

Cinema as a didactic resource in physics and mathematics education: Exploring mathematical connections to foster motivation and critical thinking

Luisa Morales-Maure^{1*} , Agustín Torres-Rodríguez² , Marcos Campos-Nava² ,
Camilo Andrés Rodríguez-Nieto³ 

¹ Faculty of Natural Sciences, Exact Sciences and Technology, Universidad de Panamá, Member of the National System of Researchers (SNI), Panama, PANAMA

² Universidad Autónoma del Estado de Hidalgo, Hidalgo, MEXICO

³ Universidad de la Costa CUC, Barranquilla, COLOMBIA

Received 19 July 2025 ▪ Accepted 15 November 2025

Abstract

In recent years, there has been a growing emphasis on incorporating innovative resources into the teaching of physics and mathematics to enhance student engagement and understanding. Among these, cinema stands out as a powerful didactic medium capable of fostering motivation, critical thinking, and the construction of scientific knowledge. This study investigates the mathematical connections that emerge from analyzing scenes in films and television series, proposing their use as pedagogical strategies to bridge abstract concepts with real-world contexts. Grounded in the extended theory of connections, the research highlights how cinematic narratives can activate diverse types of mathematical connections such as modeling, representations, and meaning making scientific content more accessible and meaningful. The study also presents findings from a workshop with secondary-level physics and mathematics teachers, revealing that the integration of cinema not only stimulates inquiry and problem-solving but also enhances reflective teaching practices and interdisciplinary thinking among educators and students.

Keywords: didactic cinema, physics teaching, mathematics teaching, mathematical connections, critical thinking, classroom motivation, innovative methodologies

INTRODUCTION

The teaching of scientific disciplines such as mathematics and physics often encounters the challenge of student disengagement, as these subjects are frequently perceived as abstract, difficult, and disconnected from everyday life. This negative perception can result in a lack of interest, low participation, and limited conceptual understanding (Grilli, 2016). To counteract these issues, it is imperative for educators to adopt innovative didactic strategies that not only capture students' attention but also promote motivation, meaningful learning, and the development of critical thinking skills within the classroom environment.

Cinema has emerged as an effective didactic tool for this purpose. Its ability to present complex concepts

visually and narratively facilitates students' comprehension and engagement. According to Grilli (2016), many young people perceive scientific activity as difficult and dull, reserved only for a select few considered geniuses. This perception can be countered through the use of resources such as cinema, which allows students to visualize and contextualize abstract concepts in a more accessible manner.

In this regard, as cited by Calvo and Verdejo (2019):

Films contain many elements that encourage reflection: excellent technical resources, strong narratives, outstanding actors, realism, and a captivating nature. When these activities are well-organized, students can learn to critically analyze a problem, reason through different perspectives,

Contribution to the literature

- This study introduces film as an innovative teaching resource for activating complex mathematical connections, going beyond the traditional approach based on classroom exercises.
- It articulates the extended theory of connections (ETC) with audiovisual pedagogical practices, demonstrating how film can foster modeling, interpretation, and meaning-making in real-life contexts.
- It offers empirical evidence on the impact of film on teacher training, highlighting its potential to promote critical thinking, interdisciplinary reflection, and more contextualized and meaningful mathematics teaching.

and express their views both orally and in writing (p. 59).

This suggests that cinema can be a valuable tool in teaching physics and mathematics, not only to motivate students but also to develop their analytical and critical reasoning skills. In this context, Efthimiou and Llewellyn (2006) developed the physics in films approach, using scenes from popular movies to illustrate physical principles and increase students' interest in general education courses. Additionally, recent research has demonstrated that the use of films in the classroom can enrich students' learning experiences, making them more critical thinkers and offering them diverse perspectives on science and technology (Caballero-González et al., 2020).

Regarding mathematical connections, several studies have been carried out focused on the understanding of mathematical objects by students at different school levels and also, that teachers improve their mathematical practice by relating mathematics to everyday life situations (Day et al., 2024; National Council of Teachers of Mathematics [NCTM], 2000; Peters, 2024; Rodríguez-Nieto & Font, 2025). In this context, for the teaching of Geometry, studies are addressed to address the problem of finding areas of flat figures (Caviedes et al., 2024), volume of three-dimensional figures (Cantillo-Rudas et al., 2024). Therefore, the literature has shown significant contributions from mathematical connections to improving the understanding of geometry through ethnomathematical connections (Rodríguez-Nieto & Alsina, 2022; Rodríguez-Nieto et al., 2025), highlighting the added value of everyday practices that encourage students to stay motivated and create ideas based on everyday life (Olivero-Acuña et al., 2025; Sudirman et al., 2024).

In the teaching of calculus, mathematical connections are fundamental because the problems associated with the meaning and representation of the objectives function, derivative and integral have been addressed through mathematical connections, modeling and integration of challenging problems where the student develops quantitative reasoning skills, critical reading and maintains an integrative position of calculus (Campo-Meneses & García-García, 2023; De Gamboa et al., 2024; García-García, 2024; García-García & Dolores-Flores, 2021a, 2021b; Rodríguez-Nieto et al., 2023, 2024,

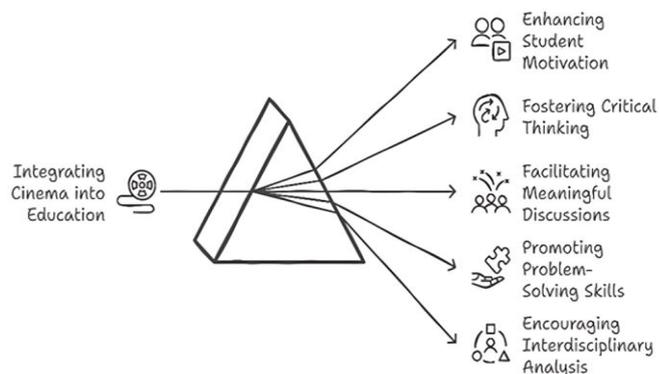


Figure 1. The impact of cinema as a didactic resource in physics and mathematics education (Source: Authors' own elaboration)

2025a, 2025b). In relation to algebra, Hatisaru et al. (2024) used mathematical connections so that pre-service teachers could appropriate the potentialities of multiple representation relationships considering the algebraic context. However, it is worth mentioning that this research proposes novel ideas by including film to explore mathematical connections where students have opportunities to appreciate mathematics in other learning environments and current experiences.

The objective of this study is to analyze the impact of integrating cinema into a didactic resource in physics and mathematics education by exploring mathematical connections within selected film scenes. This approach aims to enhance student motivation and foster critical thinking by presenting scientific concepts in engaging and meaningful contexts. Through a structured methodology based on trigger questions and the Socratic method, this study provides educators with a replicable framework to facilitate meaningful discussions, promote problem-solving skills, and encourage interdisciplinary analysis (see [Figure 1](#)).

The study evaluates the effectiveness of using cinematic scenes to generate scientific inquiry, challenge assumptions, and strengthen analytical reasoning. Ultimately, this research highlights the potential of cinema to transform traditional science education, making abstract concepts more accessible and promoting a critical and reflective learning experience.

It is crucial for educators to adopt approaches that integrate audiovisual resources into their teaching practices to transform students' perception of science

and promote a more meaningful and engaging learning experience. In this regard, it is essential to analyze how teachers can leverage mathematical connections in cinema to make abstract concepts more accessible and encourage learning through exploration and contextualization.

THEORETICAL FRAMEWORK

The use of innovative didactic resources in the teaching of physics and mathematics has been widely studied, with cinema standing out as an effective tool for fostering student motivation and critical thinking. Films and television series, by presenting scientific concepts in engaging narrative contexts, can generate interest and facilitate the understanding of complex topics. In this regard, various studies have highlighted that audiovisual resources can be employed in the classroom as pedagogical strategies that allow students to visualize real world applications of mathematical and physical principles (Caballero-González et al., 2020; López-Vicente & García-Romero, 2021).

An increasing number of educators and researchers are exploring the use of cinema as a didactic tool in secondary mathematics education. Beltrán and Asti (2014) emphasize that:

Any teacher who sees it as a motivational element and a means to introduce mathematical concepts in a different way will easily find collections of scenes with mathematical references (p. 125).

Similarly, cinema is considered a valuable resource for science education in general. According to Levin et al. (2012), cinema helps establish connections between thought and the real world, facilitating the teaching of scientific concepts in an accessible and contextualized manner. These authors assert that:

Cinema, as moving images, holds a privileged position in its ability to establish links between thought and the real world. This serves as a foundation for asserting that cinema can be effectively used as a vehicle for teaching science (p. 104).

Beyond its motivational impact, cinema also contributes to the development of critical thinking in students. Baños and Pérez (2005), argue that films contain elements that encourage reflection, such as high-quality technical production, strong narratives, renowned actors, realism, and an inherent capacity to captivate audiences. According to these authors:

If these activities are properly organized, students can learn to critically analyze a problem, reason from various perspectives, and express their viewpoints both orally and in writing (p. 59).

From the perspective of physics education, numerous studies have explored the use of cinema to contrast scientific inaccuracies found in science fiction films. Grilli (2016) notes that various experiences in this field involve students analyzing errors in storylines, special effects, and action sequences to better understand the underlying physical principles. In this regard, Efthimiou and Llewellyn (2003) found that identifying these errors contributes to more meaningful learning and improved retention of scientific concepts. The specialized literature documents multiple didactic proposals integrating cinema into science education. Pérez-González (2017) highlights its application in fields such as medicine (García-Sánchez, 2002), law (Sáez, 2013), history (Breu, 2012), and physics (Calvo, 2015; Quirantes, 2011; Efthimiou & Llewellyn, 2004). Specifically, in physics education, cinema has been used to illustrate scientific phenomena and increase student engagement with the discipline (Cambra Badii et al., 2018).

In the context of mathematics education, cinema provides a means to introduce concepts in a contextualized manner, even in films that do not explicitly address scientific topics. Sorando (2021) argues that films from various genres can serve as tools for analyzing problems, performing calculations, and fostering mathematical exploration in the classroom. According to Sorando (2021):

In teaching, we can leverage the captivating power of cinema to, through the analysis of scenes, encourage students to approach all kinds of situations mathematically and, where appropriate, develop new concepts (p. 16).

The impact of cinema on physics and mathematics education has also been observed in biographical films (biopics) that depict the lives and work of renowned scientists. Examples of this genre include *The imitation game* (2014), focusing on Alan Turing; *the man who knew infinity* (2014), centered on Srinivasa Ramanujan; *The theory of everything* (2014), portraying the life of Stephen Hawking; and *Oppenheimer* (2023), which explores the history of physicist Oppenheimer (2023) and the development of the atomic bomb. While these films have succeeded in attracting audiences already interested in science, various studies suggest that even non-scientific films can be used to generate discussions about mathematics and physics in the classroom. This study aims to explore the role of cinema as a didactic tool in physics and mathematics education, with a particular focus on identifying mathematical connections within audiovisual narratives. Selected scenes from various films and television series will be analyzed to assess their potential for teaching scientific concepts and their impact on student motivation and critical thinking.

METHODOLOGY

This study aims to analyze the impact of cinema as a didactic resource in the teaching of physics and mathematics education, emphasizing its role in student motivation and the development of critical thinking through mathematical connections. Unlike previous research that has addressed science in cinema from a documentary perspective or through explicitly scientific-themed films, this study selects specific scenes from commercial films to introduce physics and mathematics concepts in unexpected contexts, thereby facilitating student engagement and participation.

To achieve this objective, a methodological approach was employed based on the analysis of cinematic scenes from a didactic perspective. The selection of scenes was not limited to biographical films about scientists or productions with an explicit scientific theme; rather, it focused on excerpts from commercial films of various genres that present situations with explanatory potential for teaching physics and mathematics. These scenes were analyzed in terms of their scientific validity and their capacity to elicit inquiry among students.

The task was implemented with a group of teachers who taught mathematics or physics classes at secondary and high school level, in the context of a workshop within a colloquium on mathematics teaching organized at a public university in Mexico, in July 2024.

Selection of Cinematic Scenes

According to Pérez-González (2017), the selection of cinematic resources for educational purposes can be carried out using two main approaches:

1. Selecting an entire film, where the plot or storyline naturally integrates scientific concepts, allowing for a comprehensive discussion of the topic throughout the movie.
2. Selecting specific scenes, which depict physical or mathematical phenomena relevant to the curriculum, enabling a more focused and targeted analysis of particular concepts.

For this research, the second approach was chosen, as it provides greater flexibility in selecting materials that align with specific learning objectives. By focusing on individual scenes, educators can introduce a wide range of scientific principles without being constrained by the overall plot of a film. This approach allows teachers to tailor content to the needs of their students, emphasizing key concepts in a concise and engaging manner.

Furthermore, selecting individual scenes is more practical for classroom implementation, as it eliminates the need for screening an entire movie. This method optimizes the available instructional time, ensuring that discussions remain centered on the educational value of the content rather than the entertainment aspects of the

Table 1. Examples of films and their relationship with physics and mathematics concepts along with their associated scientific concepts (Monroy-Carreño & Monroy-Carreño, n. d.)

Film	Associated concept
The Andromeda Strain	Scientific method
Spider-man	Newton's second law
Volcano	Calorimetry, specific heat
Gravity	Sound waves, satellites, orbital velocity
The Lord of Rings	Parabolic motion
From the Earth to the Moon	Kinematics
Superman	Dynamics
Journey to the Center of the Earth	Thermodynamics
Hollow Man	Waves
Lost in Space	Optics
The Empires Strikes Back	Gravity
Planet of the Apes	Modern physics

film. By strategically choosing cinematic excerpts, educators can encourage critical thinking, problem-solving, and analytical discussions while maintaining student engagement and curiosity (Table 1).

The selection of these films allows educators to introduce scientific concepts through the analysis of specific scenes, creating a more dynamic and interactive learning environment (Pérez-González, 2017). By using familiar visual and narrative elements, films help make abstract or complex scientific topics more accessible and relevant to students (Calvo & Verdejo, 2019). This approach not only enhances student engagement but also provides a real-world context in which theoretical concepts can be applied and better understood (Levin et al., 2012). When students see scientific principles in action within a story or scenario they can identify with, they are more likely to develop a genuine interest in the subject matter (Grilli, 2016).

Furthermore, analyzing film scenes encourages students to actively participate in discussions, helping them connect theoretical knowledge with real-world phenomena (García-Sandoval et al., 2013). This fosters greater motivation, as students can see the direct relevance of what they are learning to their everyday lives (Levin et al., 2012). By interacting with the material in a more immersive and visual way, students are encouraged to critically examine the concepts presented, ask insightful questions, and explore various perspectives (Sorando, 2021). The result is a deeper connection with the curricular content, making learning more meaningful and encouraging long-term retention of scientific ideas (López et al., 2022), see Figure 2.

In the specific case of the collision scene depicted in Figure 2, several additional questions can be formulated to encourage a deeper analysis. Students may be prompted to consider which physical phenomena, topics, or laws are relevant to the event portrayed. They



Figure 2. Collision scene inspired by *The Vow* (2012), illustrating concepts of inelastic collisions, momentum conservation, and impact forces (© 2012 Screen Gems / Spyglass Media Group)

can also discuss whether the scene was filmed using computer-generated imagery or practical effects and reflect on whether such a scenario could realistically occur. These questions encourage critical thinking and analysis of the principles governing motion, impact forces, and energy conservation.

From a more detailed perspective, specific questions can explore how environmental factors, such as the presence of snow, influence the collision dynamics. Students can analyze why the vehicles initially move together after impact but later separate. A mathematical approach can also be introduced by assuming the truck's velocity v , its mass M , the mass of the stationary vehicle m , and the mass of the passenger m_1 to determine the velocity at which she is projected against the windshield. This type of inquiry not only fosters a conceptual understanding of inelastic collisions but also encourages problem-solving by applying Newtonian mechanics and conservation principles. Through guided discussion, students can identify key variables and develop various solution approaches based on their prior knowledge of collisions and motion.

Application of the Socratic Dialectic

The use of audiovisual resources in science education can be complemented by methodological strategies that encourage reflection and critical analysis. In this study, the Socratic dialectic is proposed as a methodology to guide classroom discussions. According to Zetina-Esquivel and Piñón-Rodríguez (2016):

The Socratic method is based on inquiry and dialectics to analyze and seek the truth, questioning everything that is assumed, eliminating claims of certainty, and exploring details to reach a general understanding or a deeper comprehension of a particular topic (p. 84).

This approach enables teachers to act as facilitators of discussions, guiding the analysis of selected scenes through open-ended questions that stimulate reflection and debate. By using these questions, educators encourage students to engage critically with the content and explore scientific concepts in a deeper way. Some suggested discussion questions include: What physical or mathematical phenomenon is related to the events in the film scene? Was the scene filmed using special effects, or is it a realistic depiction? Why? Could what is depicted in the video happen in reality? What scientific principles can explain the events in the scene? These questions promote analytical thinking, helping students connect theoretical knowledge to real-world scenarios.

An example of this dialectical process emerged during the analysis of the scene of the vehicle crash in the movie "love votes", where the instructor asked the participants about the way in which the co-driver is projected of his seat, breaking the windshield and landing on the hood of the vehicle after the impact.

Instructor: considering the masses of the vehicles, and the mass of the co-driver, is it possible that his body could have remained on the hood as shown in the considered scene?

Participant: yes, due to the mass of copilot's body, which carried the motion of the impacted vehicle.

Instructor: but is it really possible for that to happen?

The participants presented the following arguments: the position of the co-pilot in their seat influenced the outcome during a turn at the moment of the collision, the other explanation referred to the center of mass and the inertia of the co-pilot's body at the moment.

These arguments were presented for consideration, and the reasons that could explain what happened were discussed with the whole group. A question that arose from this process and later guided the discussion was: at what speed was it projected to be able to break the windshield and end up on the hood, without the body being projected out of the car?

In this example, the instructor-guided dialectic seeks to reach a greater understanding of the phenomenon under study, arriving at some general considerations based on analysis and reflection (maieutic), and questioning some responses given by participants, with the purpose of having them challenge their own prior knowledge or opinions (analogous to the irony proposed by the Socratic method).

Critical Thinking and Scene Analysis

Developing critical thinking is a fundamental objective in the teaching of physics and mathematics. According to Garcia-Sandoval et al. (2013):



Figure 3. Interaction between two boats inspired by *Life of Pi* (2012), illustrating action–reaction principles (© 2012 Fox 2000 Pictures / Rhythm & Hues)

Critical thinking is the ability to use information logically and rationally with the primary purpose of solving problems (p. 69).

The incorporation of film excerpts in the classroom creates discussion spaces that encourage students to question what they observe, analyze the underlying scientific principles, and reflect on the accuracy of cinematic representations. By engaging in these scenes, students are prompted to apply theoretical knowledge to real-world phenomena, fostering critical thinking and deeper understanding of scientific concepts.

An illustrative example of this methodology is the opening scene of *The Vow* (2012), which depicts a collision between two vehicles. A detailed observation of this scene allows for discussions on inelastic collisions, raising questions such as: How does the presence of snow affect the collision phenomenon? Why do the vehicles initially move together and then separate? What would be the projected velocity of a person inside the car after the collision? These questions not only promote conceptual understanding but also encourage students to think critically about the real-world applications of physical principles (Tippens, 2011).

Similarly, the scene from *Life of Pi* (2012), in which the protagonist is in a small lifeboat tethered to a larger boat, serves as an excellent example for discussing the principles of action and reaction. This scene allows students to explore Newton’s third law and its application in everyday scenarios. Meanwhile, the scene from *Unstoppable* (2010), where an uncontrolled train is pursued by a truck, provides an ideal scenario for examining dynamics and relative velocity. These scenes serve as valuable tools for demonstrating complex scientific concepts in an engaging and accessible way, helping students connect theoretical knowledge to real-world contexts (see **Figure 3**).

This scene serves as a useful example for discussing Newton’s third law and the conservation of momentum. Following the analysis of **Figure 3**, specific contextual questions can be posed to deepen students’



Figure 4. Arrow launch scene inspired by *Game of Thrones* (Season 3, Episode 3), illustrating projectile motion principles (© 2011–2019 Generator Entertainment / Grok Television / Startling Television / Bighead Littlehead)

understanding. For instance, why is the young protagonist able to pull such a heavy object toward himself? What would happen if, instead of two floating boats, the scenario involved two vehicles on solid ground, where the driver of the lighter vehicle attempts to pull the heavier one with a rope? Additionally, why does the larger boat appear to move toward the smaller one when pulled, yet when pushed, the smaller boat seems to drift away? These questions encourage students to reflect on the role of force interactions, mass differences, and momentum conservation in real-world applications.

The scene from *Star Wars II: Attack of the Clones* (2002), in which a Jedi discovers an invisible planet due to its gravitational effect, can be related to the historical discovery of Neptune and Pluto through the analysis of gravitational anomalies (BBC, 2017).

Mathematical Connections in Cinema

The analysis of cinematic scenes not only facilitates the teaching of physics but also allows for the introduction of mathematical connections that reinforce the understanding of numerical, geometric, and statistical concepts found in films. Sorando (2021) suggests that:

Films of any genre provide opportunities to think about problems, perform calculations, and analyze errors, thereby enhancing students’ ability to mathematically frame all kinds of situations and, when applicable, develop new concepts (p. 16).

An example of this is the relationship between parabolic motion and the scene from *Game of Thrones* (2013), where an archer fires arrows at different angles to ignite a funeral barge (**Figure 4**). This analysis allows students to discuss the influence of launch angles and air resistance on projectile trajectories.

Table 2. Summary of the proposed cinematic scenes and their relationship to scientific concepts

Film/series	Associated concept
The Vow	Elastic and inelastic collisions, energy conservation, Newton's second law
Life of Pi	Newton's second law, friction, conservation of linear momentum
Unstoppable	Vectors, relative motion
Game of Thrones	Parabolic motion, vectors, air resistance, relative motion
Star Wars II	Law of universal gravitation

This scene has been taken from a television series; however, it is considered a resource with cinematic-quality production. It comes from Game of thrones (© HBO, 2011, 2019), a medieval-era series featuring monarchies, frequent wars for territorial expansion, and elements of fantasy and mythology, including dragons. The selected scene occurs in episode three of the third season, during the funeral of a character. According to tradition, the deceased's body is placed on a boat and set adrift down the river, while an archer attempts to shoot a flaming arrow onto the boat to ignite the pyre.

This scene is ideal for introducing the concept of parabolic motion, a fundamental topic in science courses, often explored through interactive activities such as the Angry birds video game. As referenced in **Table 1**, similar cinematic resources include The lord of the rings trilogy, which frequently depicts battles featuring archers and catapults.

However, what makes this scene particularly interesting is the presence of several failed attempts before a successful shot is made. As can be seen in the **Figure 4** video, the first archer continuously misses the target, though his shots land relatively close. The second archer, who replaces him and successfully hits the target on the first attempt, makes two key adjustments: he observes the movement of banners affected by the wind and adjusts the launch angle to a higher inclination than his predecessor. These details provide a valuable opportunity for students to analyze projectile motion in real-world conditions, considering variables such as wind resistance and trajectory optimization.

The methodology proposed in this study effectively integrates cinema into the teaching of physics and mathematics by using film scenes as catalysts for reflection and analysis. Through the selection of specific excerpts, the application of the Socratic dialectic, and the promotion of critical thinking, a more dynamic and meaningful learning experience is fostered for students. By leveraging mathematical connections in cinema, educators can create engaging lessons that not only illustrate theoretical concepts but also encourage curiosity, analytical reasoning, and a deeper appreciation of science and mathematics in everyday life.

RESULTS

This study has analyzed the impact of cinema as a didactic resource in the teaching of physics and

mathematics education, with a particular focus on fostering critical thinking through mathematical connections. Five selected scenes from films and television series have been presented as instructional tools to illustrate key scientific concepts in the classroom. The selection of these resources is based not only on their ability to engage students but also on their potential to stimulate analysis and evidence-based discussion of physical and mathematical phenomena. **Table 2** summarizes the selected scenes and their associated scientific concepts:

As part of the methodological analysis, a workshop was conducted with university professors of physics and mathematics to assess the effectiveness of using cinematic scenes as a didactic tool to foster discussion and enhance learning through the Socratic method. During the sessions, trigger questions played a fundamental role in guiding participants' reflections on the scientific principles embedded in each scene. These questions encouraged educators to critically analyze the application of physics and mathematics in real-world contexts, moving beyond traditional textbook problems.

For each selected scene, the participants engaged in debates that challenged assumptions, explored alternative hypotheses, and evaluated the plausibility of the events depicted on screen. This approach not only facilitated a deeper understanding of scientific concepts but also demonstrated how strategic questioning can enhance critical thinking and active engagement in the classroom. The findings from the interaction with educators highlight the potential of trigger questions as a key tool for stimulating inquiry, promoting analytical reasoning, and encouraging the exploration of scientific concepts from multiple perspectives.

Analysis of Classroom Implementation

In the first case, the scene from The vow (**Figure 1**) depicting a collision between two vehicles was analyzed. Through guided questions, teachers identified key concepts such as Newton's laws, acceleration, and parabolic motion. A discussion emerged regarding the trajectory of the passenger after the collision, emphasizing the importance of considering the center of mass and the direction of impact. Additionally, the plausibility of the scene was questioned, leading to an analysis of linear momentum conservation and the variables influencing the dispersion of bodies after a collision. This exercise allowed participants to explore cinematography as a tool for addressing real-world

physics problems and reflecting on the possibility of estimating relevant magnitudes, such as impact velocity and transferred kinetic energy.

The second case involved the scene from *Game of thrones*, in which an archer shoots a flaming arrow at a moving boat. This segment provided an opportunity to explore the concept of parabolic motion in a more complex context than typically found in textbooks. During the discussion, additional variables such as wind velocity and target displacement were identified, leading to questions about the precision of trajectory calculations in dynamic situations.

At this point, it was highlighted that analyzing these types of scenes goes beyond the simple application of formulas, encouraging students to critically examine the values assumed in traditional problems. As a result, the teachers proposed new questions and challenges for their students, promoting a learning approach based on reasoning and hypothesis formulation.

The third case analyzed was a scene from *Unstoppable*, in which an out-of-control train is pursued by a pickup truck. In this discussion, teachers identified key concepts such as relative motion and acceleration. The feasibility of a person grabbing onto a moving train's handrail was questioned, leading to an exploration of the implications of air resistance and the speed of both vehicles. This exercise introduced the concept of inertial reference frames and the relativity of motion, encouraging teachers to reflect on how to approach these topics in the classroom to develop a more analytical mindset among students.

Developing Critical Thinking Through Cinema

A key finding of this study was the ability of cinema to foster critical thinking among participants. During the discussion of the scenes, teachers not only identified scientific concepts but also explored relationships between variables, proposed alternative hypotheses, and debated the accuracy of the events depicted on screen.

López et al. (2022) define critical thinking as:

The ability to identify arguments and assumptions, recognize significant relationships, make correct inferences, evaluate evidence, and draw conclusions (p. 162).

This process was particularly evident in the discussion of the *Game of thrones* scene, where participants not only applied the principles of parabolic motion but also formulated questions about the effect of wind and the movement of the target on the accuracy of the shot. Likewise, the discussion surrounding the *Unstoppable* scene encouraged teachers to reflect on the importance of evaluating scenarios from different reference frames and considering the influence of external factors such as friction and air resistance. This type of analysis promotes a deeper understanding of

physics and mathematics concepts and encourages the formulation of thought-provoking questions that enrich the learning experience.

The results obtained in this study demonstrate that cinema can be an effective tool for teaching physics and mathematics, not only as a means of capturing students' attention but also as a resource for generating meaningful discussions and fostering the development of critical thinking.

The application of cinematic scenes in the classroom allows for:

1. Motivating students by presenting scientific concepts in familiar and engaging contexts.
2. Encouraging discussion and critical analysis, prompting students to question the accuracy of the phenomena observed.
3. Promoting the integration of multiple scientific concepts, facilitating a more holistic understanding of the topics covered.
4. Developing problem-solving skills through hypothesis formulation and the identification of relevant variables in different scenarios.

This study suggests that science education can greatly benefit from the integration of cinema as a didactic resource. However, it is essential that educators do not merely use films as a source of entertainment but instead incorporate them strategically into their pedagogical planning, ensuring that students are guided in analyzing and discussing the observed phenomena.

As a future line of research, expanding the catalog of cinematic scenes applicable to science education is recommended, along with conducting experimental studies to measure the impact of cinema on student learning and motivation in physics and mathematics courses. This study reaffirms that mathematical connections in cinema can be a powerful tool for transforming science education. By making abstract concepts more accessible and engaging, this approach enhances students' analytical and reasoning skills while fostering a deeper appreciation of scientific inquiry.

Relationship with the Extended Theory of Connections (Rodríguez-Nieto & Font, 2025)

Within the framework of the ETC and its integration with the OSA, 12 types of connections are proposed, of which at least 6 are activated recurrently in the film article:

1. **Modeling:** This is the most dominant connection. Film scenes are transformed into real-life contexts where students model mathematically. For example, the shooting angle in *Game of thrones* is a situation modeled with parabolic trajectories.
2. **Connections between representations:** The scenes lead students to translate the visual (image) into symbolic (formulas), graphic (trajectories), or

Table 3. Mathematical connections in the context of cinema from the ETC

Scene/case	Mathematical or physical concept	ETC connection type	Description
Game of thrones (arrow launching)	Parabolic motion	<ul style="list-style-type: none"> • Modelling • Different representations 	The angle of launch and air resistance are analyzed. Students translate the visual phenomenon into graphical and algebraic representations.
The vow (car collision)	Conservation of momentum	<ul style="list-style-type: none"> • Modelling • Procedural • Meaning 	The situation is modeled using vectors and Newton’s laws. Students interpret variables in physical mathematical expressions.
Life of pi (action and reaction between two boats)	Newton’s third law, vectors	<ul style="list-style-type: none"> • Modelling • Meaning • Implication 	The magnitude and direction of forces are analyzed with vectors, as well as their graphical representation.
Star wars II (Invisible planet)	Analysis of indirect data	<ul style="list-style-type: none"> • Idealization • Modelling 	A connection is established between gravitational forces and mathematical methods for indirect deduction. (Cohen et al., 2018)
Spider-man (action on the body)	Laws of motion	<ul style="list-style-type: none"> • Modelling • Instructional 	Concepts of force and acceleration are applied in an everyday context.

verbal (explanations), activating alternating or equivalent connections.

3. **Connections of meaning:** What has been learned is linked to significant experiences. For example, the collision in *The vow* helps conceptualize linear momentum as more than just a formula.
4. **Instructional connection:** The teacher links a new concept to prior knowledge, for example, relating vectors in the case of *Life of pi* to what has been learned in previous classes about direction and sense.
5. **Procedural connection:** This is evident when students apply formulas, such as using the dot product to calculate directional derivatives, in contexts depicted in the scenes.
6. **Idealizing:** In scenes like *Star wars*, students must move from the ostensible (invisible planet) to the conceptual (gravity, gravitational anomalies), dematerializing the object.

This article on cinema uses scenes from films and TV series to introduce physics and mathematics concepts, encouraging critical thinking. Using the ETC framework, the following connections are identified (see [Table 3](#)).

DISCUSSION

The results presented in this article show that the use of cinematic scenes favors the emergence of various mathematical connections relevant to the deep understanding of concepts in physics and mathematics. This finding significantly converses with previous literature on mathematical connections (Dolores-Flores & García-García, 2017; NCTM, 2000; Rodríguez-Nieto et al., 2023), which emphasizes the need to establish links between representations, procedures, and real-life contexts to improve conceptual understanding.

From this perspective, there is a convergence between the findings of this study and the ETC, developed by Rodríguez-Nieto and Font (2025).

According to this theory, mathematical connections are not limited to associations between concepts but arise as a result of complex mathematical practices that involve objects, processes, and semiotic functions. In this sense, the analysis of film scenes not only activates procedural and representational connections, as has been widely documented (Businskas, 2008; García García et al., 2021), but also promotes connections of modeling, meaning, and idealization, aspects less explored in previous research.

The use of film as a teaching resource particularly enhances extra-mathematical connections, that is, those that link mathematics with real-life situations or the physical world (Dolores-Flores & García-García, 2017). Unlike previous research that focused on traditional school contexts (e.g., word problems or artificial graphs), this study demonstrates that students can construct authentic mathematical meanings from the visual and narrative experiences provided by film. As Sorando (2021) argues, these experiences allow students to “mathematize” everyday situations, approaching the discipline from an active and critical stance. Furthermore, the article provides a novel methodological approach by integrating film with the Socratic method, promoting not only conceptual understanding but also the development of critical thinking, a fundamental aspect of the modern vision of mathematics education (Caballero-González et al., 2020; García-Sandoval et al., 2013). This type of teaching practice allows the connections activated by students to emerge from a reflective and argumentative stance, aligned with the current demands of the STEM curriculum.

The main contribution of this study to mathematics education is to offer an innovative and theoretically grounded strategy for activating mathematical connections through the analysis of film scenes, articulating the motivational potential of film with the robust theoretical frameworks of ETC and the OSA. This

contribution expands teaching possibilities beyond the traditional classroom, demonstrating that film is not only a complementary resource but also a powerful medium for fostering intra- and extra-mathematical connections, promoting modeling, and developing a more integrated and major understanding of mathematical knowledge. This article not only expands teachers' methodological repertoire but also strengthens their understanding of the role of mathematical connections in teaching based on cultural and audiovisual contexts, opening new avenues for future research on curricular integration and learning.

An additional point concerns the degree of physical credibility of the selected scenes. In our design we deliberately combined sequences that are broadly consistent with the laws of physics and others that exaggerate or even violate them (for instance, action scenes in which heroes emerge unharmed after falling from great heights or after high-speed impacts), using them as a context to foster mathematical and scientific argumentation in line with previous work on dialogue and proof in mathematics education (Gutiérrez, 2018; Morales-Maure et al., 2022). Explicitly contrasting these two types of situations became one of our criteria for scene selection, because it allows teachers and students to discuss which elements could occur in reality, which cannot, and what physical principles justify those judgments, resonating with approaches to teacher education that foreground pedagogical content knowledge and structured reflection on practice (Flores-Castro et al., 2024; Morales-Maure et al., 2025). During the workshop, participants were repeatedly invited to take a stance on the realism of each scene and to support their positions with arguments grounded in physics and mathematics, echoing calls to cultivate critical and evidence-based reasoning in mathematics and science classrooms (Morales-Maure et al., 2022). In this way, "unrealistic" scenes cease to be mere spectacle and are transformed into powerful triggers for critical thinking, helping students to confront naïve conceptions, interrogate cinematic conventions, and use scientific laws and quantitative estimations as tools for evaluating what they see on screen, a form of critical engagement with technologically mediated representations that is also consonant with recent analyses of AI adoption in Latin American mathematics education from a post-humanist perspective (Chacón-Rivadeneira et al., 2024).

CONCLUSIONS

This study proposed a set of selected scenes from commercial films as a teaching resource for physics and mathematics, not only for motivational purposes but also as triggers for debate and analysis aimed at strengthening critical thinking. By integrating mathematical connections into the analysis of these scenes, it was evident that film can act as an effective tool

for illustrating scientific concepts in engaging and meaningful narrative contexts for students. Beyond the specific scenes used, the study presents a replicable methodology based on proactive questions and the use of the Socratic method, allowing teachers to structure in depth discussions that can be adapted to other audiovisual resources. This methodology fosters argumentation, hypothesis formulation, and problem-solving skills, promoting active and reflective student participation.

The implementation of a workshop with teachers demonstrated positive results: participants were highly engaged, creative, and able to identify relevant scientific concepts in film scenes, generating meaningful discussions from both qualitative and quantitative perspectives. It was evident that the combination of film and Socratic questioning facilitates a more dynamic and interdisciplinary learning experience, where teachers not only recognize scientific principles but also question, contextualize, and redefine them. The analysis of film phenomena also allowed us to assess the role of critical thinking in the interpretation of audiovisual messages, transcending simple conceptual identification. This capacity for reflection contributes to developing more analytical teachers, capable of critically evaluating the information they consume in different media.

The findings of this study confirm that film, when integrated with appropriate methodological strategies, represents a transformative teaching resource in the teaching of physics and mathematics. The mathematical connections emerging in film analyses help challenge assumptions, strengthen analytical reasoning, and facilitate the understanding of abstract concepts. Future research could expand the repertoire of scenes analyzed and investigate the effects of these strategies on student learning and motivation through experimental studies at different educational levels. It is also important to develop specific teaching tools to assess the impact of these resources on students' conceptual understanding and critical thinking.

Author contributions: LM-M: data curation, writing - original draft; AT-R & MC-N: formal analysis, writing - review & editing; CAR-N: data curation, writing - review & editing. All authors agreed with the results and conclusions.

Funding: No funding source is reported for this study.

Acknowledgments: The authors would like to thank the university entities where they work and allow them to do research in mathematics education.

Ethical statement: The authors stated that both the participants (professors) and the university were informed that this article on beliefs is for educational purposes, not economic or political purposes, and that they voluntarily agreed to participate. All authors of this article are authorized to use the data, especially the first author, who was responsible for collecting the data and has access to the data. Furthermore, this article presents no ethical issues and is approved by the participants.

AI statement: Generative AI was not used in the construction of this article, but ChatGPT translator was used in some cases, which is a valid and reliable tool.

Declaration of interest: No conflict of interest is declared by the authors.

Data sharing statement: Data supporting the findings and conclusions are available upon request from the corresponding author.

REFERENCES

- Baños, J. E., & Pérez, J. (2005). Biocinema: La experiencia de emplear películas comerciales con estudiantes de biología [Biocinema: The experience of using commercial films with biology students]. *Revista de Medicina y Cine*, 1(2), 42-46.
- Beltrán, P., & Asti, A. (2014). Utilización didáctica del cine en matemáticas [Didactic use of film in mathematics]. *Enseñanza & Teaching*, 32(2), 123-145. <https://doi.org/10.14201/et2014321123145>
- Breu, R. (2012). *La historia a través del cine: 10 propuestas didácticas para secundaria y bachillerato* [History through film: 10 teaching proposals for secondary and high school]. Graó.
- Businskas, A. M. (2008). *Conversations about connections: How secondary mathematics teachers conceptualize and contend with mathematical connections* [Doctoral dissertation, Simon Fraser University]. Summit Institutional Repository. <https://summit.sfu.ca/item/9245>
- Caballero-González, A., Pérez-Sánchez, A., & Ramírez-Rodríguez, P. (2020). El cine como herramienta didáctica para el aprendizaje de conceptos científicos [Film as a teaching tool for learning scientific concepts]. *Revista de Innovación Educativa*, 8(2), 45-58.
- Calvo, F. (2015). Thermodynamics of nanoalloys. *Physical Chemistry Chemical Physics*, 17(42), 27922-27939.
- Calvo, E., & Verdejo, A. (2019). El cine, un recurso didáctico para la introducción de la perspectiva de género [Cinema, a teaching resource for introducing the gender perspective]. *Revista de Investigación Educativa Universitaria*, 2(1), 58-73.
- Cambra Badii, I. A., Michel Fariña, J. J., & Lorenzo, M. G. (2018). Contribuciones del cine y la Psicología a la Enseñanza de la Física y otras ciencias naturales: El caso Copenhagen [Contributions of film and psychology to the teaching of physics and other natural sciences: The Copenhagen case]. *Revista de Enseñanza de la Física*, 30(1), 9-24.
- Campo-Meneses, K. G., & García-García, J. (2023). Conexiones matemáticas identificadas en una clase sobre las funciones exponencial y logarítmica [Mathematical connections identified in a class on exponential and logarithmic functions]. *Bolema: Boletim de Educação Matemática*, 37, 849-871. <https://doi.org/10.1590/1980-4415v37n76a22>
- Cantillo-Rudas, B. M., Rodríguez-Nieto, C. A., Font, V., & Rodríguez-Vásquez, F. M. (2024). Mathematical and neuro-mathematical connections activated by a teacher and his student in the geometric problems-solving: A view of networking of theories. *Eurasia Journal of Mathematics, Science and Technology Education*, 20(10), Article em2522. <https://doi.org/10.29333/ejmste/15470>
- Caviedes, S., De Gamboa, G., & Badillo, E. (2024). Mathematical connections involved in area measurement processes. *Research in Mathematics Education*, 26(2), 237-257. <https://doi.org/10.1080/14794802.2024.2370333>
- Chacón-Rivadeneira, K., Morales-Maure, L., García-Marimón, O., Sáez-Delgado, F., Gutiérrez González, J., & Alfaro Ponce, B. (2024). Artificial intelligence adoption in Latin American mathematics education: Challenges and opportunities. *Journal of Posthumanism*, 4(3), 1141-1161. <https://doi.org/10.63332/joph.v4i3.3195>
- Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education*. Routledge. <https://doi.org/10.4324/9780203224342>
- Day, L. J., Siemon, D., Callingham, R., & Seah, R. (2024). Connecting the threads: The role of multiplicative thinking in algebraic, geometrical, and statistical reasoning. *Research in Mathematics Education*, 26(2), 325-347. <https://doi.org/10.1080/14794802.2024.2372365>
- De Gamboa, G., Barrera, S. C., & Badillo, E. (2024). El papel de las conexiones intra matemáticas en el aprendizaje de los números decimales [The role of intra-mathematical connections in learning decimal numbers]. *Avances de Investigación en Educación Matemática: AIEM*, (25), 131-149. <https://doi.org/10.35763/aiem25.6399>
- Efthimiou, C. J., & Llewellyn, R. A. (2003). Physics in films: An analysis of physical principles in popular movies. *American Journal of Physics*, 71(11), 1109-1117.
- Flores-Castro, E., Campos-Nava, M., Ramirez-Diaz, M. H., & Moreno-Ramos, J. (2024). The construction of knowledge for the teaching of sciences: A reflection seen from the pedagogical content knowledge (PCK). *Kurdish Studies*, 12(1), 3536-3555.
- García-García, J. (2024). Mathematical understanding based on the mathematical connections made by Mexican high school students regarding linear equations and functions. *The Mathematics Enthusiast*, 21(3), 673-718. <https://doi.org/10.54870/1551-3440.1646>
- García-García, J., & Dolores-Flores, C. (2021a). Exploring pre-university students' mathematical connections when solving Calculus application problems. *International Journal of Mathematical Education in Science and Technology*, 52(6), 912-936.

- García-García, J., & Dolores-Flores, C. (2021b). Pre-university students' mathematical connections when sketching the graph of derivative and antiderivative functions. *Mathematics Education Research Journal*, 33, 1-22. <https://doi.org/10.1007/s13394019-00286-x>
- García-Sánchez, J. (2002). El uso del cine en la enseñanza de la medicina [The use of film in medical education]. *Revista Iberoamericana de Educación Médica*, 15(3), 99-115.
- García-Sandoval, A., Lara-Barragán, A., & Cerpa-Cortés, E. (2013). Enseñanza de la física y desarrollo del pensamiento crítico: Un estudio cualitativo [Teaching physics and developing critical thinking: A qualitative study]. *Revista de Educación y Desarrollo*, 24, 67-76.
- Grilli Silva, J. (2016). Cine de ciencia ficción y enseñanza de las ciencias. Dos escuelas paralelas que deben encontrarse en las aulas [Science fiction cinema and science education. Two parallel schools that must meet in the classroom.]. *Revista Eureka sobre Enseñanza y Divulgación de las Ciencias*, 13(1), 137-148. https://doi.org/10.25267/Rev_Eureka_ensen_divulg_cienc.2016.v13.i1.10
- Gutiérrez, J. J. (2018). Teoría de números: De ciencia pura a ciencia aplicada [Number theory: From pure science to applied science]. *Pensamiento Matemático*, 8(1), 57-66.
- Hataru, V., Stacey, K., & Star, J. R. (2024). Conexiones matemáticas en las estrategias de solución de problemas de álgebra de profesores de matemáticas de secundaria en formación [Mathematical connections in the algebra problem-solving strategies of pre-service secondary mathematics teachers]. *Avances de Investigación en Educación Matemática: AIEM*, (25), 33-55. <https://doi.org/10.35763/aiem25.6354>
- Levin, L., Beatriz, C., & Elisabeth, M. (2012). De la mesa del laboratorio al celuloide: El cine en la enseñanza de las ciencias [From the laboratory bench to the celluloid: Cinema in science education]. *Revista Iberoamericana de Educación*, 58, 99-117. <https://doi.org/10.35362/rie580475>
- López, M., Moreno, E. M., Uyaguari, J. F., & Barrera, M. P. (2022). El desarrollo del pensamiento crítico en el aula: Testimonios de docentes ecuatorianos de excelencia [The development of critical thinking in the classroom: Testimonies from outstanding Ecuadorian teachers]. *Areté, Revista Digital del Doctorado en Educación de la Universidad Central de Venezuela*, 8(15), 161-180. <https://doi.org/10.55560/ARETE.2022.15.8>
- Monroy-Carreño, M., & Monroy-Carreño, P. (n. d.). El cine como recurso didáctico en la enseñanza de la física [Film as a teaching resource in the teaching of physics]. *FANCINE*. <http://www.cchnaupalpan.unam.mx/muestras/m4/TALL/Fancinec.pdf>
- Morales-Maure, L., Campos-Nava, M., García-Marimón, O., & Gutiérrez, J. (2022). The argument and demonstration exemplified in a mathematical dialogue. *Infinity Journal*, 11(2), 211-222. <https://doi.org/10.22460/infinity.v11i2.p211-222>
- Morales-Maure, L., Chacón-Rivadeneira, K., García-Marimón, O., Sáez-Delgado, F., & Campos-Nava, M. (2025). Enhancing mathematics teacher training in higher education: The role of lesson study and didactic suitability criteria in pedagogical innovation. *Trends in Higher Education*, 4(3), Article 39. <https://doi.org/10.3390/higheredu4030039>
- NCTM. (2000). *Principles and standards for school mathematics*. National Council of Teachers of Mathematics.
- Olivero-Acuña, R. R., Rodríguez-Nieto, C. A., Moll, V. F., Cantillo-Rudas, B. M., & Rodríguez-Vásquez, F. M. (2025). Ethnomathematical connections between the production of coastal cheese, geometric solids, measurements, and proportionality: A study with a Colombian merchant. *Eurasia Journal of Mathematics, Science and Technology Education*, 21(4), Article em2608. <https://doi.org/10.29333/ejmste/16081>
- Pérez-González, N. (2017). *El cine como recurso en la enseñanza de la física* [Film as a resource in the teaching of physics] [Master's thesis, Universidad de Salamanca].
- Peters, A. (2024). Using the TIMSS curriculum model to develop a framework for coherence and its role in developing mathematical connections. *Research in Mathematics Education*, 26(2), 300-324. <https://doi.org/10.1080/14794802.2024.2371026>
- Quirantes Sierra, A. (2011). Física de película: Una herramienta docente para la enseñanza de Física universitaria usando fragmentos de películas [Physics from Film: A teaching tool for university physics using film clips]. *Revista Eureka sobre Enseñanza y Divulgación de las Ciencias*, 8(3), 334-340. https://doi.org/10.25267/Rev_Eureka_ensen_divulg_cienc.2011.v8.i3.09
- Rodríguez-Nieto, C. A., Cabrales, H. A., ArenasPeñaloza, J., Schnorr, C. E., & Font, V. (2024). Ontosemiotic analysis of Colombian engineering students' mathematical connections to problems solving on vectors: A contribution to the natural and exact sciences. *Eurasia Journal of Mathematics, Science and Technology Education*, 20(5), Article em2438. <https://doi.org/10.29333/ejmste/14450>
- Rodríguez-Nieto, C. A., & Font, V. (2025). Mathematical connections promoted in multivariable calculus' classes and in problems-solving about vectors, partial and directional derivatives, and

- applications. *Eurasia Journal of Mathematics, Science and Technology Education*, 21(4), Article em2619. <https://doi.org/10.29333/ejmste/16187>
- Rodríguez-Nieto, C. A., Pabón-Navarro, M. L., Cantillo-Rudas, B. M., Sudirman, S., & Font, V. (2025a). The potential of ethnomathematical and mathematical connections in the pre-service mathematics teachers' meaningful learning when problems-solving about brick-making. *Infinity Journal*, 14(2), 419-444. <https://doi.org/10.22460/infinity.v14i2.p419-444>
- Rodríguez-Nieto, C. A., Rodríguez-Vásquez, F. M., Font, V., Sudirman, S., & Cantillo-Rudas, B. M. (2025b). Engineering students' mathematical understanding based on the quality of mathematical connections activated to solve tasks about function's graph and its derivative. *Educational Process: International Journal*, 17, Article e2025394. <https://doi.org/10.22521/edupij.2025.17.394>
- Rodríguez-Nieto, C. A., Rodríguez-Vásquez, F. M., & Font, V. (2023). Combined use of the extended theory of connections and the onto-semiotic approach to analyze mathematical connections by relating the graphs of f and f' . *Educational Studies in Mathematics*, 114, 63-88. <https://doi.org/10.1007/s10649-023-10246-9>
- Rodríguez-Nieto, C., & Alsina, Á. (2022). Networking between ethnomathematics, STEAM education and the globalized approach to analyze mathematical connections in daily practices. *Eurasia Journal of Mathematics Science and Technology Education*, 18(3), Article em2085. <https://doi.org/10.29333/ejmste/11710>
- Sáez, J. M. (2010). Utilización de las TIC en el proceso de enseñanza-aprendizaje, valorando la incidencia real de las tecnologías en la práctica docente [Use of ICT in the teaching-learning process, assessing the real impact of technologies on teaching practice]. *Revista Docencia e Investigación*, 20, 183-204.
- Sorando, J. (2021). Cómo enseñar y aprender matemáticas con el cine [How to teach and learn mathematics with film]. *Ciencia*, 72(3), 16-21.
- Sudirman, Rodríguez-Nieto, C. A., & Bonyah, E. (2024). Integrating ethnomathematics and ethnomodeling in Institutionalization of school mathematics concepts: A study of fishermen community activities. *Journal on Mathematics Education*, 15(3), 835-858. <http://doi.org/10.22342/jme.v15i3.pp.835-858>
- Tippens, P. E. (2011). *Física, conceptos y aplicaciones* [Physics, concepts and applications]. McGraw-Hill.
- Zetina-Esquivel, E., & Piñón-Rodríguez, P. (2016). El método Socrático en los programas educativos actuales: Una propuesta de Martha C. Nussbaum [The Socratic method in current educational programs: A proposal by Martha C. Nussbaum]. *La Colmena*, 91, 79-90.

<https://www.ejmste.com>