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Drama in STEAM education: Possible approaches and connections to drama-based activities in STEAM education

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RESEARCH ARTICLE

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ABSTRACT

Drama in Education (DiE) has been a well-known teaching technique for an active learning approach for students. It utilizes different forms of conventions to enhance a student's learning experience in the classroom, offering alternatives instead of the traditional teaching approaches. Drama can encourage students to learn and think critically and improve public speaking, communication, and confidence. The article portrays the use of drama activities in STEAM education by depicting the benefits and challenges. This study uses a qualitative approach to collect data, including relevant literature, descriptions of drama activities, and observation. The findings display that drama in STEAM education can improve and stimulate students' learning and knowledge in a particular subject. This study aimed to view 19 higher education students' perspectives of drama activities in STEAM. Two activities were completed during this pilot study and observations were made throughout the process. Furthermore, drama in STEAM stimulated the students, were more enthusiastic about exploring, examining and learning, socializing with their groupmates, and the confidence to perform.

KEYWORDS

drama in education, drama-based pedagogy, STEAM education, arts-based practices in education

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INTRODUCTION

Applied drama in education can help students in thinking about their individual or social problems and learn how to explore issues, experiences, and connections. Students can use their imaginary knowledge and experience the real world to generate an "as-if-world" (DICE project, 2010). Drama allows participants to express themselves freely in the safety frame of the created story, which promotes reflective thinking. Educational drama works with diverse conventions and techniques, thus, developing students' competencies in the classroom, and strengthening the interoperability between subjects, including experiences of democratic process (Neelands, 2009; Novák & Horváth, 2022). Using drama in the classroom can be a challenging teaching strategy because teachers may not have the proper methods of managing the students. Drama uses most of the intelligences in learning activities such as logical and verbal-linguistic learning. Drama improves reasoning, creativity, and interpersonal skills in different subjects (Gardner, 1993; Kalidas, 2014).

AIMS OF STUDY

This study focuses on a review of literature that is relevant to the advantages, relevance, and potential links of drama and STEAM education. The next part of the study displays a pilot case study regarding two drama activities with university students to observe and demonstrate if drama is a useful method in STEAM. Data has been analysed using a qualitative method applying the observations and reflections of the researchers.

RESEARCH QUESTIONS

During this pilot study, two research questions about the use of dramatic activities in STEAM education were discussed. The research questions sought to understand how the integration of dramatic methodologies in an educational setting can affect students' academic performance.

RQ1: How do higher education students view dramatic activities in a science or history class?

RQ2: What can students achieve in a STEAM classroom when they engage in dramatic activities?

LITERATURE REVIEW

Arts-based educational approaches have been used in classrooms and research over the past few decades as "Arts-Based Educational Research" (Barone & Eisner, 2006); and in science education (Dorion, 2009; Metcalfe, Abbott, Bray, Exley, & Wisnia, 1984). Leavy (2015) argues that arts-based methods have proven useful in projects that aim to describe, explore and discover particularly drama. Drama involves participation and discussion skills that can be effective in learning (Nicholson, 2005). The combination of cognitive and emotional dimensions of dramatic learning can provide valuable resources for research. Dramatic activities have been shown

to be useful in teaching and learning as they integrate emotion and cognition into instruction (Littledyke, 2008).

Lee, Patall, Cawthon, and Steingut (2015) showed that "Drama-based pedagogy (DBP)" has a significant impact on the achievement of positive results in the educational environment. The authors concluded that *"DBP has a positive effect on achievement and a variety of related psychological and social outcomes."* (Lee et al., 2015, p. 36). Among the many interesting findings of the meta-analysis, it highlights that *"in the 21st-century skills and motivational outcomes, DBP had the strongest effects for upper elementary and middle school samples"* (Lee et al., 2015, p. 37). Dramatic activities also promote a range of knowledge, imagination, and intelligence (Leavy, 2015; Rathwell & Armitage, 2016). This concept is based on recent studies on the impact of drama education in primary and secondary schools (Varelas et al., 2010).

New research opportunities include natural sciences, student interest in marker-space, or the STEM/STEAM models,[1] one of the innovations in 21st-century education (Walan, 2019). Research shows the prominent role of drama in the development of the Lisbon Key Competences in Education, for example, the development of 'learning to learn' and many other skills and abilities: *"Intuition, vocabulary, logical thinking, attention, self-discipline, critical thinking, social thinking, helpfulness, courage, self-expression, attention to each other, imagination, sense of reality"* (DICE, 2010, p. 43). It creates an opportunity for the participants to observe the issues and phenomena addressed in the sessions, thereby making individual and collective interpretations. With its tools, it can enrich the learners' indirect experience to broaden their perspectives and open up possibilities for reflections and participation of the students (Wager, 2014; Novák, 2019).

Drama is a teaching and learning technique that captures students' attention and can highlight content in a way that students can understand (Waters, Monks, Ayres, & Thomson, 2012). According to Turner (2010), drama in education promotes a positive academic learning experience where it engages the imagination and creative side of students. Tombak (2014) aimed to show the importance of drama in kindergarten to enable students to think independently and to promote students' imagination. Basom (2005) goes even further and states that the use of drama in education can promote students' communication skills in speaking, listening, and body language.

Drama in education can be a conscious development tool and allows the learning process to be fun and increase students' self-confidence (Isyar & Akay, 2017). Heathcote and Herbert (1985) state that drama is seen as an effective and useful teaching strategy as it allows students to be reflective and active in the classroom and to develop their oral skills. Drama also allows students to be empowered during their work and develops their problem-solving and management skills and competencies. Furthermore, through dramatic activities, students learn how to work in a team and develop their organizational skills and improvisation. All these skills are used in all parts of their lives and are useful in their future work when they have to work on projects with other colleagues and during interviews to think quickly and answer questions (Mages, 2016). The impact of drama on learning has been proven by research and as Gavin Bolton states: "*Drama has a lot to do with pedagogy because it is an art*" (1993, p. 39).

[1]STEM: science, technology, engineering and mathematics; STEAM: science, technology, engineering, art and mathematics.

Drama creates interpersonal relationships that lead directly to personal and emotional growth. It also helps students find their identity, see the world through different lenses, grasp experiences, and form different concepts and relationships. In summary, drama deserves more recognition in education because it brings many benefits to students' learning experiences and can be effectively implemented if teachers have adequate tools, resources, curriculum, background knowledge, and information about teaching different subjects through drama (Zaghloul, 2020).

Mages (2016) also agrees that drama allows students to increase their self-confidence and emotional resilience. Drama activities present new experiences and perspectives for all students, where teachers try to make students think outside the box and allow students to think independently (Zaghloul, 2020). Dramatic methods include a wide range of expression and allow teachers to give all students, regardless of ability, the opportunity to express their ideas and emotions. Swartz (2015) reveals that learning through drama develops critical 21st-century communication skills that develop both oral and written skills such as innovation, creativity, imagination, problem-solving, and collaboration. A study by McLauchlan and Winters (2014) discovered that students involved in high school drama highlighted the positive impact of being able to create and collaborate based on their interests and experiences. Drama not only gave students an opportunity to express themselves but also empowering themselves. It serves as a collaborative experience that is guided by the whole group, allowing students to take ownership of the learning situation (Stinson & Freebody, 2006).

The collective form of problem-oriented learning is drama, which is a form of creating meaning, based on the models presented to the students by the teacher. The attention of the drama teacher, who orients the play and organizes the learning situation, is directed to the student who is gaining the dramatic experience while being a performer becomes a secondary, necessary but additional element of the dramatic process (Heathcote, 1984; Neelands, 2009). Drama as a pedagogical intervention, also known in the literature as creative drama or classroom drama, is nothing more than "*the process of acting out of stories*" (Bethlenfalvy, 2020; Bolton, 1999). This is led by the drama teacher, which is a process-oriented, improvisational, learning-oriented, and dramatic form in which students examine imagined possibilities and real-world experiences through their imagination, involvement, empowerment, original ideas, exploratory actions, and subsequent reflections (O'Neill, 1996; Davis & Behm, 1987, 262; Kaposi, 2008; McCaslin, 2006; Gallagher, 2014; Novák, 2016, 48).

APPROACHES TO DRAMA-BASED ACTIVITIES FROM THE ASPECT OF STEAM EDUCATION

Perhaps it is clear from the above that these kinds of art investigations can also be defined as drama-based procedures and art-based research (ABR) helps to understand them as precisely as possible. Art-based research, in which art is a means of cognition, and the creation of art can be the primary form of cognition and investigative experience (Kiss, 2014). *"Art-based practices can be especially useful for research projects that are descriptive, exploratory, and exploratory"* (Leavy, 2015, p. 21). ABR-type studies related to the participation paradigm build on the experiences and feedback of the participants and pay special attention to the exploration of unique

worldviews that can be realized through art. Their starting point is that art is not only a product, but also an epistemological process (Norris, 2000).

STEAM EDUCATION

STEAM Education helps make the educational environment more like the real world by making realistic connections between academic content and practice. Students can learn how to solve real-world problems by using multiple skills and knowledge that develop their creative and innovative thinking (Sochacka, Guyotte, & Walther, 2016). Therefore, art-based methods combine different topics and content, editing on a deeper and more creative level. It allows students to learn in a unique environment that fosters a deeper connection to real-world problems and solutions and presents new learning opportunities. In STEAM, like drama in education, learning themes and content must be authentic because students must immerse themselves in real-world challenges, so not all aspects of STEAM pedagogy can be taught by just one teacher. STEAM pedagogy needs teachers and teacher teams, and subject collaborations in all subject areas to create the basis for students' understanding and learning by planning and building a new educational structure. Teachers must prepare an educational project plan that includes the rearrangement of teaching methods in the school. Art-based methods play an important role in STEAM pedagogy because when students gain real experiences of learning about different cultures, social-emotional learning, and collaboration, it becomes the embodiment of STEAM (Quigley & Herro, 2016). Segarra, Naralizio, Falkenberg, Pulford, and Holmes (2018) argue that students who are not interested in typical subject instruction are often more interested in STEAM classrooms. When engaging in arts-based practices such as creating, presenting, performing, responding, and reflecting; this level of participation automatically promotes students' concentration, motivation, and builds self-confidence (Strauss, 2013). Nichols (2015) supports this claim by describing how students become creative and interested when engaging in a variety of arts-based activities in the classroom, become ambitious, confident, and able to understand and manage their learning skills. with their appropriate behaviour. Moreover, STEAM enables inclusivity in classrooms allowing each student to engage and participate in the classroom in their own way. STEAM urges learners *"(…) to be curious, experiment, and take risks — key dispositions artist habits of mind engender"* (Bequette & Bequette, 2012). They also utilize different learning methods when trying to problem solve and are allowed to have their own views when learning through art (Strauss, 2013).

DRAMA IN STEAM EDUCATION

Drama also presents challenges, especially for teachers, they find that drama in education can be difficult to implement in the classroom due to the management of students based on noise level, disruption to other classes, and disinterested students. However, teachers can overcome this by creating well and clearly structured activities where students can enjoy working in groups and even the shyest students can benefit from drama in education. Jacobs (2016) presents the challenges of drama in education in terms of meeting various regulatory requirements and that it does not meet educational objectives. Another challenge faced is the set regulations and

frameworks in the school curriculum because many teachers in today's schools are not qualified to create drama activities or teach certain subjects. Additionally, drama activities take time to plan and implement in the classroom (Dorion, 2009). Some institutions may not consider the importance of drama in education and refuse to support it in their curriculum (Zaghloul, 2020). Similarly, drama in education has a positive effect on the acquisition of social skills, improving communication skills and self-awareness, as well as cognitive skills (Freeman, Sullivan, & Fulton, 2003). Social skills are an important tool for students because they allow them to express positive or negative emotions, protect themselves, or ask for help. However, if any emotion cannot be expressed socially, it can be done socially through drama. They get an alternative way to express themselves which allows them to concentrate during their lessons (İşyar & Akay, 2017). Some research shows limitations when trying to implement dramatic activity in STEAM (Wang, Moore, Roehrig, & Park, 2011). One of the challenges of STEAM activity is presented as the lack of time for teachers to implement, explain, facilitate, and complete the activity, to use appropriate materials and tools for the activity, and technology. Drama can be considered a particularly useful teaching method in kindergarten and primary school education. Drama can develop children in all aspects and all subjects, from mathematics, social studies, and language subjects. Drama and theatre-based research also shows that drama in education can promote academic achievement, subject retention, and positive attitudes towards lessons (Fleming & Merrell, 2004).

The visual and performing arts offer students a perspective on how others identify, explain, and evaluate the meaning of their work. This concept teaches students to follow their ideas, maintain their vision, and be satisfied with their finished product (Reilly Michaud, 2014). Drama can help students understand different scientific theories and how scientists work (McGregor, 2012). A significant contribution and less researched area of drama pedagogy to this STEAM concept is Dorothy Heathcote's expert drama curriculum (Heathcote & Herbert, 1985). The 'Mantle of the Expert' methodology of this model - in the 1980s – in an undiscovered way by STEAM researchers, runs parallel to the current outputs of STEAM classrooms.

The use of drama in STEAM allows students to create social interactions and collaboration among participants (Dorion, 2009). Abed (2016) further discusses that drama can stimulate collaborative learning, which can increase students' motivation to learn science. However, even with positive attitudes towards drama in STEAM, there are challenges. Braund (2015) also argued for the possibility of misunderstandings occurring during the teaching process or during student learning. McGregor (2012) emphasized when using drama in science education, the need to combine mind and body to convey understanding.

Drama supports both the understanding of scientific concepts (Dorion, 2009) and the understanding of how scientists work (McGregor, 2012, 2014). Moreover, drama offers an opportunity to explore, investigate, and communicate scientific concepts (McGregor, 2012, 2014). Abed (2016) suggests that drama can promote collaborative learning, thereby increasing students' motivation to learn science. Reports by Alrutz (2004) and Abed (2016) confirm that drama is effective in stimulating students' interest in science learning. Cogswell and McLauchlan (2014) argue that drama is an effective teaching and learning tool that allows students to express themselves and communicate through art that complements cognitive responses.

In the figure below, we would like to highlight some approaches to drama-based activities and STEAM Education that aim to explore possible connections (Table 1).

Table 1. Possible approaches and connections to drama-based activities and STEAM education

Drama-based procedures	STEAM Education for development	Possible STEAM and Drama Education based project goals
The process of developing students' competence through dramatic activities	Promoting the diversity of group and individual participation in STEAM Education	New dimensions of course design by connecting the tools of two approaches
"The Mantle of the Expert" model by D. Heathcote in educational drama	The interdisciplinarity of the chosen learning topics, the experts involved in the project work together	Artistic, performative modalities in teaching, using an inter- and multimodality learning environment
Drama develops students' attention skills in the learning process and beyond. Drama can help students express themselves	The STEAM model gives students a broader perspective on how to learn to create a project	It focuses on how social and personal context can be developed using drama in STEAM Education
Drama-based pedagogy focused on equality and diversity	Participatory collaboration in STEAM project	An inclusive approach to the STEAM learning environment using drama
How do students learn about cooperation and competition in drama pedagogy classes?	How do STEAM activities engage students in taking responsibility for their own work?	How do dramatic activities engage the imaginative plans, ideas, actions and solutions of students who think about a better world?

METHODOLOGY

We used a qualitative method, in which participant observation was used as the main data collection tool during the pilot study. With this approach, we were able to actively participate in the observed situation, while simultaneously documenting our observations in several ways. Bernard (2006) explains the advantages of participant observation. First, the participant observation approach broadens the scope of the study, allowing for a wider range of data collection. Second, how the observer can seamlessly fit into the environment, and the third advantage is that this approach helps researchers ask relevant questions. The next advantage is a thorough understanding of the meaning of the data collected, and the final advantage is that the participant observation approach can address issues that are difficult to address with other data collection techniques.

Detailed field notes

Detailed field notes capture the depth and nuance of observed behaviours and interactions. During the research, we recorded the participants' activities and contextual information deemed relevant to the research focus. We used descriptive and reflective writing techniques to convey the observed events, capturing details that might not be revealed by other data collection methods. Field notes added narrative context to observed phenomena by providing insight into participants' perspectives and emotions.

Target group characteristics

19 first-year university students were interested in drama in education and participated in this study. Participants were selected based on their enthusiasm for drama-related activities and willingness to actively participate in the research. It is noteworthy that all the participants in this class were women, so this study introduces a gender aspect to the investigation. The subsequent decision to focus on first-year students was driven by a desire to explore the early stages of students' interest in drama education and to understand their interest in this field, which was evident early in their academic journey. This demographic can influence group dynamics, communication styles, and the overall experience of participating in drama education. The researchers approached the interpretation of the results with an awareness of the possible influence of this particular demographic composition on the study's outcome.

This qualitative study was conducted at ELTE University in Budapest, Hungary during a bachelor program class. This setting was chosen based on its significance to the research question, ensuring that the selected environment provided ample opportunities for observation. The setting was characterized by its relevance to the study's objectives and the natural occurrence of the observed behaviors.

The purpose of this art-based methods course. The student will gain experience on the principles and methodology of art-based pedagogical procedures and gain insight into the related pedagogical, and special education possibilities of adaptation and intervention. The student will meet the artistic intervention methods that are applicable in the fields of development, education, integration, and inclusion.

The aims of the art-based methods course. The student gains experience in the basic principles and methodology of art-based pedagogical procedures and gains insight into the related pedagogical and special pedagogic possibilities of adaptation and intervention. The student becomes familiar with artistic intervention methods applicable in the field of development, education, integration, and inclusion.

STEAM WORKSHOP DRAMA ACTIVITIES

This investigation goes through two different dramatic activities in science and history. The first activity was called "The Life Cycle of a Butterfly". In this activity, students were divided into groups of 3 and choreographed a dance or sequence of movements about the life cycle of butterflies. Before dividing the students, the researcher gave a short PowerPoint about the life cycle of a butterfly using photos. After, the students created and practiced their dance or movements for about 25–30 min. Finally, the students presented their silent dance or movements to the class, and it took about 10 min in total.

The second activity was "Indian Caste System", the students were given a short presentation about the Indian caste system with photographs and descriptions of each caste group. The students were then divided into groups of 4 or 5 and given the task of sketching a day in the life of a caste group in India. They had to make a set lasting at least 2–3 min; they were able to script or improvise their scene during rehearsal. Students had around 30 min to prepare and rehearse the set and then presented their scene to the class, which took about 10–15 min in total. To conclude the dramatic activities, students were required to reflect on the activity to explore their personal understanding, feelings, experiences, and insights (Fig. 1).

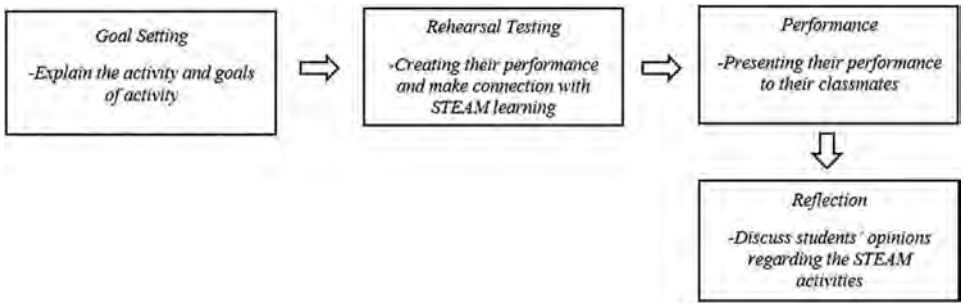

Fig. 1. Process of students conducting drama activity

FINDINGS

We obtained answers to RQ1 and RQ2 from the detailed field notes and observations from the activity and found four observations. The purpose of the observations was to analyse the process and try to visualize the importance of using drama in STEAM. Furthermore, the quotes are from the students' reflections regarding their perceptions of these two activities.

Our first observation was creativity where participants said that the drama activities made them more interested in the theoretical side of the scientific presentation of the activity. Both drama activities allowed the students to be creative and each group was very unique and showed their own version and understanding of the activity. One group used props, another group used their fingers to represent the life cycle, and another group used their whole body for movements.

One student remarked,

"*My favourite was when we had to illustrate in smaller groups how a butterfly was born. Once again, the creativity of the groups struck everyone, since each of us expressed the life stages of a butterfly in different and creative ways*".

Another student said,

"*I really enjoyed this activity because I was able to be creative and it was the same for my classmates. We were all doing the same activity, but we were doing it differently. It was fun to do something other than listening to the teacher explain the butterfly cycle*".

A student put it similarly,

"*I found the activity incredibly engaging and enjoyable. I was able to show my creativity with my classmates and it made the experience even more meaningful for them. Even though we were all working on the same activity, there were so many different approaches and performances. It was good to see different interpretations and perspectives from my classmates*".

According to McGregor (2012), incorporating drama in science increases student engagement in and facilitates understanding of challenging concepts. The shared feelings among the students highlight their unanimous appreciation of the activity. Their collective enthusiasm is focused on the opportunity to express their creativity together in smaller groups. The specific approach of each group created a diverse display of interpretations and performances.

It showcased the richness of individual perspectives that comes from collective experience. The contrast between dynamic, creative activity and traditional teacher-led explanations further emphasizes the students' preference for hands-on, participatory learning methods over passive teaching approaches. Together, these reflections emphasize the positive impact of interactive and creative activities in the classroom environment. Creative drama has been shown to be effective in a variety of educational contexts, including science education (Abed, 2016; Çokadar & Yılmaz, 2010). Incorporating creative drama into science lessons can be beneficial in developing divergent thinking skills, creativity, and oral and written communication skills (Hendrix, Eick, & Shannon, 2012).

In the second drama activity, the students were even more creative and each group presented an imaginative, short summary representing the Indian caste system. One group used the entire classroom space to represent the set and used all members of the group. Another group was very interactive and formed a dialogue throughout the sequence; another group decided to do the series without dialogue, just a physical representation of their caste. Furthermore, each group presented their activities in a different, artistic, and original way, applying the learned drama conventions.

A student indicated,

> "*The hierarchy of Indian culture had to be illustrated in small groups, and the creativity and versatility of the groups was again shown: some created dialogues, others non-verbally emphasized the hierarchy*".

The second research observation was that the activities facilitated group collaboration by generating different ideas and perspectives on the topic. One student mentioned,

> "*The activity showed the importance of working together and that each person brings something to the performance and we create something as a group or team. We had to work together to come up with the story*".

Another student put it this way,

> "*To create a performance or a play, you have to work together. We all needed group work for the activity to describe the caste system. We all discussed our ideas and tried to use them in our performance*".

Learning through drama promoted academic performance, motivation, positive attitude, and cooperation. We observed that the participants were worried about the language barrier. The students confirmed that they could use their native language among themselves to stay within a comfort zone, but they were able to step out of this comfort zone during the group reports. In addition, there was no time limit for each activity and the students did not feel the pressure to rush, however, this is not always the case, because time can also be limiting. All participants were able to perform during their activities, but during the preparation, the researchers noticed that not all students participated in the preparation before the lesson. The activities involved students working together and nearly every student participated, some more than others, but overall students were excited to come up with their ideas and work together to present their set and dance to their classmates. One female student explained her idea, instead of shutting her down, another student supported her idea and added her perspective. The students were not shy about expressing themselves, but their opinions and ideas about dance were acknowledged.

Table 2. Summary of research observations

Observation	Key findings in drama activity 1	Key findings in drama activity 2
1	Students demonstrated increased creativity leading to fluid interactions.	Students planned in small group dialogues and presented the characters in scenes to the whole class.
2	Students engaged in a dynamic and supportive learning environment.	Students demonstrated collaboration when creating the set.
3	The improvisational setting encouraged experimentation and "thinking out of the box" skills.	Students used problem solving skills to direct and create dialogue for their short set.
4	All students got involved, their motivation showed, and varied presentations were made.	The students showed enthusiasm when preparing their presentations.

The students have not known each other for very long, but working together allowed comfort, and after the presentations, the students reacted positively to each other and their work. In short, the students proved to be creative and collaborative creating unique and varied performances. The activity allowed the students to develop and use their imagination. Moreover, through dramatic forms, it was possible to promote different learning styles and interests among students (Alrutz, 2004).

The next research observation from these two dramatic activities was problem-solving and thinking skills. The students were supported by both the researchers, they were not afraid to ask for help or further explanation of the activity. Batdi and Batdi (2015) and Şengün and İskenderoğlua (2010) highlighted that creative drama involvement has significant positive effects on academic performance, creativity, critical thinking skills, affective range, and general attitude.

Our last observation category was the students' motivation and involvement in the activities. The students were enthusiastic in the performance and preparation of the two drama activities. The activity showed how the students feel more connected to the topic discussed, how they participate in the learning process, and how they feel motivated. Therefore, the students were excited to do the activities and did not feel pressured or nervous because they felt encouraged by the researchers during their preparation. After their presentations, the researchers gave positive feedback on each group's presentation (Table 2).

CONCLUSION

In STEAM education, drama allows the teaching and learning process to be enjoyable and motivates students to be interested in learning about the subject. Drama can be considered a valuable tool in STEAM education in the service of competence development. This pilot study demonstrated the relevance and significance of this teaching method in classrooms and its positive impact on student learning. Additionally, this study found that drama helped students learn a STEAM subject better and enjoyed it more than traditional learning methods. Students can be creative, express, themselves and work in groups to gain a better understanding of the topic. It was found that the students were more motivated to learn and were able to present the

themes in their own artistic interpretations. Drama has also been found to boost students' confidence and concentration in the teaching and learning process. Drama also helps teachers develop students' language skills by creating a safe and relaxed classroom atmosphere. Finally, drama makes the teaching and learning process enjoyable and encourages students to convey their ideas realistically or imaginatively.

Drama activities designed for math or science subjects are fun, active, and effective and promote visual activities that support student learning by achieving easy and fast learning. Drama activities in STEAM classes allow students to enjoy using tools and working in groups to become more motivated in a particular topic. However, the use of drama in the STEAM classroom also presents challenges, for example, not all students want or can participate, some students find it difficult to complete the activities, and lack time, experience, and confidence. Through a variety of interdisciplinary studies, both students and teachers in the STEAM classroom can experience the power of attention to the social environment and the importance of interdisciplinary teamwork. The latest research in this area also shows that the drama-based practice used in teacher training can promote many aspects of higher education (Cziboly, Lyngstad, & Zheng, 2021; Malinina, 2023). This pilot study shows that the distance between theory and real teaching can be overcome with drama-based pedagogy in teacher education.

However, we must acknowledge the limitations of this research, especially the relatively small sample of 19 students. The different representation of the participants, as well as the narrow demographic characteristics observed in terms of age, gender, and educational level, pose challenges for drawing definitive conclusions about the research questions. The participants' limited experience with STEAM education and drama-based pedagogy raises concerns about the generalizability of the results to the broader student population. It is essential to recognize that the outcomes and challenges identified in this pilot study may not fully capture the diverse perspectives of higher education students. The limitations presented underscore the need for caution in interpreting the results, emphasizing that the insights gained from this research offer preliminary understanding that should be validated and extended in future studies. The different representation of the participants, as well as the narrow demographic characteristics observed in terms of age, gender, and educational level, make it challenging to draw definitive conclusions about the research questions.

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