) produce new approaches to foster the five states of mind to be able to create a learning environment, in which the trainees could mediate the capacity of their own and that of others to develop. Cognitive coaching, within this process, could also be described as a formative model to promote teacher self-evaluation to help them develop their self-efficacy, identity, and teaching skills. From this perspective, it is important to ease reflective process and possible responses coming from the mentee, the mentor in this study drafts questions. To be able to produce any cognitive development, a good mentor should use paralanguage, structuring as well as meditative questioning response behaviors [20]. The four strategies given above are always utilized during both the planning and reflective conversation sessions to help the mentees give the most suitable decisions about their teaching practices. A teacher could also be provided autonomy to a certain extent and this would ease their professional development conducted through cognitive coaching.

4.3 Peer coaching

Peer coaching is regarded as a part of reflective process and a fruitful tool to create collaborative efforts and it warrants consideration as a potentially serviceable solution for improving teacher effectiveness when implemented both in pre-service and in-service teaching settings. Peer coaching as almost the most basic supervision mode employed in classes is regarded as a clinical and reflective process, in which teacher teams or student teachers regularly observe themselves for the sake of refining teaching practice, encouraging reflective practice, providing assistance, suggestions, and support [9, 24, 25]. This process is considered as a tool for the more experienced teachers to use the skills they gained during their in-service teacher program. Research also advocates the use of peer coaching implementations to empower transfer of training to real teaching practice in classes, supercharging collegiality by means of peers' exchange of feedback together with reflective development of teachers [9, 25].

The most common way of peer coaching is conducted in the following way: A teacher invites his or her peer to monitor his/her class to collect data about what is really happening in class. This could be done through note taking, checklist, a narrative agreed, a simple observation task, and drawing conclusions. The teacher could ask his/her peer to put emphasis on, for example, what different patterns of interaction occur or which students contribute the most in the lesson. It is better for the observer not to be involved in evaluating the teacher's lesson for the sake of having a positive evaluation. Coaching benefits and expectations are negotiated between the peers during a pre-conference and post-conference.

Taking the recent developments and changes in Education 4.0, Göker [9] argues that these peer coaching environments could play a key role in creating the required reflective learning communities, in which teachers and teacher candidates would be trained as practitioners to lead to change. Göker [9] further maintains that one strategy for development of teachers mostly suitable for the creation of a reflective learning community is that of peer coaching, described as the process of two peers studying on planning instruction, developing support materials, and monitoring each other's work with students. Within this framework, peer coaching is regarded as nonjudgmental, based on classroom observation followed by feedback, and intended to develop teaching skills. Openness and trust are the two essential characteristics of peer coaching process and peers need to be sensitive to be non-evaluative

or nonjudgmental during the pre/post-conference sessions, in which they discuss, share their own experiences, teaching, and learning behaviors as well as teaching practices.

5. Conclusion

Any change in teacher behavior, which plays a key role in forming and shaping organizational culture in schools, is not an easy task. From the stand point of educational innovation for the intelligent information society, promoting reflective practices and developing professional learning communities through reflective, cognitive, and peer coaching implementations is essential to lead to a teacher change. The current innovative and leadership-based learning objectives introduced by Education 4.0 have made it obligatory for teachers to change. As Education 4.0 environments require future creative convergence talents, teachers should carry out new tasks to take greater ownership of growing creative convergence talents and to change processes of their school culture. This change process could be achieved through creating reflective learning communities together with a redefinition of the meaning and scope of teacher supervision. For the sake of achieving these changes in teacher behaviors, this study discussed a "Teacher Competency Development Model," in which, innovative learning opportunities for teachers in educational organizations were offered through innovative models in teacher supervision based on cognitive, reflective, and peer coaching and their utilization within the educational contexts. It is obvious that if teachers create a professional and reflective learning community aiming at behavioral change in reflective practices and promoting professional development, learning becomes self-directed and they definitely become empowered thorough learning management, which looks to be an essential task required by Education 4.0. Today, we have a digital society and life style has changed. Learning management needs to respond to the prospective changes of behaviors of both teachers and learners.

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