AG EDITOR

Artificial Intelligence as a Pedagogical Resource in Initial Teacher Training

La inteligencia artificial como recurso de enseñanza en la formación inicial docente

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ABSTRACT

This study examines the integration of Artificial Intelligence (AI) in initial teacher education, focusing on its role in strengthening classroom curriculum management through teaching and assessment methodologies. A quantitative and descriptive design was applied using a Likert-type scale, with confirmatory factor analysis for validation and Cronbach's alpha for reliability, complemented by inferential analysis. Findings indicate that teaching how to teach with AI is shaped by classroom practices, influencing how AI-based processes are perceived and their alignment with competency achievement. Results suggest that pre-service teachers develop greater confidence in using AI for didactic design, although only a small percentage view AI's organization and presentation as fully coherent and useful for verification and continuous improvement.

Keywords: Teacher; Teaching. Assessment; Artificial Inteligencie.

RESUMEN

En los procesos de formación docente se busca potenciar las habilidades y los saberes para gestionar el currículo de aula, considerando las metodologías de enseñanza y de evaluación, la indagación se ha dirigido a describir la enseñanza con IA en la formación inicial docente, apoyándose en un estudio cuantitativo, a la vez descriptivo, utilizando una escala tipo Likert empleando un análisis factorial confirmatorio para su validación y alfa de Cronbach para la fiabilidad apoyados en el análisis inferencial, se resalta que el enseñar a enseñar con el uso de la IA en la formación inicial docente, está condicionada al trabajo que se realiza en el aula de clase, esto identifica como se perciben los procesos aplicando IA y su relación coherente con el logro de las competencias en la búsqueda de una mejora de la enseñanza, se puede inferir sobre la capacidad que tiene los docentes sobre el uso de la IA en el diseño didáctico de cada espacio de formación, y como esto fortalece la confianza de uso por los profesores en formación. Se ha identificado que los porcentajes no muy alto perciben la organización y presentación de la IA son coherentes y útiles como medio de verificación y de mejora constante.

Palabras clave: Docente; Enseñanza; Evaluación; Inteligencia Artificial.

INTRODUCTION

Teacher training processes seek to improve not only the management of knowledge in different areas of training, but also the integration of diverse experiences to make classrooms a process that transforms

perceptions about teaching, learning, and assessment. Thus, the practices carried out in the various training spaces seek to develop a practice aimed at reflecting on teacher-student communication in order to better organize the micro-curriculum.[1]

With the paradigm shifts in curriculum design and development, especially that of competencies, for [2,3,4] these changes have had an impact on curriculum design and development, the definition of objectives, the selection of content, and the methodologies that teachers and the evolution to be used, as elements of educational practice, modifying the interaction between teachers and students in the search for an organization of teaching and learning.

The teacher, as the organizer and executor of the curriculum, has the obligation to present and explain the work proposals, arguing them on the basis of the relationship between teaching, learning, and evaluation,[5,6] This step allows the classroom climate and organization to be established as a reference point for the development of learning.

In this regard, in the context of initial teacher training, the use of teaching and assessment methodologies should be considered throughout the entire training process and not as a specific class/subject that delves into the construction of knowledge and the use of information to improve educational practice. Teaching how to teach and assess requires involving students in the planning process to select learning methods and techniques and assessment techniques.

The concepts of teaching are based on didactics,[7,8] as it is an art that requires mastery of these concepts and the adaptations that classroom contexts require, for [9,10,11] the choice of strategies is fundamental as it has an impact on the success that the student can achieve, allowing interaction in experiential learning situations, strengthening knowledge and acquiring new knowledge, and developing various skills.

In the context of teacher training, changes are needed in teachers' practices, integrating profound and well-founded innovation.[12] For [11] innovation in teaching must involve a review, change, and transformation of practices themselves. It is essential that teachers increase their knowledge of all components of classroom teaching.

For [13] teachers must demonstrate mastery of curricular approaches and models, as well as knowledge of teaching and classroom curricular design for the comprehensive education of students.

Teaching strategies include those mentioned by [8,10,14,15] aimed at the acquisition of information, such as presentations, readings, research, guided work, which allow for the codification of information, mind maps, graphic organizers, information retrieval, case studies, projects, and problems.

Among the characteristics identified in learning strategies, they seek to promote effective learning, allowing for the systematic sequencing of content, avoiding improvisation at all costs, strengthening autonomy, cooperative work, and empowering students as managers of their own learning. Along with these strategies, assessment should be considered a process of improvement aimed at innovation.

Artificial intelligence as a learning resource

Many of the difficulties encountered when reviewing assessment as a process for improving teaching and learning are related to "students' beliefs about their intelligence and its effects on their learning ability," the relationship between educational objectives and the methodological elements used, lack of preparation in elements related to the selection of learning resources, the connection between planned objectives and assessment practices, the focus on the first categories of taxonomy, together with the effect that the use of technological tools has on students.[16]

The basis for the first barrier is present when memorization is given priority: "An excessive focus on memorization can lead to superficial understanding and an inability to apply knowledge in new situations". [17] This becomes the dominant element. It is a fact that this category of evolution should not be demonized or excluded from the processes of measuring learning. Therefore, any attempt to devalue or overvalue memorization as an initiating element of learning in humans, to privilege or limit memorization, constitutes one of the initial elements in practice in educational systems that are oriented under curricular standards.

It is a fact that tools are essentially neutral. "Their effectiveness depends on how they are used and whether they are adapted to the educational context".[11] In the development of learning planning processes, artificial intelligence tools are objects that enhance the teaching and learning processes that take place within educational centers, and these objects contribute to the identification of strengths and areas for improvement. "When tools are not chosen carefully, they may not respond to the current educational model, becoming a barrier.[18]

The barrier arises when tools that are unsuitable for the methodological and systemic contexts are proposed, coupled with the fact that they are used without the analysis and discussion specific to each methodological approach, and the tool fails because it does not respond to the current model.

"It is crucial that students understand AI for it to be effective".[19] is the most complex to overcome because it is related to ideas and beliefs carried over from contexts where the terms being compared are constructed

to be applied in totally different contexts in which comparisons, "The use of incomplete or non-contextualized AI can lead to distorted processes".[20]

There will be other barriers that can be overcome with less effort and sufficient will, such as teacher training for evaluative roles and instructional design. "Teacher training in instructional design and evaluative roles is essential to improving the quality of learning".[21] Another barrier worth mentioning is the understanding of circular standards, achievement indicators, operational objectives, the identification of student progress, and the direct relationship with the proposed methodology in the classroom. "It is essential that teachers understand curriculum standards, achievement indicators, and operational objectives to guide the teaching-learning process".[22]

AI as a resource

The creation of autonomy in educational processes is oriented toward finding the best models by applying the stages of the scientific method or research procedures,[23] understanding that each stage of these positivist models begins by identifying as a problem the standard to be achieved or the competency proposed in the curriculum design, and that bibliographic reviews are not only the subject matter proposed in the curriculum content but are also linked to the knowledge and skills already learned and the prospects for the following grades of school, focused on the use of the best tools and methodologies for testing the hypothesis or hypotheses that represent the evolution of learning in a pedagogical laboratory, since "The classroom can be seen as a pedagogical laboratory where tools and methodologies are used to test hypotheses about the evolution of learning".[24]

In classrooms, the presence of independent variables such as methodology, resources, methods, models, techniques, procedures, and content modifies the dependent variable. "In educational research, independent variables are those that the researcher manipulates or selects to observe their effect on the dependent variable, which in this case is learning".[25] This proposes the idea that all related processes are independent variables that must be reviewed to achieve the best objects to use in experimentation (class), since the main hypothesis (the standard or competency to be achieved) is all this to explain the educational phenomenon at the classroom level that is produced by the interaction between the teacher and the student, this whole process always being intentional on the part of the teacher, and because it is intentional, it is susceptible to review. "The teacher intentionally seeks to explain the educational phenomenon through interaction with students, and this process is subject to review and adjustment to achieve learning objectives".[26]

Design has to do with the proposed development plans written in the teaching plans. This is where intentional autonomy proposes models, methodologies, procedures, techniques, and resources appropriate to each identified particularity. However, autonomy is limited because in this positivist model, the conversion of all proposed teaching actions is mandatory. "However, this approach may limit the assessment of qualitative aspects of human development.",[24] into a number that represents measured learning. Thus, any human activity within the classroom must be accounted for in order to categorize the presence of any achievement according to taxonomies. From a research perspective, the design of the process is aware that human development is qualitative rather than quantitative, but educational processes must be represented and analyzed as collective data. Therefore, the design of the studies also includes the presence of assessment tools that demonstrate achievements in the teaching processes of the teacher, as well as those achieved in the learning processes of the student. "These tools may include rubrics, portfolios, classroom observations, surveys, and standardized tests".[25]

Objectives and assessment with AI

In the construction of documents that organize educational processes, there is a recurring question among those involved in this construction: what is the purpose of educating people? "Education should prepare individuals to participate actively in society, promote social justice, and contribute to the common good".[27] Thinking about the process of education implies the responsibility of organizing the lives of others, even those who are not yet born, and this has implications for human life because, like it or not, it involves comparing the lives of past generations with those of present generations and the opportunities of future generations. "Education must be inclusive, equitable, and of high quality, ensuring that all students have the opportunity to develop their full potential".[22] These comparisons create international conflicts that are projected onto social models and modified by them according to the interests of the historical moment.

The curriculum represents the aspirations of a nation and the proposals of that man, and sets out cross-cutting themes, philosophical dimensions, and theoretical-scientific dimensions. "The curriculum is conceived as an educational project that defines the intentions, content, and teaching methods, as well as the assessment criteria".[28] It promotes the construction or development of each and every human category. More specifically, it presents educational standards, achievement indicators, areas of knowledge, blocks, and components, where the evaluation of learning is a cycle of "test application, test review, results analysis, and reinforcement."

This test, aligned with the standards proposed in each curricular space, "is a continuous process that includes test administration, review of results, data analysis, and content reinforcement. This cycle allows for the identification of students' strengths and weaknesses and the adjustment of teaching strategies to improve their performance".[29] These are referred to as monthly standard tests, annual tests, or end-of-grade tests, each with a different purpose.

Standards, achievement indicators, and competencies constitute the benchmark or pattern that all teachers must work with in the training process, with the understanding that they are aware of the national aspirations proposed in the curricula and the aspirations of citizens. "Achievement indicators are specific criteria that allow for the evaluation of students' progress toward achieving standards." and any student who passes the standard assessments is moving toward the future that the nation has planned for them.[30] Conversely, those whose achievement indicators show that they cannot meet the standard are far from being the citizens that the training systems require. From this perspective, assessment already has a generic and standard purpose, and education fulfills its training function. "The assessment of learning is a continuous process that includes the application of tests, the review of results, the analysis of data, and the reinforcement of content".[31] Assessment designed in this way would have an approach that considers assessments to integrate the processes and final products into monthly, quarterly, and end-of-year tests, with a diagnostic and formative function, which in some way become mandatory generic goals to be achieved as evidence of learning, which would be an achievement for both the teacher and the student, the latter being a step towards the citizen they aspire to be. However, what about all those students for whom the standard is too low or too high? Should they be promoted to the next level of education proposed in the curriculum? How is progress that is not promoted by standardized generic evolution evaluated? Is automatic promotion correct? "This policy, according to the United Nations Educational, Scientific and Cultural Organization (UNESCO), is a more cost-effective policy".[32]

It is clear that diversity within classrooms causes students in the same grade or level to progress toward standards in different ways. "Teachers must consider the particularities that arise in the classroom, such as the diversity that exists in terms of cognition, since not all students have the same learning abilities".[33] This progress, which differs in each individual as a result of multiple variables surrounding the teaching and learning process, produces alterations in the products and the comparison with the standards proposed in the curriculum. The evaluation also assesses the contingencies in the processes and, as the skill domains were not shown, the extent to which the evaluations are reliable, how the evaluation and teaching were integrated, there is a deep understanding of the skills to be assessed, the criteria are clear, the instruction is adjusted, how adaptive the learning is, what the actual level of progress is, because it is evident that the standard has not been achieved. What is the value of progress if the proposed goal in direct relation to the standards was not achieved, because progress can also be superior to the objectives proposed and achieved in the initial stages, since student progress can be taken as unfinished products or tailor-made products, and this must also be evaluated because there is progress.

METHOD

The study was developed considering the positions of the quantitative approach, considered a descriptive design, which has allowed for the establishment of an organization based on the analysis and foundation of the theory. The following five variables have been considered: , AI literacy, pedagogical competencies with AI, attitudes and disposition towards AI, teacher professional development, and impact on pedagogical practice.

For the selection of the sample, the cluster was considered, formed by year of entry to the institution, to be selected at random. The inclusion criterion is to have two years of study at the university, and the exclusion criteria are to be first- and second-year university students.

To design a research instrument to collect the information, a 20-question instrument was developed, with four questions per variable.

For the scale validation process, a pilot study was conducted, and the data were tabulated in SPSS version 25 software. This allowed for the identification of nine initial factors and a Cronbach's alpha and KMO, adjusting the instrument. In the application, it was reduced to two factors. In the application of the scale in the pilot study and in the sample, an informed consent form was completed for participation in the research. The information collection period corresponds to the first quarter of 2025. Table 1 shows the total variance explained and identifies the factors obtained from the sample.

Table 1. Total explained variance						
Factor	**Initial eigenvalues**			**Sums of squared extractions**			**Sum of squared rotations**
	Total	**% of variance**	**Cumulative %**	**Total**	**% of variance**	**Cumulative**	**Total**
1	9,723	48,616	48,616	9,230	46,149	46,149	8,814
2	1,188	5,939	54,555	0,654	3,269	49,418	7,640

3	0,888	4,441	58,997
4	0,787	3,933	62,930
5	0,751	3,755	66,685
6	0,640	3,202	69,886
7	0,636	3,179	73,065
8	0,612	3,058	76,123
9	0,573	2,865	78,988
10	0,532	2,659	81,647
11	0,482	2,408	84,055
12	0,466	2,328	86,383
13	0,428	2,140	88,524
14	0,416	2,078	90,602
15	0,373	1,867	92,469
16	0,345	1,723	94,192
17	0,334	1,670	95,862
18	0,298	1,490	97,352
19	0,293	1,463	98,815
20	0,237	1,185	100,000
Extraction method: Maximum likelihood.			

Cronbach's alpha was used in the reliability study. Table 2 shows the values obtained, as well as the KMO values that allow factor analysis with values of 0,962, indicating that factor analysis can be performed.

Table 2. Bartlett's KMO test and reliability statistic				
Kaiser-Meyer-Olkin measure of sample adequacy.			**Cronbach's alpha**	**N of items**
Bartlett's sphericity test	Approximate chi-square	6179,413	0,938	20
	gl	190		
	Sig.	0,000		

The research involved the participation of 570 university students from the central campus located in Tegucigalpa, distributed across morning, afternoon, evening, and weekend sessions. A Likert-type questionnaire was used to collect the information. The questionnaire was administered in person. Prior to its administration, respondents were informed of the purpose of the research and their rights as participants, guaranteeing their identification, privacy, and anonymity, as well as their right to respond sincerely and honestly.

For ethical considerations, informed consent was obtained, taking into account the principles of autonomy, ensuring understanding and confidentiality, and freedom of participation. SPSS software, version 25, was used for data analysis, which allowed the characteristics of the variables to be identified. This was done to establish student participation and the teaching dynamics of assessment in teacher training.

RESULTS

When developing the curriculum, the selection of different teaching-learning strategies and the selection of different resources used by teachers are taken into consideration. In identifying conceptual knowledge about artificial intelligence, 33,9 % of respondents have knowledge about artificial intelligence, 30,5 % agree with its use, and a smaller percentage, 23,7 %, are indifferent to these concepts. With the above, the identification of educational applications or applications to their field of study, 34,4 % and 34,6 % indicate that they know and understand how they are applied in the teaching field, and 31,5 % are indifferent to knowing the applications and their use in their training. The risks and benefits of using AI must be considered. 43,2 % are clear that there are consequences to the use of AI in teacher training, along with 30,5 % who hold the same perception, while 23,4 % disagree or are indifferent to this aspect.

Regarding the integration of artificial intelligence into classroom teaching by teachers, table 3 shows values of 38,8 % and 30,2 %, with students strongly agreeing and agreeing, respectively, on the potential of artificial intelligence to improve teaching and learning processes, which can be managed in initial teacher training and replicated in the workplace.

Table 3. Artificial intelligence improves teaching and learning processes				
		Frequency	Percentage	Valid percentage
Valid	Strongly disagree	12	2,1	2,1
	Disagree	59	10,4	10,4
	Indifferent	106	18,6	18,6
	Agree	172	30,2	30,2
	Strongly agree	221	38,8	38,8
	Total	570	100,0	100,0

It can be inferred that teachers are capable of using AI in the instructional design of each training space, and that this strengthens the confidence of teachers in training in its use.

To this can be added how it favors the personalization of learning and its application in assessment: 37,9 % of those surveyed agree and 30,2 % agree with using it to generate assessment strategies and resources and relate them to the teaching strategies that can be applied according to competencies. Some 28,8 % are indifferent and 13,1 % disagree with its use in assessment.

Regarding professional development as teachers in training, questions were asked about previous training received, the need for training, and the level of self-efficacy with the training received. Table 4 shows that 29,1 % and 39,1 % agree or strongly agree with training on AI, in addition to requiring training on the specialized application of artificial intelligence together with simulators as a complement to academic training processes.

Table 4. Sufficient training to understand the use of artificial intelligence in education			
		Frequency	Percentage
Valid	Strongly disagree	16	2,8
	Disagree	47	8,2
	Indifferent	118	20,7
	Agree	223	39,1
	Strongly agree	166	29,1
	Total	570	100,0

The role of teachers in the classroom changes as different curricular reforms are implemented by countries, regions, or institutions. Figure 1 shows that the role of teachers changes with the use of AI. Thirty-eight percent agree with this change, while 33 % agree that the role of teachers is dynamic. while 17 % are indifferent to identifying the importance of teachers' functions as changes are made to the curriculum.
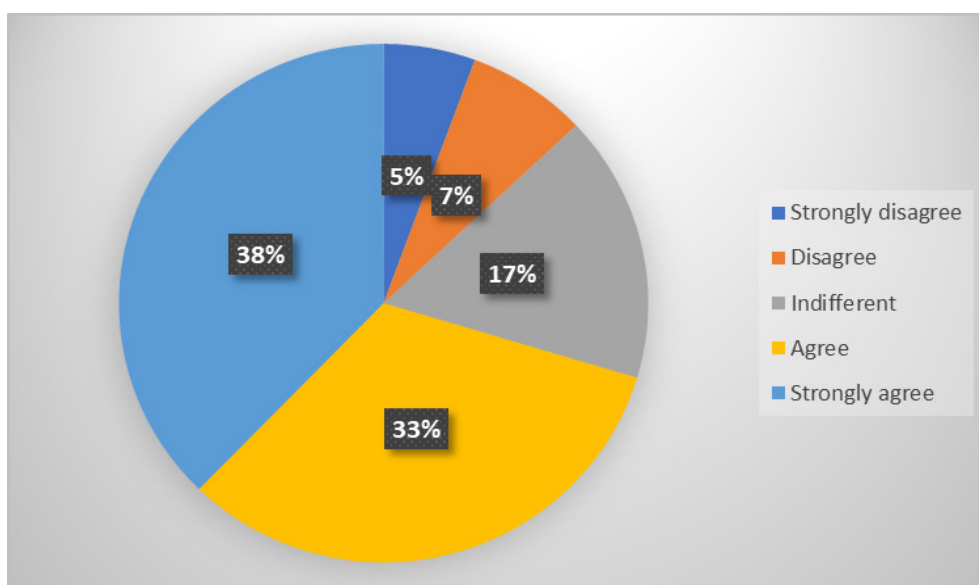

Figure 1. Transformation of the role of teachers with the use of AI

Considering that understanding the resources and products required to establish the scope of competencies

and learning strategies, 34,2 % indicate indifference to explaining the use of assessment strategies, and 21,6 % ( ) together with 30,7 % agree or totally agree with actions that seek to understand and explain each instrument used in assessment with the use of AI.

In addition, linking teaching-learning strategies with assessment and artificial intelligence, these maintain a relationship with the models in which the curriculum is designed and developed,[34] . The aim is to identify the relationship between assessment and the curriculum model. To this end, 66,7 % have identified this relationship, while a smaller percentage, 33,3 %, do not identify it in the pedagogical spaces studied. Table 5 organizes the summative and formative diagnostic assessment described in the descriptive letters, which can be integrated and reviewed as the study program progresses, taking into account the teacher's emphasis on the use of the results.

Table 5. Diagnostic, Formative, and Summative Assessment

Type of assessment	Identified use	Assessment emphasis
Diagnostic	64,4 %	
Formative	67,14 %	64,9 %
Summative	64,7	67,9 %

The emphasis on educational innovation and the use of AI focuses on proposing initial micro-curricula that address the individual characteristics of students in order to improve teaching and learning processes. It has been found that the emphasis of assessment is quantitative, at 67,7 %, which is associated with long-term memorization.

In specific areas of teacher training, including curriculum design, teaching, and assessment, it has been found that these areas demonstrate the development and application of assessment tools, allowing for association and application in similar contexts, thus enabling meta-evaluation to determine relevance, quality, and significance. This allows for the organization of cooperative work strategies that enhance student autonomy.

DISCUSSION

In the search for information on the integration of artificial intelligence with teaching and learning resources in teacher training that enhance student literacy, strengthen the achievement of competencies in different training spaces, and promote the use of AI, in professional development, and the impact that can be found in pedagogical practice, more than 50 % of those consulted have identified an impact of AI on the teaching role and teaching practice.

Through the application of the scale, it has been identified that there are different points of view regarding the use of AI, which are considered in the validity of the instruments and allow us to understand how students are understanding the use of artificial intelligence in initial teacher training,[35] use and management of different applications, their potential, and the benefits obtained both as a study tool and as a resource, in addition to being applied as future teachers.[36] Therefore, the integration of AI for teaching and learning should be considered, promoting reflection on its advantages and disadvantages.

In accordance with its use in the classroom, the use of AI allows for the enhancement of planning processes, the design of activities, and their improvement, to be integrated and validated in class simulations,[33] promoting the personalization of learning according to the characteristics of the students and the teaching approaches and models. Personalization is conditioned by the number of students in the classroom, along with the resources and additional time dedicated by the teacher to personalize teaching.

The use of available technological resources allows teachers in training to consider the use of AI in their teaching practice,[37] in order to improve their performance, enhancing creativity and seeking to reduce plagiarism through the use of AI. Although its use is emphasized in reviewing homework assignments, it is important to consider whether its use enhances creativity or is overused in order to reduce workload rather than enhance creativity.

The training received is not sufficient to be applied to its full potential; in-depth training is required to strengthen confidence in the use of AI. With regard to teaching with AI, it is identified that assessment,[46] should seek to improve the teaching-learning process, based on reflection on educational practice. Analysis of the results of AI use allows for integration from diagnostic, formative, and summative assessment.

Review and improvement based on the results allows for the validation and contextualization of the instruments developed, whether they be rubrics, objective tests, graphic organizers, among others, which allows for the improvement and contextualization of the proposal.[39] Generating examples that can be applied in teacher training also strengthens the approach to validity and ensures that what is expected is measured, learning to design and apply reliable, valid, and relevant assessment instruments.[20,40]

The complexity of using AI lies in integrating the work of the teacher into the proposals that can be obtained

from the different applications. The role of the teacher must be critical and reflective, teaching the use of AI as a resource to enhance teaching, planning, and the development of assessment proposals.

The limitations of the study are considered to be the nature of the university, which is exclusively dedicated to teacher training, which can be considered a weakness in the reproducibility of the study. It must be adapted to the areas in which it is intended to be used.

CONCLUSIONS

Teacher training seeks to create spaces for reflection among teacher trainers, and it is essential to have an integrative vision in the planning and development of the classroom curriculum. This allows for teachers who are capable of applying artificial intelligence with strategies that are consistent with the teaching-learning process, considering the student in the process of construction, reflection on their role as students and as future teachers, and demonstrating the use of the tool to enhance professional practice.

Proper planning ensures that students develop mechanisms for using technological resources to organize academic work sequences.

Teaching how to teach with the use of AI in initial teacher training is conditioned by the work done in the classroom. This identifies how the processes applying AI are perceived and their coherent relationship with the achievement of competencies. In the search for improved teaching, it has been identified that a relatively small percentage perceive the organization and presentation of AI as coherent and useful as a means of verification and constant improvement.

Finally, it is important to consider students' perceptions of learning about the use of AI. It should be noted that there is awareness of the importance of learning its application through teaching practices, promoting self-assessment, co-assessment, and methodological consistency in teaching and assessment, which allow for the explanation of various criteria in order to achieve the success of the strategy so that it can be replicated in the workplace.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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