

TECHNICAL THEATRE: "SHE KILLS MONSTERS" WHITE PAPER

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SPECIAL THANKS

The lesson described in this paper was developed as part of the GoSTEAM@Tech Program, a collaboration partnership between Georgia Tech's Center for Education Integrating Science, Math, and Computing (CEISMC), K-12 school districts, and local community organizations. The GoSTEAM@Tech Program is generously funded by a private funding organization. This work would not have been possible without the dedicated teachers who designed and refined these lessons in their classes.

Suggested Citation: Kessler, T. C. & King, K. (2024). "Technical Theatre: She Kills Monsters." White Paper. <https://steam.ceismc.gatech.edu/research-and-evaluation/>

WHAT IS STEAM?

STEAM stands for Science, Technology, Engineering, Arts, and Mathematics, but can mean many different things. For example, some use the “A” in STEAM to represent different arts disciplines (e.g., visual arts, music, or theatre), while others use the “A” to represent broader ideas, like creativity, problem solving skills, or making [1, 2]. Some use STEAM as a way to engage students in STEM through arts projects, such that the arts play a supporting or “subservient” role [3]. Others see STEAM as a transdisciplinary approach to integrating different disciplines, with each discipline valued equally and receiving equal attention in instruction and assessment [4]. We recognize the validity of different ways of defining STEAM, their unique purposes, and the important role of teachers in defining the STEAM approach that works best in their classroom.

Because there is no cohesive definition for STEAM or established set of STEAM best practices [5, 6], we looked for “high-quality lessons learned” in the STEAM literature [7]. We drew on existing models of integration, including Bresler’s model of arts integration [3] and the National Research Council’s STEM integration framework [8] to develop our own working definition of STEAM. For us, high-quality STEAM instruction involves student-centered instructional pedagogies (e.g., project-based learning, problem-based learning, inquiry learning), group learning, and real-world application to increase cross-disciplinary content knowledge through learning goals for students in both STEM and arts disciplines [9]. We understand that implementing STEAM can be complex and challenging. Thus, we envision STEAM as a continuum, moving from low to high levels of integration, collaborative practices, and complexity of STEAM projects.

WHY STEAM?

STEAM is being used across the globe in an effort to improve student outcomes in STEAM disciplines [10]. Studies in K-12 settings have shown that STEAM can increase students’ STEM content knowledge, increase their intent to continuing studying or participating in STEAM, generate positive attitudes towards STEAM, and improve gender dynamics in the classroom [11-15]. With training and support, studies find positive pedagogical benefits for teachers, such as using authentic assessment, integrating technology in instructional approaches, and forming connections with resources and experts outside the school building to support STEAM instruction [16-18]. STEAM aligns well with approaches that allow teachers to step into a facilitator role, supporting student-led exploration, and to engage in collaborative relationships with their colleagues.

GoSTEAM@TECH

GoSTEAM@Tech is a professional development program designed to promote authentic integration of the arts into K-12 computer science, engineering, and invention instruction. The primary goal of GoSTEAM is therefore to create safe, interdisciplinary spaces where meaningful, cross-disciplinary collaborations can occur. Teachers from different disciplines, with the support of university-based coaches and Innovators-in-Residence, come together to design and implement novel STEAM lessons and initiatives in their schools. You can read more about the GoSTEAM@Tech program here: <https://steam.ceismc.gatech.edu/>.

TECHNICAL THEATRE: “SHE KILLS MONSTERS”

LESSON DESCRIPTION

Teachers at a STEM-certified high school in the metro-Atlanta area implemented a multi-week STEAM unit focused on technical theatre during the 2021-2022 school year, which was an expansion upon a 2019-2020 collaborative project between the dance and mechatronics teacher. Specifically, the 2021-2022 production was designed and implemented by four teachers: two theatre teachers, one audio/video technology (A/V Tech) and film teacher, and one mechatronics/engineering teacher. The production was based on a play by Qui Nguyen called, “She Kills Monsters,” which centers on the gaming world of Dungeons & Dragons [19]. The play tackles pressing social issues, as the protagonist navigates grief, high-school bullying, and sexuality.

Ultimately, the teachers aimed to incorporate STEAM through integrating STEM-focused subjects with various aspects of the theatre production. Teachers described the project as taking place primarily in out-of-class time as an extracurricular activity, though teachers referenced standards based on A/V Tech and Film, such as visual effects, lighting, sound, design, and filmmaking. Additionally, teachers incorporated geometry, chemistry, and mechatronics as students designed costumes and built sets.

Also taking place in 2021-2022, a group of seniors in an A/V Tech and film class produced a documentary of the play, which further integrated technology and film into the production. During the 2022-2023 school year, a different group of A/V Tech and film students edited and finalized the documentary as a part of their capstone project. In total, more than three terabytes of film were gathered, and students in 2022-2023 worked to edit the film down to a 30-minute documentary.

In both the stage production and documentary work, teachers aimed to help students explore the guiding question: “How do we design a world that parallels current society by embracing the audience experience to drive production design?”

Driving question:

How do we design a world that parallels current society by embracing the audience experience to drive production design?

LESSON IMPLEMENTATION

As a part of the “She Kills Monsters” technical production, four teachers began preparing in the fall of 2021. In preparation, they developed a costume design shop comprising of sewing machines, fabric, and

other necessary supplies. A large part of the preparation for the production involved working with an Innovator-in-Residence who specialized in fantasy and cosplay costume design. The Innovator's efforts during the fall semester included preparing the costume design shop and developing lesson plans to be implemented with students in the spring semester.

In the spring, the four teachers implemented the lesson with 28 9th – 12th grades students. Students worked either on stage as an actor or behind the scenes on set design, costume design, or A/V Tech. Students working backstage met at least once a week to participate in production meetings and to work on their deliverables, which were all handmade. While teachers and the Innovator helped to guide students through their efforts, they ensured students had *"artistic freedom"* to create costumes or sets of their choosing. The picture below displays an example of these deliverables, which include dragon heads used by characters in the production and the set designed to resemble castle walls.



As a part of the production, teachers integrated several AV/Tech and film standards, such as lighting, visual effects, sound, design, and filmmaking. Moreover, mechatronics was a key aspect of the costume and set design process, tying in engineering standards to create sets and costumes. For example, students utilized the engineering design process to consider methods for creating the dragon costumes pictured above. Utilizing the engineering design process provided students with an authentic application of the design process frequently present in theatrical productions.

Teachers also integrated additional STEAM subjects to the production, such as geometry, algebra, and chemistry. In particular, geometry and algebra were often used in costume design when working on sizing and patterns. Chemistry was also used in costume design, as students considered the oxidation and breakdown of materials as they created costuming pieces. Smaller lessons were implemented throughout the course of the spring semester regarding more specific technical skills, such basic sewing techniques.

The production required significant student ownership of their work, and the teachers and Innovator acted as supportive figures to troubleshoot issues or assist with specific tasks. For example, students

would often ask for particular materials, like metal to make armor, which teachers or the Innovator would purchase for the students. One teacher explained that for many students, their time working on the production became *“kind of a home away from home for some of those kids that were in there a lot,”* suggesting that students were committed and passionate in their work on the production.

In post-surveys gathered after the premiere of the production, students shared their favorite aspects of the lesson, which often included *“designing”* or *“brainstorming”* the deliverables for the production. In particular, students enjoyed *“getting to work on a big project”* and seeing the *“final product come together”* in the culmination of the production. As previously mentioned, the production was a significant undertaking, not only for the teachers, but for the students as well. Sometimes the *“tedious work on final details”* or disappointment if their deliverable *“did not end up being used”* were students’ least favorite aspects of the production. For some, the large scope of the project was their least favorite aspect because of *“how long it took.”*

Taking place in concurrence with the production, students in the A/V Tech class gathered footage for a documentary on the creation and implementation of *“She Kills Monsters.”* Students started filming about two weeks prior to the first dress rehearsal and were able to gather about three weeks of film. Documentary filming also included interviews with students participating in the theatre production, which were filmed in a film studio at the school. Because the production took place in the spring of 2022, the documentary efforts continued into the subsequent school year to give students time to finalize the documentary and incorporate footage from the production. Thus, during the 2022-2023 school year, four 12th-grade students taking an A/V Technology class continued the documentary production efforts of the 2021-2022 students. In particular, these students worked with the film captured during the production to put together a 30-minute documentary. The film editing was a part of the students’ capstone projects, and while the students worked collaboratively as a team to edit the film, each student had a specialized role on the team. The A/V Tech teacher integrated various standards into this project as well, including visual effects, lighting, sound, design, and filmmaking, especially when editing the film or conducting post-production interviews with teachers and students who worked on *“She Kills Monsters.”*

In focus groups at the conclusion of the 2022-2023 school year, students shared that by working on the documentary, they learned new technologies that they had not used before, such as *“Dolly’s and gimbals [for] more sophisticated projects”* or *“more advanced equipment with more 4K cameras.”* Though students were nervous to use this equipment at first, they realized it was important to *“go outside of [their] comfort zone, learn how to use this stuff, experiment with it, and kind of build [their] technique, build [their] technical expertise.”* Students also gained non-academic skills, such as collaboration and communication, as they were working closely together as a team. The team-aspect of the project required students to build *“chemistry in a way and kind of figuring out the whole documentary process and how like [they] were able to work together to put such a like, big, big video together with so much information.”* As the documentary was student-led, students had *“a larger voice”* when it came to working with their teacher, and the students indicated they feel prepared for *“what [they want to] do in the future with documentary film work.”* While not necessarily a part of the technical theatre production itself, the documentary captured the efforts of their peers in developing the play and was a component of the overall lesson, as it allowed students to capture the ways arts and engineering students and teachers collaborated on the production. The documentary is available to view here: <https://steam.ceismc.gatech.edu/126-2/gosteam-projects/she-kills-monsters/>.

CHALLENGES & RECOMMENDATIONS

There were several challenges experienced when implementing this lesson. Teachers expressed that while much of the production was student-led, there was still a lot of leg work and collaboration required from teachers to put on the show. The support of the Innovator was crucial in supplementing teachers' efforts. As the premiere got closer, the teachers explained that the Innovator had to put in extra hours and take work home to ensure everything was completed. In a similar vein, because the production was primarily an extracurricular activity, students needed to be accountable for completing projects in time for the final production. This was difficult for students, as they were balancing their schoolwork as well as ensuring their deliverables were ready for the premiere. These two examples show a need for ongoing communication between the teachers and students, related to time and task management.

Furthermore, the out-of-classroom nature of this technical theatre production displays teachers' abilities to leverage classroom standards to successfully develop a technical production. To implement a technical production, consideration of A/V Tech, film, mathematics, chemistry, and mechatronics standards are critical. Specifically, A/V Tech and film standards, such as visual effects, lighting, sound, design, and filmmaking, help to create a dramatic environment which points the audience to important scenes or helps cue the actors. Mathematics and chemistry standards are also necessary when developing costumes that both fit the measurements of the actors and maintain a realistic look and feel. Additionally, mechatronics standards, such as AC theory, electronic motors, hydraulic systems, and semiconductors, are useful in building intricate set designs and props. Teachers were successfully able to apply these standards to activities beyond the school day.

As the "She Kills Monsters" production utilized various tools, materials, and expertise, schools interested in implementing a technical production should consider the avenues of support or resources available at their school. For example, the Innovator guiding students with costume design for "She Kills Monsters" had eight years of experience in costume design, and specifically, in fantasy costume design. By having such a specialty, the Innovator was able to work with students on specialized costumes, providing tips and tricks to create realistic and quality costumes.

In terms of the documentary, there were some challenges when it came to the filming and editing. In particular, the A/V Tech teacher shared that there were *"two completely different documentaries"* produced by the group of students who filmed the documentary footage and the students who edited the final documentary the following school year. Schools interested in creating a documentary may want to consider the grade level of students participating in gathering and editing the film as, in the case of "She Kills Monsters," all of the students who gathered the documentary film footage graduated prior to any editing taking place.

In addition, while students described developing teamwork skills through the project, they also described challenges with collaboration. For example, in the end-of-year focus group, students described navigating challenges working with a peer who was not completing their tasks in a timely manner. These students explained that they had to find a new group member to pick up the extra work because of the disengaged team member. This issue highlights the importance of mentoring students in the development of communication and project management skills when working on such a labor-intensive project.

KEY TAKEAWAYS

The technical theatre work done to support the production of “She Kills Monsters” integrated multiple disciplines and required extensive collaboration between teachers and students, who brought their expertise and skills in engineering, performing arts, and A/V Tech. The support of an Innovator-in-Residence with costume design allowed for additional interdisciplinary connections and lightened the workload for teachers. For students, this project required an extensive time investment but resulted in a sense of gratification for many as they saw their work displayed in final artistic products, including the costuming, props, set design, audio and lighting works, and documentary film.

RESOURCES

Below are links to resources that may support implementation of similar STEAM projects:

[STEAM Pedagogical Approaches](https://steam.ceismc.gatech.edu/pedagogical-approaches/): A brief compilation of different pedagogical approaches for STEAM teaching. <https://steam.ceismc.gatech.edu/pedagogical-approaches/>

[She Kills Monsters Documentary](https://steam.ceismc.gatech.edu/126-2/gosteam-projects/she-kills-monsters/): A student-made documentary film about the production. <https://steam.ceismc.gatech.edu/126-2/gosteam-projects/she-kills-monsters/>

There are related lessons on the GoSTEAM@Tech website, which build on the skills and content described above:

[Animatronic Puppets](#)

[Cosplay and Electronics](#)

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