

Strategies Based the STEAM Approach for the Empowerment of University Teachers

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Abstract

University higher education complies a vital role in society, since it prepares future professionals to face the challenges of today's world, that is why university education must ensure that students acquire solid skills in areas such as STEAM, for this it is necessary to have empowered teachers, from this perspective, the present research aimed to propose strategies based the STEAM approach to improve the empowerment of university teachers. The research approach was quantitative, working with a questionnaire as a data collection instrument, which was validated through Cronbach's alpha coefficient, and then applied to a sample of 50 university teachers from a Peruvian public university. Six strategies were proposed that combined the STEAM approach with the empowerment of university teachers, these responded to the dimensions: instructional leadership, autonomy and professional development.

Keywords

Teacher Empowerment, STEAM, instructional leadership, autonomy, professional development

1. Introduction

In 2015, the United Nations adopted the Sustainable Development Goals (SDGs) that must be achieved in the next 15 years, where SDG4 seeks to guarantee quality education, promoting education and learning opportunities [1].

Higher education represents a fundamental role for society, since it is the pillar of formation of future professionals, so university teaching is a component that must ensure that students acquire solid skills in disciplines such as: Science, Technology, Engineering, Art and Mathematics (STEAM).

The STEAM approach is interdisciplinary [2], offering a dynamic educational framework that fosters critical thinking, problem solving and creativity [3]. To apply this approach in university teaching, it is necessary to have empowered teachers, since they are the ones who, in the performance of their work, transmit the knowledge and skills.

Empowerment refers to the ability to make decisions and to be able to act critically and reflectively, thus, [4] specifies that in the teaching field, empowerment translates into self-efficacy, where each teacher executes their teaching processes to generate learning.

Under the panorama of higher education, the empowerment of university teachers is a pressing concern, because a trend towards low teaching performance is evident. Many teachers still work with traditional pedagogical approaches that lack innovation and that do not involve adaptation to change in students, this makes them not feel motivated or have autonomy, working without feeling empowered within the teaching-learning process; Other teachers have had difficulties incorporating technology into the development of their classes. On the other hand, teachers have not demonstrated sufficient mastery in the disciplines contemplated by STEAM, considering that this approach is relevant for didactic science education [5], probably the majority of teachers have not been trained under this interdisciplinary approach, however, [6] states that they must be self-motivated and work autonomously to acquire this knowledge.


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The low empowerment of university teachers has a negative impact on the quality of higher education, limiting the professional preparation of students, which is why addressing this problem becomes an educational and social necessity, from this perspective it is formulated: how do you improve the empowerment of university teachers?

The objective of this research was to propose strategies based the STEAM approach to improve the empowerment of university teachers.

2. State of the art

According to [7], technology and science are in permanent advance today, which allows us to understand the world and its constant changes, where STEAM education makes its way to improve scientific competitiveness, in the same way [8] point out that currently there is a growing global trend towards the development of STEAM education, where teachers play a very important role, likewise, [9] considers that teachers in these changing times must be trained with STEAM skills to respond to the challenges that society poses, as well as greater training in digital skills [10].

In the study of [11] a Lesson Study Model (LSM) was integrated into STEAM education for science teachers during the pandemic, focusing on: distance STEAM education, lesson study, lesson planning processes, lesson planning challenges, assessment methods, and strategies and techniques, finding that this model contributed to pedagogy. On the other hand, in the research of [12] analyzed the effectiveness of the STEAM model and integration with education, they found that educators and researchers need to have an understanding of the essence and connotations of STEAM.

Teacher empowerment, according to [13] is a process that seeks to strengthen the self-efficacy of teachers so that they trust in their ability to achieve their objectives and face challenges, likewise, it defines instructional leadership, autonomy and professional development as key components of teacher empowerment. Along the same lines, [14] states that teacher leadership is a model of improvement that addresses both the learning needs of students and teachers, and considers that professional growth is fundamental. On the other hand, [15] complements the study of empowerment, noting that new ways of modernizing professional development programs should focus on the acquisition of new teaching methods and techniques through practical opportunities that allow teachers to reflect on the knowledge acquired, It also [16] points out that it found that teachers had a low participation in decision-making and medium institutional support for their professional growth as empowerment practices, which is closely related to teacher promotion systems.

Regarding instructional leadership as an element of teacher empowerment, according to [13] it is understood as the ability of educational leaders to guide and support teachers in their improvement of teaching and learning, according to [17] it also highlights the lack of research in this area of empowerment and recommends the formulation and implementation of models of empowerment processes for managers. Even, [18] considers shared leadership, thus instructional leadership is combined with decision making, where educational leaders and teachers work together to improve teaching and learning.

Another important element of teacher empowerment is autonomy, as indicated [13] refers to the sense of control that teachers have in aspects such as planning their classes, student evaluation and decision-making in their classrooms, as he points out [19] who, through interviews, identified that by integrating teachers in the implementation of the curriculum, it allowed them to have more autonomy and make more informed decisions about their teaching. Although this does not always happen, for [20] teacher autonomy empowers the teacher in the classroom, the institution, the community and leads to educational effectiveness and professionalism, however, this autonomy is often not enough due to institutional limitations.

Being necessary to raise the quality of education in a changing society, for [21] the professional development of teachers will have an impact on the educational results of students, as pointed out [22] there are policies that provide opportunities for teachers to examine their own implicit biases and seek professional development that leads to empowerment and commitment to their teaching work.

Despite the existence of research related to teacher empowerment, as well as studies related to strategies with a STEAM approach, it is evident that the necessary research has not yet been carried out to link the STEAM approach as part of the empowerment of university teachers to improve their autonomy, promote their leadership, encourage innovation and provide them with better opportunities for professional development.

3. Methodology

The population was made up of 200 teachers from a Peruvian public university; a non-probabilistic convenience sampling was used, assuming a sample of 50 teachers, with whom the diagnosis of teacher empowerment was carried out. The focus of the research was quantitative, non-experimental and cross-sectional. A questionnaire was designed to carry out the diagnose teacher empowerment based on three dimensions: instructional leadership, autonomy and professional development, considering nine items for each dimension; the questionnaire was validated based on the reliability analysis through Cronbach's alpha coefficient of 0.810 with a pilot test of 15 respondents, with this result the internal consistency of the instrument was validated. The virtual form was designed using the Google Forms tool; the evaluation scale was based on Likert: strongly agree (5), agree (4), undecided (3), disagree (2), strongly disagree (1).

The questionnaire was applied in July 2023 and was anonymous. Subsequently, a descriptive analysis was carried out to diagnose the empowerment of university teachers, for which a three-level scale was used for each dimension: low (9 – 20), medium (21 – 33) and high (34 – 45). The questionnaire is available at this [link](#).

The strategy proposal is based on the structure: strategy objective, metrics to measure, implementation plan, resources and tools, risks and mitigations.

4. Results

4.1. Descriptive analysis

According to table 1, in the results of the **instructional leadership** dimension, 10% of the respondents show a low level of instructional leadership, while the remaining 90% show a medium level; according to these findings, teachers are having difficulty structuring effective lesson plans, which could result in less effective learning experiences for students.

Table 1
Descriptive analysis. Instructional leadership dimension.

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Low	5	10,0	10,0	10,0
	Medium	45	90,0	90,0	100,0
	Total	50	100,0	100,0	

For the **autonomy** dimension, as seen in table 2, 4% of teachers show a low level, while 96% are at a medium level. These findings show that there is a trend where teachers are experiencing difficulties in selecting and applying effective pedagogical methods; on the other hand, there is a problem regarding the ability of teachers to innovate in their pedagogical approaches and adjust their teaching to the needs of their students.

Table 2
Descriptive analysis. Autonomy dimension.

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Low	2	4,0	4,0	4,0
	Medium	48	96,0	96,0	100,0
	Total	50	100,0	100,0	

In the **professional development** dimension (table 3), it is observed that 8% of university teachers show a low level, 86% a medium level and 6% a high level. According to these results, it is inferred that the majority of teachers present challenges in generating research and academic contributions, still leaving a gap regarding a greater commitment to research. In addition, a lack of practice in university teachers was evident critical self-assessment of your performance.

Table 3
Descriptive analysis. Professional development dimension.

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Low	4	8,0	8,0	8,0
	Medium	43	86,0	86,0	94,0
	Total	3	6,0	6,0	100,0

The findings of the research revealed that the empowerment of university teachers is at a medium level, thus, the need arises to address the problem of university teacher empowerment.

4.2. Proposal of strategies based on STEAM

For the **instructional leadership** dimension, the design of interdisciplinary learning experiences, interdisciplinary meetings should be held so that teachers can share ideas and collaborate in the planning of STEAM projects, it will be necessary for teachers to receive training regarding the integration of STEAM in projects; finally, teams of teachers should be created to design and execute collaborative projects. For the development of digital STEAM resources, the STEAM digital resources available in the institution will be identified and evaluated, to later provide training in the integration of STEAM technology through a platform for access to digital resources.

Regarding the strategies for the **autonomy** dimension, it was proposed, design of customized STEAM projects, where training will be provided in the design of STEAM projects, for this a support process will be established for the planning and execution of projects, recognizing the diversity of projects within the institution. In customized STEAM professional development programs, a catalog of courses and professional development resources will be designed, facilitating the creation of personalized development plans for teachers, establishing a competency recognition system.

The strategies for the **professional development** dimension were: STEAM mentoring programs, here STEAM mentor teachers will be identified and trained so that they can provide accompaniment to other teachers, through a monitoring and evaluation system of mentoring programs. For the STEAM self-assessment and reflection strategy, workshops will be held and resources will be offered for teacher self-evaluation, with this a monitoring and support system will be established to implement self-evaluation, with the results obtained those teachers with outstanding improvements in STEAM teaching will be rewarded.

Figure 1 illustrates the implementation plan, resources and tools, identified risks, and mitigation. As part of the implementation plan, table 4 shows for each dimension, the objective to be achieved, the metrics that will be necessary to evaluate the improvement of teacher

Table 4
Definition of objective, metrics and examples of each dimension

Instructional leadership	Objective	Promote the instructional leadership of university professors, allowing them to design interdisciplinary learning experiences and develop STEAM digital resources, with the purpose of enriching the quality of teaching
	Metrics	<ol style="list-style-type: none"> 1. Evaluation of students' perception of the quality of learning experiences. 2. Average rating of STEAM digital resources created by teachers.
	Example of practical application	<ol style="list-style-type: none"> 1. Implementation of a joint informatic and graphic design project to develop a mobile application that combines programming and design principles. 2. Creation of an online platform for interactive simulations of programming courses.
Autonomy	Objective	Enhance the autonomy and empowerment of university teachers through the design of STEAM projects and personalized professional development programs, in order to adapt teaching to individual needs.
	Metrics	<ol style="list-style-type: none"> 1. Increase in the participation of teachers in educational innovation activities. 2. Evaluation results of the impact of implemented STEAM projects on student performance.
	Example of practical application	<ol style="list-style-type: none"> 1. Creation of a research project for computer engineering students tailored to their interests and skills. 2. Training program for teachers who wish to improve skills such as the integration of emerging technologies.
Professional development	Objective	Promote the professional development of university professors through mentoring programs and self-assessment processes to empower them and turn them into agents of change.
	Metrics	<ol style="list-style-type: none"> 1. Frequency of participation in STEAM self-assessment and reflection processes. 2. Evaluation of perceived improvement in teaching after participating in mentoring programs.
	Example of practical application	<ol style="list-style-type: none"> 1. Frequency of participation in STEAM self-assessment and reflection processes. 2. Evaluation of perceived improvement in teaching after participating in mentoring programs.

The study, being a proposal, does not present real limitations, however, for an implementation stage some risks could be manifested that should be mitigated in their impact, therefore, in each proposed strategy, as seen in figure 1, the possible potential risks that would affect it are indicated, as well as the way to mitigate them so that they do not affect negatively.

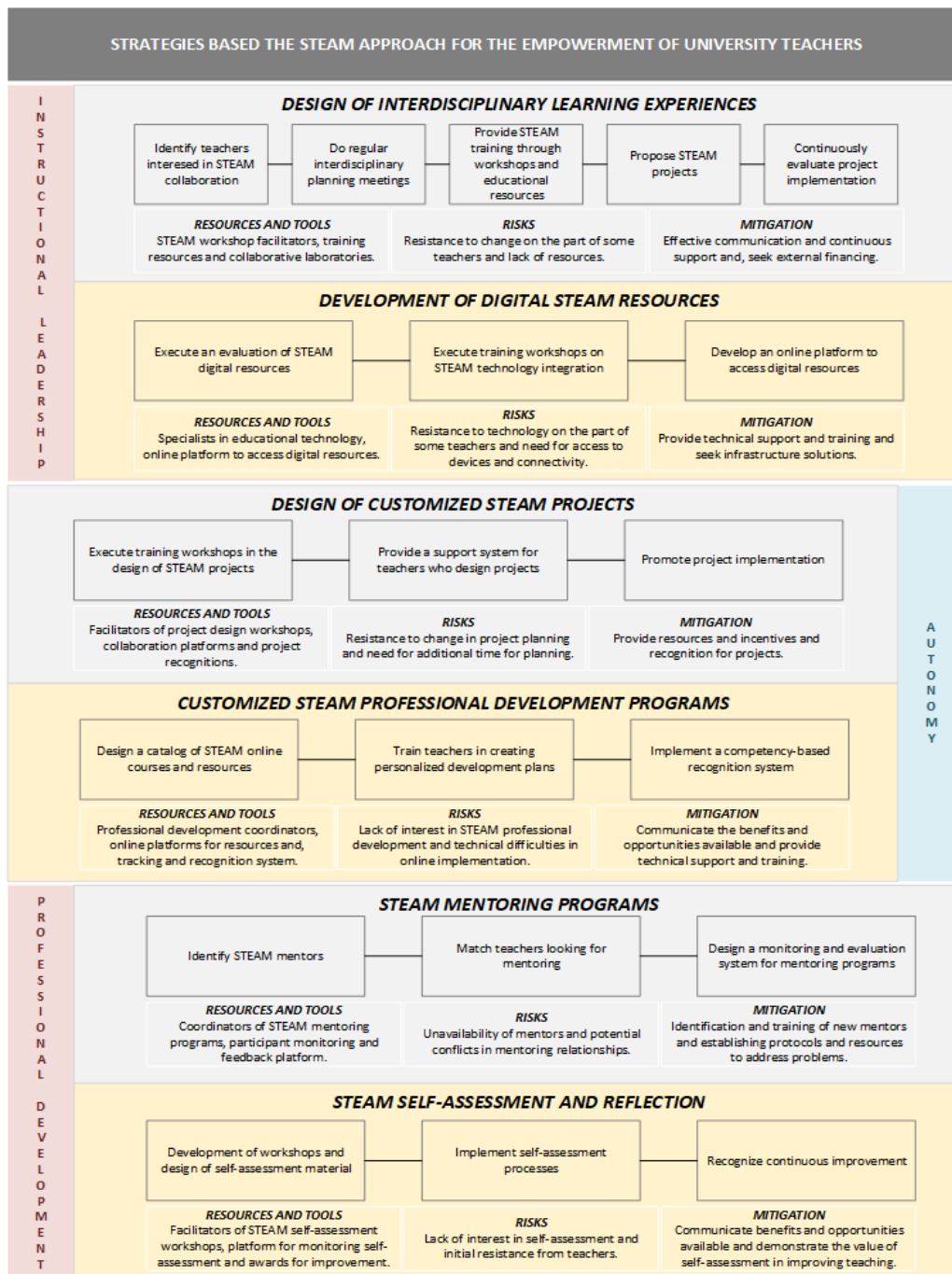


Figure 1: Summary of proposed strategies for each dimension

5. Discussion

In the discussion of results, strategies were proposed that responded to the dimensions of empowerment, thus based on what was stated in the research of [14], the teacher's leadership allows a more assertive response to the needs of students, also considering professional development important, in the same way, [13] mentions that autonomy is an important element for teacher empowerment.

The development strategy of *digital STEAM resources* agrees with what was stated by [10], who mentions that today teachers must be able to respond to challenges based on digital skills. The *personalized STEAM project design* strategy fits with the research of [12] since the effectiveness of the STEAM model integrated with education was analyzed and the proposed strategy aims for teachers to be trained based on this approach so that from there they can

propose research projects. [19] mentioned that the integration of teachers allowed teachers to improve their decision-making regarding their teaching, from this perspective, *the STEAM self-assessment and reflection strategy* seeks to ensure that the teacher can have complete power in their decision-making and work under self-assessment for continuous improvement.

6. Conclusions

Regarding the strategies proposed for the **instructional leadership** dimension, the design of interdisciplinary learning experiences seeks to foster interdisciplinary collaboration among teachers to design learning experiences enriched with STEAM elements; the development of digital STEAM resources aims to empower them, improving instructional leadership by enriching the learning experience.

Regarding the strategies proposed for the **autonomy** dimension, the design of personalized STEAM projects proposes to empower teachers to design projects under this approach aligned with their interests and experiences, promoting teacher autonomy and allowing them to choose topics of their interest; personalized STEAM professional development programs aim to empower teachers to personalize their professional development, acquiring skills and knowledge that strengthen their autonomy.

For the strategies of the **professional development** dimension, STEAM mentoring programs seek the empowerment teachers through mentoring, guiding them for their professional development and improving the quality of teaching; STEAM self-assessment and reflection will empower teachers so that they are able to self-evaluate and establish a reflection on their teaching practice in the STEAM context, promoting their ability to make informed decisions in teaching.

This study could be complemented with the implementation of STEAM strategies in a pilot university institution and evaluate their effectiveness, which would allow validating the proposals and making the necessary adjustments, which would serve as a basis for the creation of a standardized methodology to implement STEAM strategies not only in university environments, but that can be adapted to various organizational contexts.

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