Education 4.0

Education 4.0 promotes visualizing how teachers' traditional digital competencies adopt innovative practices.

1. Introduction

Due to the accelerated developments in technology, especially in education, it has become necessary for teachers to adapt to change. Because of this, it has been crucial for them to transform their knowledge and skills to move from traditional teaching to innovative practices supported by technological resources [1][2]. Specifically, Education 4.0, with advanced connectivity supporting more outstanding virtualization processes [3], recognizes the role of teachers in educational processes and their contribution to the improvement of education. Education 4.0 is understood as that which promotes the application of physical and digital resources that provide innovative solutions to the current and future challenges of society [4]. Therefore, it promotes changing the vision of teachers' digital competencies from old skills to innovative practices. In the context of education 4.0 [5], a teacher's profile describes a specialized professional with digital competencies oriented to innovation, problem-solving, entrepreneurship, collaboration, connection, and understanding the needs of society. Acquiring these competencies requires stimulation through practical experiences [6].

Education 4.0, unlike traditional education, seeks to provide solutions to these challenges. Therefore, the integration of innovative pedagogies supported by emerging technologies [7] and best practices [4] provides these solutions. However, they require the acquisition and development of digital competencies and those that lead to reflection, problem-solving, informed decision-making, and practical experience, to develop innovative solutions. Therefore, evidence-based educational innovation (EBEI) is presented as an alternative that relies on practical experiences where digital competencies (DCs) in general and digital information competencies (DICs) in particular can be stimulated.

In this area, several applications of EBEI have been carried out. Studies such as [8] mention that EBEI responds to the need to offer relevant and updated teacher training to contribute with experiences in technological innovation. However, [9] adds that this can happen as long as teachers are committed and motivated to change. Likewise, [10] states that EBEI promotes training in digital competencies to manage technological resources that connect knowledge with teaching practice and produce innovation [11]. Thus, EBEI promotes learning conceived from practical experiences with technology; this aligns with [12] that these changes reconfigure the teacher–student relationship.

The EBEI linked to DIC tries to bring the teacher closer to a reflective performance model. [13] points out that a teacher who has developed DC is inquiring, creative, and reflective. Thus, it is expected that, in a virtual environment where information is constantly updated, a citizen (teacher, student, citizen, and general) can discern the appropriate information [14] and evaluate it [15]. Therefore, DIC promotes the ability to deal with information and leveraging it to build knowledge, learn, and respond to problems or needs in everyday practice [16]. DIC involves recognizing the need for information, locating it in open [17] or closed sites, analyzing it, managing it, storing it, and transforming it into knowledge [18][19][20]. Thus, DIC also promotes communication and the dissemination of information [21][22]. Its purpose is to achieve collaboration and exchange to facilitate the construction of knowledge [23]. Some are the theoretical CD frameworks that have been proposed and in which CDIs are highlighted among them is the DigComEdu [24], the Association of College and Research Libraries [18], DigComEdu Chek-In [25], the common framework of digital teaching competence of the National Institute of Educational Technologies and Teacher Training [26], DigCom [27], among others.

2. Evidence-Based Educational Innovation Model Linked to Digital Information Competence in the Framework of Education 4.0

What is the relationship between the perceived capacity of the teacher's digital competency and the fulfillment of the innovation actions based on EBEI? The following was found in this regard:

Teachers perceived themselves as having good digital competencies in information search, selection, and evaluation, which are necessary to carry out step I of EBEI. In step I, delimiting the object of innovation, teachers required these competencies to support their proposed changes in their teaching practices, evidenced in the task delivered. In addition, this competency helped them to have clarity about the necessary elements to achieve such change. First, they developed search techniques that helped them find and select the information of their interest with greater precision. Second, they critically evaluated the information found. Therefore, it is concluded that the teachers knew how to take advantage of the potential offered by the resources available on the internet to fulfill this step and support their teaching and research functions.

Additionally, the self-perceived information search, selection, and evaluation skills and the information storage skills favored the fulfillment of step II, search for evidence available in the bibliography or specialized sites. In this step, teachers demonstrated that their innovations proposed through the tasks were supported by evidence or bibliographic resources from open and private sources, in Spanish and English, which were considered under APA standards. In this way, their interest in the search and selection of OER as research resources was also evidenced. However, the results of their self-perception indicate that there should be more awareness about using OER for research and the OER characteristics and purposes, especially because the verification of the license of use is an aspect they do not consider relevant.

On the other hand, the self-perceptions of the competencies of information use helped fulfill step III, formulating the innovation. In this step, these competencies allowed the teacher to process the information of the previous step, contrast it with other authors, and synthesize the relevant information. They determine the value of the information according to the search purposes and then, based on this, make decisions, and proceed to create new knowledge through formulating the innovation. Therefore, it is concluded that the competencies of information use are strongly linked to step III of EBEI. This step, critical in fulfilling the other EBEI steps, should be taken attentively.

Additionally, the self-perceptions of evaluating and using information made it possible to determine compliance with steps IV and V of innovation, application, and evaluation. These competencies allowed the teacher to design or adapt the intervention phases to apply the innovation and assess it (i.e., through techniques and instruments). Based on these competencies, the teacher acquired inputs (evidence) that allowed him/her to determine the application and evaluate the innovation more precisely. However, for the fulfillment of these steps, research competencies are also required.

The self-perceptions of the communication and dissemination of information competencies are related to fulfilling step VI, publishing and disseminating the innovation. On the one hand, the competencies of communication of information allowed the teacher to choose the most appropriate technological means to communicate it. In contrast, the competency of publishing information allowed him/her to determine the space or place of dissemination (congresses or events). Thus, we conclude that teachers have the competencies to communicate by technological means (e.g., the EVA to share resources and innovations). However, it is also necessary to consider that to disseminate or publish the innovation effectively, the teacher must be motivated and not be affected by work overload. Consequently, we conclude that digital information competencies are closely related to fulfilling innovation actions based on EBEI, and we can say that the binomial digital competencies and innovations are correspondent.

Finally, we provided a validated evidence-based innovation model within the framework of Education 4.0, which has six steps to be executed sequentially and inclusively (i.e., without omitting any step). This model allows teachers to analyze and disseminate innovative evidence to guide their professional performance; therefore, it is closely linked to the DIC that guides informed decision-making. Thus, in tune with Education 4.0, this model promotes research practice to facilitate changes in teacher performance; it can be applied in the classroom by the teacher or in teacher training programs. In addition, the findings can provide information for training processes specifically to develop or improve digital and informational skills in teachers, researchers, administrators, and trainers seeking educational innovations. As a future line of research, we envision analyzing the perceived digital competencies of teachers versus their effective behavior.

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