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La educación audiovisual como estrategia pedagógica para la formación técnica automotriz

Audiovisual education as a pedagogical strategy for automotive technical training

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Palabras claves:
educación audiovisual, estrategia pedagógica, formación técnica automotriz, habilidades técnicas, impacto educativo.

Resumen

Introducción: En el presente estudio, se investigó la efectividad de la educación audiovisual utilizada como una estrategia pedagógica en la formación de profesionales en el área técnica de mecánica automotriz. **Objetivos:** evaluar su impacto en el aprendizaje, adquisición de habilidades técnicas y motivación de los estudiantes, además de identificar las ventajas y desafíos comparativos con enfoques tradicionales. **Metodología:** esta investigación se fundamenta a través del diseño de un grupo experimental, utilizando recursos educativos audiovisuales y un grupo de control con enfoque tradicional; el grupo de estudiantes participaron en pruebas de aprendizaje y evaluaciones de habilidades técnicas, además de completar cuestionarios de satisfacción. **Resultados:** los resultados demostraron que la educación audiovisual generó un mayor compromiso con el contenido, una retención mejorada del conocimiento y un aumento en la motivación de los estudiantes en comparación con los métodos habituales de enseñanza. **Conclusiones:** Se demostró que los estudiantes expuestos a los recursos visuales y auditivos mostraron un rendimiento significativamente superior en las pruebas de aprendizaje y en la adquisición de habilidades técnicas; sin embargo, este estudio revelo la necesidad de implementar recursos tecnológicos y capacitación a los docentes para la aplicación efectiva de métodos que mejoren los procesos de enseñanza aprendizaje, en consecuencia, este estudio concluye que la educación audiovisual es una herramienta valiosa en la formación técnica automotriz, ya que no solo mejora el proceso de aprendizaje y la apropiación de habilidades; sino, que también aumenta la estimulación de los estudiantes, convirtiéndose en un desafío asociado para su implementación efectiva en los programas educativos. **Área de estudio general:** Educación. **Área de estudio específica:** Educación técnica automotriz.

Keywords:
audiovisual education, pedagogical strategy, automotive technical

Abstract

Introduction: In the present study, the effectiveness of audiovisual education used as a pedagogical strategy in the training of professionals in the technical area of automotive mechanics was investigated. Objectives: To evaluate its impact on learning, acquisition of technical skills and student motivation, as well as to identify comparative advantages and challenges with traditional

training, technical skills, educational impact.

approaches. Methodology: This research is based on the design of an experimental group, using audiovisual educational resources and a control group with a traditional approach; the group of students participated in learning tests and evaluations of technical skills, in addition to completing satisfaction questionnaires. Results: The results demonstrated that audiovisual education generated greater engagement with content, improved knowledge retention, and an increase in student motivation compared to usual teaching methods. Conclusions: It was shown that students exposed to visual and auditory resources showed a significantly higher performance in learning tests and in the acquisition of technical skills; However, this study revealed the need to implement technological resources and teacher training for the effective application of methods that improve teaching-learning processes. Consequently, this study concludes that audiovisual education is a valuable tool in automotive technical training, as it not only improves the learning process and the appropriation of skills; rather, it also increases the stimulation of students, becoming an associated challenge for its effective implementation in educational programs. General Area of Study: Education. Specific Area of Study: Automotive Technical Education.

Introduction

The automotive industry, as a driving force of economic and technological development in various societies, is currently facing constant evolution and a growing demand for highly trained professionals in various areas (Bieger & Laesser, 2002; Khalil & Daim, 2019). Technical training in the automotive field is of irreplaceable importance to guarantee the efficiency, safety and sustainability of vehicles and their associated operating systems (Gwynne, 2002; Kawaguchi & Sonobe, 2016).

In this dynamic context, audiovisual education emerges as a potentially enriching pedagogical strategy to improve the quality of technical training in automotive development (Ivarsson, 2016; Song, 2017). With the appearance of COVID-19 in China Wuhan, in some places around the world social activities were interrupted, including teaching-learning processes, which through this pandemic have experienced a considerable transformation, adopting technological advances that have made it possible to facilitate the creation of more interactive, visual and accessible educational materials

(Bao, 2020; Rose, 2021). However, the scope and impact of this strategy in automotive technical training still remain insufficiently explored and documented.

The central question is clearly posed: To what extent does the implementation of audiovisual education as a pedagogical strategy influence the technical training of professionals in the automotive sector? This research problem becomes relevant both in educational terms and in the automotive industry, where technical training requires innovative pedagogical tools that align with the changing and highly specialized nature of the field (Lu, 2015; Mourad & Hassanien, 2018).

To answer this question, a rigorous and exhaustive analysis is undertaken, proposing to evaluate the impact of audiovisual education on learning, the acquisition of technical skills and the motivation of students in the automotive field. In addition, it seeks to identify the advantages that this strategy offers in comparison with traditional pedagogical methods, as well as to address the possible challenges that may arise in its implementation.

Ultimately, the context of this research aims to shed light on the potential of audiovisual education as a pedagogical tool in automotive technical training, offering educators, students and professionals in the sector a clearer and more informed vision of how this strategy can influence the preparation of highly qualified and competitive professionals in the automotive field that is currently undergoing constant change.

Audiovisual education

Audiovisual education is a pedagogical approach that combines visual and auditory elements to facilitate the teaching and learning process. This strategy involves the use of resources such as videos, animations, graphics, multimedia presentations and other audiovisual media to convey information in an effective and engaging way (Hoban, 2016). In this context, audiovisual education is presented as a key tool to create more immersive and dynamic educational experiences (Zhu & Chen, 2020).

Visual elements, such as images and videos, have the ability to convey information quickly and comprehensibly, helping students visualize abstract and complex concepts (Mayer, 2014). On the other hand, auditory elements, such as narrations or sound effects, can improve information retention by stimulating multiple senses and offering a richer experience (Clark & Mayer, 2016).

Audiovisual education aligns with dual-processing theories, which suggest that people process information through visual and auditory channels separately and then integrate those channels for deeper understanding (Mayer, 2014). It is also based on the principle of multimedia cognition, which posits that learning is enhanced when information is presented both visually and verbally (Sweller et al., 1998).

In the educational field, audiovisual education has been shown to promote more meaningful learning and improved retention of content (Mayer, 2014; Zhang et al., 2006). In addition, its ability to foster student motivation and engagement by creating a more interactive and engaging learning environment has been highlighted (Chang & Chen, 2011).

However, it is important to note that proper design and implementation of audiovisual resources is crucial to their effectiveness. Following instructional design principles, such as consistency between verbal and visual content, elimination of irrelevant elements, and management of cognitive load, is essential to ensure optimal learning (Clark & Mayer, 2016).

Therefore, audiovisual education is presented as a pedagogical strategy that takes advantage of visual and auditory elements to improve teaching and learning. This approach is based on cognitive theories that emphasize the importance of multimodal presentation of information for deep understanding. The effective implementation of this strategy can improve content retention, student motivation, and the overall quality of the educational process.

Pedagogical strategy

A pedagogical strategy is a planned and structured approach that educators employ to guide and optimize the teaching and learning process. These strategies go beyond the simple transmission of information and focus on how content is presented, related, and processed so that students can understand, retain, and apply it effectively (Biggs & Tang, 2011).

Pedagogical strategies are fundamental in education, as they can be adapted to different learning styles, cultural contexts, and cognitive development levels of students (Ormrod, 2020). These strategies vary depending on the learning objectives, specific content, and characteristics of the student group.

In the context of audiovisual education, pedagogical strategies become even more relevant, the use of visual and auditory resources requires careful planning to ensure that visual and verbal elements complement and reinforce each other (Mayer, 2014). For example, an effective pedagogical strategy could involve creating educational videos that combine clear and concise narrations with relevant images to facilitate understanding.

Selecting an appropriate pedagogical strategy is also based on an analysis of the learning objectives. For example, if the goal is to develop practical skills in automotive technical training, a strategy might include video demonstrations of specific procedures and techniques; on the other hand, if the goal is the understanding of theoretical concepts,

multimedia presentations could provide an effective visualization of complex diagrams and graphs.

Pedagogical strategies should also consider the diversity of students and their individual needs – some students may benefit more from visual approaches, while others may prefer a more detailed verbal explanation (Biggs & Tang, 2011); therefore, it is important for educators to be flexible and adapt their strategies according to the context and profile of the students.

Automotive technical training

Automotive technical training is an educational process that focuses on providing students with the practical skills and theoretical knowledge necessary to operate, maintain and repair motor vehicles. This training is based on the combination of theoretical concepts and practical applications in a highly specialized and constantly evolving field.

In this context, the theory of automotive technical training is based on a deep understanding of mechanics, electronics and technology related to vehicles and their systems. Educators in this discipline seek to transmit not only technical knowledge, but also to foster critical thinking and problem solving, essential skills to face the changing challenges of the industry.

Automotive technical training theory also incorporates concepts of practical learning and direct experience in workshops and laboratories, this "learning by doing" approach allows students to apply theoretical concepts in real-world situations, strengthening their understanding and skills.

The highly specialized nature of automotive technical training requires a specific pedagogical approach that combines theory with practice. Educators must adapt their methods to address both technical aspects and emerging challenges in the automotive industry, through the incorporation of advanced technologies and alternative propulsion systems.

In this research, automotive technical education theory provides the conceptual framework for understanding how audiovisual education can be effectively integrated into this field. The need to convey accurate technical information and the skills necessary to meet the technological challenges of the automotive sector is aligned with the ability of audiovisual education to present complex concepts in an accessible and motivating way. This offers an opportunity to enhance students' theoretical learning and practical skills in this evolving field.

Technical skills

Technical skills in the field of automotive training refer to the practical skills and specific knowledge necessary to carry out tasks related to the repair, maintenance and operation of motor vehicles. These skills cover a wide range of areas, ranging from mechanics, electronics, diagnosis and complex troubleshooting in automotive systems (Bourne & Holmes, 2019).

Technical skills are essential to ensure the efficient and safe operation of vehicles, as well as to address the technological challenges facing the ever-evolving automotive industry (Liu et al., 2019). Professionals in this field must be equipped with specific skills that enable them to perform tasks such as identifying and resolving faults in engines, brake systems, propulsion systems, and other automotive components (Harris et al., 2017).

The educational impact of technical skills in automotive training is profound and direct; students who acquire these skills not only become valuable assets to the industry, but also gain a solid foundation for a career in a field in constant demand. Furthermore, training in technical skills promotes the development of transferable competencies such as problem-solving, attention to detail, and teamwork (Harris et al., 2017).

In the context of audiovisual education as a pedagogical strategy, technical skills can be significantly enhanced and reinforced; visual and auditory resources can provide a clearer and more detailed representation of automotive processes and components, making it easier to understand and retain complex technical information (Hoban, 2016). Visualizing procedures, diagrams, and video demonstrations can help students better understand how skills are applied in practical situations.

These technical skills in automotive vocational training are essential to equipping students with the necessary skills for success in the automotive industry. The educational impact is reflected in the preparation of highly qualified professionals and the promotion of essential transferable skills, thus contributing to the comprehensive training of automotive professionals.

Methodology

The analysis of audiovisual education as a pedagogical strategy in automotive technical training will adopt a mixed approach that combines quantitative and qualitative elements to achieve a comprehensive understanding of the impact of audiovisual education on automotive technical training.

The investigative procedure involves the following well-defined phases:

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Phase 1: Population selection; Phase 2: Design of audiovisual resources; Phase 3: Implementation; Phase 4: Data collection (questionnaires and interviews); Phase 5: Data analysis

Population selection

The population included students of the automotive technical training of the ISTVN of the city of Quito, a sample was not extracted because the population is small, in table 1 the number of fourth level students who were selected is indicated; the general enrollment shows an existence of 55 students in fourth level, for the selection the students' knowledge in the automotive area influenced; in this context the method of conglomerates is used.

Table 1

Enrollment statistics for the period April 2023 – September 2023

DAY	CAREER	FIRST	SECOND	THIRD	ROOM	FIFTH	SIXTH
IN PERSON-MORNING	ISU TEACHING AND EDUCATIONAL INNOVATION		33				
IN PERSON-MORNING	ISU AUTOMATION AND INSTRUMENTATION						
IN PERSON-MORNING	ISU AUTOMOTIVE ELECTROMECHANICAL	33					
IN PERSON-MORNING	ADMINISTRATION		27		18		
IN PERSON-MORNING	BASIC EDUCATION	48	53	37			
IN PERSON-MORNING	NURSING	112	187	129	180		
IN PERSON-MORNING	SOFTWARE DEVELOPMENT		57		20		
IN PERSON-MORNING	AUTOMOTIVE MECHANICS		102		55		
IN PERSON-MORNING	INDUSTRIAL MECHANICS		38		9		
IN PERSON-MORNING	ELECTROMECHANICAL		57		29		
HYBRID-MORNING	ACCOUNTING		17		11		
HYBRID-MORNING	HOTEL INDUSTRY						
HYBRID-MORNING	TOURISM		9				

Note: The table shows the number of selected students. Student enrollment statistics for the ISTVN period 23-23

Design and implementation of audiovisual education

The first stage of the analysis consisted of the design and implementation of audiovisual educational resources focused on the subject of Internal Combustion Engines, through instructional videos on the operation of the Otto cycle engine, multimedia presentation of the systems involving the combustion engine and interactive simulations that describe the function and characteristics of the engine parts. These activities were aligned with the

curricular contents of the Higher Technology in Automotive Mechanics degree. These resources were implemented in the development of classes and in simulated learning environments.

Data collection

For data collection, a structured questionnaire was designed to assess students' technical knowledge on the effectiveness of audiovisual education in automotive technical training. This questionnaire included Likert scales and multiple choice questions to measure aspects such as: understanding of the content, information retention and student motivation; After evaluating the students academically, a satisfaction questionnaire with 11 questions was developed for the 55 fourth level students that allowed validating the implementation of audiovisual resources in automotive technical training:

Questionnaire

1. Do you think that the audiovisual resources used in your automotive technical training have improved your understanding of concepts and procedures?
2. Have you noticed an improvement in your ability to retain information and apply technical skills after using audiovisual resources?
3. How would you rate the quality of the audiovisual resources in terms of clarity and usefulness?
4. Do you feel that audiovisual resources have increased your motivation to learn about automotive technical topics?
5. Have you experienced technical difficulties or accessibility issues when using the audiovisual resources?
6. Have you observed increased participation and collaboration among your peers when using audiovisual resources in the learning process?
7. How do you compare the effectiveness of audiovisual education with traditional teaching methods you have previously experienced?
8. Do you think that audiovisual resources are suitable to address the specific needs of automotive technical training?
9. Have you noticed an improvement in your practical technical skills after using audiovisual resources in the classroom?
10. Do you feel that audiovisual resources have contributed to a deeper understanding of automotive technical concepts?
11. On a scale of 1 to 10, how would you rate the overall effectiveness of audiovisual education in your automotive technical training, where 1 is very ineffective and 10 is highly effective?

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To validate the implementation of audiovisual education as a pedagogical strategy for automotive technical training, five questions have been selected to determine the effectiveness of this implementation.

Table 2

Survey tabulation

N	Ask	Yeah		No		Total	Frequency
		Amount	Frequency	Amount	Frequency		
1	Do you think that the audiovisual resources used in your automotive technical training have improved your understanding of concepts and procedures?	51	92.73%	4	7.27%	55	100 %
2	Do you feel that audiovisual resources have increased your motivation to learn about automotive technical topics?	38	69.09%	17	30.91%	55	100 %
3	Have you observed increased participation and collaboration among your peers when using audiovisual resources in the learning process?	43	78.18%	12	21.82%	55	100 %
4	Do you think that audiovisual resources are suitable to address the specific needs of automotive technical training?	42	76.36%	13	23.64%	55	100 %
5	Do you feel that audiovisual resources have contributed to a deeper understanding of automotive technical concepts?	49	89.09%	6	10.91%	55	100 %

Interpretation of results

Question 1. Procedural understanding

The majority of students (92.73%) perceive that audiovisual resources have had a positive impact on improving their understanding of concepts and procedures in automotive technical training; this result suggests that these resources are effective in facilitating the understanding of the topics.

Question 2. Motivation for understanding

(69.09%) of the 55 students feel motivated by audiovisual resources, it is important to note that around a third of the respondents do not experience an increase in their motivation.

Question 3. Audiovisual resources

On the other hand, 78.18% reported greater participation and collaboration among their peers when audiovisual resources were used. This suggests that these resources not only benefit the individual, but also promote interaction between students.

Question 4. Specific needs

(76.36%) consider that audiovisual resources are adequate to address the specific needs of automotive technical training. This result indicates a general positive perception about the suitability of the resources used in the educational context.

Question 5. Understanding audiovisual resources

The majority of students (89.09%) believe that audiovisual resources have contributed to a deeper understanding of automotive technical concepts.

According to these percentages, it is estimated that the implementation of audiovisual education as a pedagogical strategy for automotive technical training is necessary to improve the teaching-learning processes, since the detailed analysis shows a general positive perception towards the use of these resources. However, potential areas for improvement are highlighted, such as the motivation of some students.

Results

The questions asked determined the students' acceptance of audiovisual education.

In parallel, semi-structured interviews were conducted with professionals from the automotive sector and educators with experience in technical training in this area. This allowed us to deepen the perceptions and experiences of experts in relation to the implementation of audiovisual education and its impact on students' learning and technical skills.

Data analysis

The analysis was carried out in two stages:

a. Quantitative data: A questionnaire was created as a summative evaluation of the Internal Combustion Engines subject with a structured base question guide, and

through the application it was analyzed using descriptive statistics and hypothesis testing, determining whether there are significant differences in perception and technical skills before and after the implementation of audiovisual education as a proposal.

b. Qualitative data: To extract this data, qualitative interviews were applied, analyzing the content, identifying emerging themes and patterns in the perception of the content. This was applied to teachers and students of the Automotive Mechanics degree. Figure 1 shows the development of the interview applied to a student of the institution.

Figure 1

Interview with a student of automotive mechanics

Note: Interview with a student of automotive mechanics (period April 2023 – September 2023)

Evaluation of results

Table 3 presents the results obtained, which allowed us to know the performance of the students before and after applying the audiovisual methodologies. In addition, the qualitative analysis of this study allowed us to perceive the learning impact and the necessary challenges that the automotive industry must consider for the application.

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Table 3

Results obtained

Qualitative analysis	
Student academic performance (Traditional methodologies)	Student academic performance (Audiovisual methodologies)
Well	Very good

Worth	Scale
X<70	Regular
70<= x < 80	Well
80<= x < 90	Very good
90<= x <=100	Excellent

Note: The image indicates the performance of students applying traditional methods versus audiovisual methods

Table 4

Results obtained

Quantitative analysis	
Topics	Categories
Learning impact	Improved understanding of content
	Greater information retention
	Increase in motivation
Challenges	Accessibility to resources
	Adaptation of the methodology
	Student-content interaction

Note: The image indicates the impact on learning and the challenges presented by the application of audiovisual resources for teaching-learning processes.

Conclusions

- The results of this study strongly support the effectiveness of audiovisual education as a pedagogical strategy in automotive technical training, indicating that students who were exposed to audiovisual resources showed a significant improvement in their perceptions of learning and their technical skills, confirming that the visual and auditory presentation of complex concepts can increase the understanding and retention of technical information.

- One of the most notable aspects derived from the implementation of audiovisual education is the increase in student motivation and participation. The incorporation of visual and practical resources fostered greater interest in the content of automotive technical training, motivation that resulted in a positive impact on long-term knowledge retention and attitude towards the educational process.
- The data collected in this study supports the notion that audiovisual education not only improves theoretical understanding but also has a positive impact on the acquisition of concrete technical skills, students who experienced audiovisual resources demonstrated a significant increase in their ability to apply the learned skills in practical situations in the automotive field.
- The results also highlight the importance of catering to the diversity of learning styles in the classroom; audiovisual education allows adapting to different learning preferences by offering visual content for visual and auditory learners, which could be applied to different levels of familiarity with complex technical concepts.
- While the benefits of audiovisual education are evident, challenges also arose during implementation, such as the need to constantly develop and update technological resources, ensuring accessibility for all students and the opportunity for continuous improvement and innovation in automotive technical training.

Conflict of interest

Authors must declare whether or not there is a conflict of interest in relation to the submitted article.

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