



Analysis of the teaching practice that fosters creativity through an IEHR 1.5 inventory

Análisis de la práctica docente que fomenta la creatividad mediante inventario IEHR 1.5

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ABSTRACT

Teachers must develop not only disciplinary knowledge in students, but also critical thinking, communication, collaboration and creativity, since, in the current twenty-first century, all these competencies are necessary to manage in the knowledge society (UNESCO, 2019). In addition to making changes in the way we teach and learn, it is crucial to incorporate technology into teaching practice, which is fundamental in the deployment of new technologies in education (OECD, 2020). In order to analyze how the development of creativity in higher education students is fostered through teaching practice, the Inventory of Teaching Strategies, Technological Tools and Digital Resources (IEHR 1.5) was designed, through the triangulation of sources: 1) Literature review, 2) Operationalization of three dimensions of creativity proposed by Urban (1991) and 3) Information provided by the IAG. To this end, 130 teachers from 20 universities in Mexico, Argentina, Guatemala, Cuba and El Salvador, responded to the IEHR 1.5 inventory (made up of 25 teaching strategies, 25 technological tools and 16 digital resources), which allowed us to know the frequency with which teachers use certain teaching strategies, technological tools and digital resources during their teaching practice to promote creativity.

Keywords: Creativity, Inventory, Didactic Strategies, Technological Tools and Digital Resources.

RESUMEN

Los docentes han de desarrollar no sólo conocimiento disciplinar en los estudiantes, sino también: pensamiento crítico, comunicación, colaboración y creatividad, ya que, en el actual siglo XXI todas estas competencias son necesarias para manejarse en la sociedad del conocimiento (UNESCO, 2019). Además de realizar cambios en la forma de enseñar y aprender, es crucial incorporar la tecnología a la práctica docente, que es fundamental en el despliegue de las nuevas tecnologías en la educación (OCDE, 2020). Con el objetivo de analizar cómo a partir de la práctica docente se fomenta el desarrollo de la creatividad en los estudiantes de educación superior, se diseñó el Inventario de Estrategias didácticas, Herramientas tecnológicas y Recursos digitales (IEHR 1.5), mediante la triangulación de fuentes: 1) Revisión de la literatura, 2) Operacionalización de tres dimensiones de la creatividad propuestas por Urban (1991) y 3) Información proporcionada por la IAG. Para tal efecto, 130 docentes de 20 universidades de México, Argentina, Guatemala, Cuba y El Salvador, respondieron el inventario IEHR 1.5 (conformado por 25 estrategias didácticas, 25 herramientas tecnológicas y 16 recursos digitales), que permitió conocer la frecuencia con la que los docentes utilizan determinadas estrategias didácticas, herramientas tecnológicas y recursos digitales durante su práctica docente para fomentar la creatividad.

Palabras clave: Creatividad, Inventario, Estrategias Didácticas, Herramientas Tecnológicas y Recursos Digitales.

INTRODUCTION

According to Duarte (2003), the teacher should foster an environment that enables encounter and communication among people, use materials, and carry out activities that stimulate curiosity, creative capacity, and sufficient confidence, so that dialogue, free expression of ideas, moods, and interests are generated by all participants in the class without exception. Meanwhile, Zabalza (2009) considers that knowing and studying teacher training and reviewing the teacher's practice allow a close approach to classroom dynamics.

Regarding the use of technology in education, Jaramillo and Vásquez (2019) stated that various technological tools and artifacts have become necessary support in communicative, medical, industrial, labor, and educational processes. According to Molinero and Chávez (2019), teachers and students can learn more dynamically; their level of competitiveness will be higher to the extent that technologies are used more for projects, tasks, and class exercises. Thus, the importance of integrating technological tools lies mainly in enhancing the capacities of connectivity, adaptability, and immediacy present in the classroom during teaching practice (Rodríguez, 2020).

In addition to technology and disciplinary knowledge, the Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura (UNESCO) declared in 2019 that, in school, students should develop competencies such as communication, critical thinking, collaboration, problem solving, creativity and innovation, which are necessary to function in the knowledge society. For its part, the Organización para la Cooperación y el Desarrollo Económicos (OCDE) considers that teachers play a fundamental role in the effective deployment of the potential of new technologies in education (2020).

Based on the above, the general objective emerged: To analyze the teaching practice that fosters the development of creativity in higher education students through the Inventory of Didactic Strategies, Technological Tools, and Digital Resources (IEHR 1.5). The specific objectives are as follows:

To identify the frequency with which teachers use teaching strategies, technological tools, and digital resources in the classroom to foster the development of creativity in their higher education students.

To analyze how professors foster the development of creativity in their higher education students through their teaching practice.

To determine what other didactic strategies, technological tools, and digital resources, in addition to those listed in IEHR 1.5, teachers propose to use to foster the development of creativity in their higher education students.

Theoretical framework

In order to gather information about teaching practice, instruments such as questionnaires have been designed, which are answered individually, in groups, or in scheduled surveys. Among these instruments is the Teaching Behavior Inventory (ICD) designed by Fernando Arias Galicia in 1984, which, from the student perspective, seeks to determine how teachers organize or structure the subject, the methods used to explain or clarify concepts, the nonverbal behavior used to attract the student's attention and interest, the efficient use of class time, and the techniques used to foster student participation in class (Medrano, 2019).

On the other hand, the Educational Innovation Observatory of Tecnológico de Monterrey (2017) developed an Educational Trends Radar, in which it created a Glossary with 19 pedagogical trends and 26 technological trends, concluding that some teachers use technology in their classes only as support and that, although education is constantly changing, the practice is traditional in most cases.

Similarly, Zuluanga and Salina (2022), considering the function they fulfill and aiming to describe tools for collaborative project management oriented toward the development of creative thinking, created a catalog with 20 tools divided into 4 groups: 1) Communication, 2) Creative techniques, 3) Formulation and feedback, and 4) Prototyping and Simulation.

Although the data obtained from the aforementioned instruments provide relevant results for the educational field, it was considered necessary to design a new instrument: the inventory called IEHR, created with the purpose of understanding teaching practice focused on developing divergent thinking in higher education students. Its first version comprises 16 didactic strategies (ED), 40 technological tools (HT), and 10 digital resources (RD). To design IEHR, the proposals of Torrance (1974) and the Componential Model of creativity by Urban (1991) were taken into account; divergent thinking is understood as the ability to generate multiple ideas or solutions from a single starting point and is composed of the subdimensions: fluency, flexibility, elaboration, and originality.

When designing IEHR, the conceptualization of didactic strategies was also considered, understood as the procedures to promote learning, facilitating the acquisition and comprehension of the contents, proposed by Díaz (1998). Regarding technological tools, the concept proposed by Padilla and Conde-Carmona (2020) was used, who mention that they are the instruments responsible for knowledge management, promoting communication, facilitating the exchange of information, and enhancing learning opportunities. Meanwhile, digital resources are those materials that are characterized by requiring technology for their reproduction, used by teachers in the classroom to make explanations more attractive, help in the comprehension of the contents, facilitate communication, make the acquisition of knowledge easier, and reinforce learning with digital examples (Martín, 2021).

Although divergent thinking can be considered crucial in the creative process by allowing different approaches and options to be explored before reaching a solution, with the aim of further analyzing the construct of creativity, which is defined by Urban (1995) as the result of the joint action of cognitive and personality components, namely: general knowledge and base thinking, specific knowledge, divergent thinking, motivation, task commitment, openness and tolerance of ambiguity, to create version IEHR 1.5, 2 additional components from his Componential Model of creativity were used: 1) Motivation, defined as the engine that drives the individual to engage in creative tasks and that can differentiate creative people from non-creative ones; it is an essential component for achieving accomplishments. Motivation can be both intrinsic and extrinsic and affects the way knowledge and skills are acquired, and 2) Openness and tolerance of ambiguity implies the individual's willingness to consider multiple possibilities and perspectives, as well as to manage the uncertainty that may arise during the creative process. Openness to new experiences is fundamental to fostering creativity (Urban, 1995).

In short, with the aim of analyzing how the development of students' creativity in higher education is fostered through teaching practice, a pilot test of IEHR 1.5 was carried out, consisting of 25 teaching strategies, 25 technological tools, and 16 digital resources.

METHODS

To analyze teaching practice, it was considered pertinent to know which didactic strategies are implemented and to inquire about the technological tools and digital resources that teachers use in the classroom to foster the development of creativity in higher education students. Below, the characteristics of the participants, the instrument used, and the mode of application in the research are presented.

Participants

The selection of participants was carried out through a non-probabilistic convenience sampling, which is defined by Otzen and Manterola (2017) as a procedure that allows including subjects who agree to participate, considering their accessibility and proximity to the researcher. However, for the sample selection in the IEHR 1.5 pilot, some inclusion criteria were also considered, namely: being higher education teachers (bachelor's, engineering, and postgraduate), who work in face-to-face, virtual, or online mode; with full-time, part-time, or per-course contracts; and being teachers in Spanish-speaking countries.

Instrument

The IEHR 1.5 inventory version is composed of 25 didactic strategies, 25 technological tools, 16 digital resources. The response options are: In no class, In few classes, In some classes, In most classes, and In all classes.

The last item of this inventory is the question: In addition to those previously mentioned, what other strategies, technological tools, and digital resources do you use in your teaching practice with higher education students? This is intended so that the teachers who respond to the instrument may provide additional information to enrich the inventory list.

Application modality

The administrative support for IEHR 1.5 was computer-based, with a self-administered online application. The link directing teachers to the LimeSurvey platform was sent and shared via email, where they responded to the frequency with which they use ED, HT, and RD.

It should be noted that the invitation was sent to various public and private sector universities,

including: Universidad Veracruzana, Universidad Autónoma de Yucatán, Universidad Autónoma de Sinaloa, Universidad Autónoma de Coahuila, Universidad Autónoma de Occidente, Universidad de Sonora, Universidad de Guadalajara, Universidad de Chihuahua, Universidad Autónoma Metropolitana -Iztapalapa, Instituto Tecnológico de Nuevo León, Instituto Tecnológico de Ensenada, Instituto Tecnológico de Orizaba, Instituto Tecnológico Superior de Zongolica, Universidad Experimental de las Fuerzas Armadas, Universidad Nacional de Rafaela, Universidad de Pinar del Río, Universidad Pedagógica Nacional, Centro Escolar Caserio El Castaño Cantón Conacaste, Universidad Modular Abierta. Regional San Miguel, Universidad Mariano Gálvez de Guatemala.

RESULTS

After inviting teachers from Mexico, Argentina, Guatemala, Cuba, and El Salvador, the IEHR 1.5 inventory was answered by 130 teachers from 20 universities. Of the total, 60 were women (46.2%) and 70 men (53.81%), with more than a single representative in each of the various age groups, with 29.2% concentrated between the ages of 36 and 45 years. Regarding the educational level of the 130 teachers, 25.4% have a bachelor's degree-engineering, 40.8% have a master's degree, and 33.8% have a doctorate.

Regarding labor contracting, 38.5% is per subject, 24.6% per hour, and 36.9% are full-time teachers. The teachers reported having from a year to 46 years of experience; of them, the highest percentage recorded is 8.5% with 20 years of experience. Regarding the disciplines in which they teach, the following Table 1 shows the disciplinary areas in which the teachers who participated in the IEHR 1.5 pilot teach.

Table 1. Disciplinary area in which teachers teach.

Disciplinary area	Frequency	Percentage %
Physical-Mathematical and Earth Sciences	27	20.8
Chemical-Biological	10	7.7
Medicine and Health Sciences	6	4.6
Humanities and Behavioral Sciences	35	26.9
Social Sciences	31	23.8
Agricultural Sciences and Biotechnology	6	4.6
Engineering and Technology	41	31.5

Note: 26 teachers from the sample of 130 teach classes in more than a single discipline.

As shown in Table 1, the disciplinary area with the greatest participation was teachers who teach engineering and technology (31.5%), followed by Humanities and Behavioral Sciences (26.9%).

Regarding the teachers' responses about the frequency with which they use ED, HT, and RD in class, taking into account that the IEHR 1.5 inventory aims to be an instrument for understanding teaching practices that foster the development of creativity in higher education students, based on ED, HT, and RD, after analyzing the data from the sample of 130 teachers, with the SPSS and Julius software, considering the responses "In most classes" and "In all classes", the ED with the highest percentage of use are:

Critical thinking: 86.2%

Open questions: 78.4%

Collaborative work: 74.6%

On the other hand, the EDs with the lowest percentage of use by the sample of 130 teachers are:

Kölb cycle: 16.9%

Improvisation activities: 18.4%

Gamification: 20%

Figure 1 shows all the mean frequencies of use of the list of EDs from the IEHR 1.5 inventory, arranged in descending order.

Regarding HT, when adding the frequencies of the responses "In most classes" and "In all classes", the teachers indicated using more:

Word processors: 49.2%

Multimedia Presentation Tools: 43%

3HT (Collaborative learning platforms): 41.6%

In relation to HT, it was found that they have a lower percentage of use:

3D modeling applications: 6.9%

Programming and robotics environments: 8.5%

Mindfulness applications: 10%

Figure 2 presents all the mean frequencies of use of the list of HTs from the IEHR 1.5 inventory, arranged in descending order.

Regarding the RDs that the 130 teachers indicated using the most, according to the percentage, are:

Electronic books: 69.3%

Educational websites: 50.8%

Databases and digital libraries: 46.1%

On the other hand, the RDs with the lowest percentage of use are:

Memes: 6.1%

Digital comics or comic strips: 9.2%

Educational blogs: 12.3%

In descending order, all the mean frequencies of use of the list of RDs from the IEHR 1.5 inventory can be seen in Figure 3.

As can be observed in Figures 1, 2, and 3, the 130 teachers who responded to the IEHR 1.5 use, within the classroom, the various ED, HT, and RD listed in this inventory, to foster the development of creativity in their higher education students through their teaching practice.

Only in the teaching strategies of Creative Thinking and Collaborative Work was the response option "In no class" not selected by any teacher, which indicates that these two have been used at some point by all the teachers who responded.

According to the responses of the sample of 130 teachers participating in the piloting of IEHR 1.5 to develop creativity in their students, they mostly opt to implement activities that require students to generate multiple solutions, contrast them, refine prototypes, and solve real situations, mainly through the ED: Critical Thinking, Open Questions and Collaborative Work.

Regarding technology, the HT and RD: word processors, multimedia presentation tools, collaborative learning platforms, e-books, educational websites, databases and digital libraries, which were mostly selected by teachers; upon analyzing them, it is observed that all are related or complement each other; in addition, they help both teachers and students to be able to carry out collaborative work.

On the other hand, regarding the last item of this inventory--"In addition to the aforementioned, what other strategies, technological tools, and digital resources do you use in your teaching practice with higher education students?"--the teachers stated that, in addition to the ED of the IEHR 1.5 inventory, they use business plans and professional presentations, riddles, creation of models by students, exams, and competitions between teams. Regarding HT, they also reported using Generative Artificial Intelligence (IAG) through the apps Chat GPT and Copilot, while for RD they said they make use of audiobooks.

The most widely used ED, HT, and RD can not only support the transmission of content; their combination will also strengthen cognitive and social processes essential for creativity, namely, the generation of multiple ideas, rich exposure to visual stimuli, and constructive interaction.

CONCLUSIONS

The IEHR 1.5 inventory enabled the collection of data on ED, HT, and RD, which, when analyzed, helped identify the frequency with which professors promote the development of creativity in their higher education students through the use of teaching strategies, technological tools, and digital resources in the classroom.

The IEHR 1.5 inventory made it possible not only to understand what teachers do but also how, from their teaching practice, they help their students integrate technology into their lives through the HT and RD they use in the classroom.

Based on the last open question (what other strategies, technological tools, and digital resources do you use in your teaching practice with higher education students?), it was possible to learn how teachers contribute to continuous professional development and more effective classrooms by proposing additional ED, HT, and RD that could be used in the classroom to foster the development of creativity in their higher education students.

On the other hand, IEHR 1.5 is not a closed instrument, since its format allows it to be complemented and continuously evaluated. By taking into account the proposals made by the teachers

themselves in the open question, or by considering the other components of creativity (commitment to the task, general knowledge and base thinking, specific knowledge), IEHR 1.5 can be renewed.

Finally, using the IEHR 1.5 instrument in further educational research will allow deeper exploration of the ED, HT, and RD used by teachers to foster creativity, which in turn is useful for making proposals to improve and optimize the activities implemented by teachers, thereby significantly improving the quality of teaching.

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