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The power of anime: using anime for education and outreach in STEM

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Anime is a powerful tool for science education and outreach, thanks to its popularity among younger generations and its greater accessibility. Anime conventions attract patrons from diverse generational, educational, and professional backgrounds, presenting a unique opportunity for public scholarship and for generating enthusiasm for science education. Anime Expo (AX), an annual convention held around the fourth of July in Los Angeles, is the largest anime convention in the United States and one of the largest in the world. AX 2025 hosted 410,000 attendees from 65 different countries. This event features a 3-days symposium of academic panels from the *Journal of Anime and Manga Studies* (JAMS). This work demonstrates that anime is a powerful tool for science education and outreach. The introduction discusses anime's tangible effects on global protest movements and the monetary and social impact of anime conventions on attendees and their hosting cities. The body of our work discusses how, for the past 3 years, "The Physics of Anime" panel has been presented at the JAMS@AX Symposium, and the success of this panel has yielded an excellent example of public scholarship and science outreach. Pre- and post- "Physics of Anime" panel surveys administered at the AX 2025 JAMS symposium revealed a strong preference for using anime to teach Science, Technology, Engineering, and Mathematics (STEM) concepts, especially among the current target demographic (20–30-years-olds). Overall, the majority of the survey participants expressed greater comfort with the subject matter. Specific details of the survey are the subject of this work.

KEYWORDS

science education, public outreach, popular culture, STEM education, anime, engagement

1 Introduction

Anime is commonly understood as being "animated media from Japan," though this definition has shifted given the rise of international animated media, like Netflix's *Castlevania*. Manga are commonly understood to be comic books and printed cartoons originating from Japan. Both anime and manga have gained extreme levels of popularity in the United States. According to a 4,275-person survey by popular culture publication, *Polygon*, 42 percent of Gen Z watch anime weekly ([Polygon Staff, 2024](#)).

A *Publishers' Weekly* report notes that manga sales have “quadrupled” since 2020, and that unit sales of manga in 2023 were “351% higher” than the same period in 2019 (Aoki, 2024).

Aside from its general popularity, anime yields a real-world power in its ability to unify people. During the 2011 student protests in Santiago, Chile, protestors were encouraged to contribute their “spirit energy” in a battle for guaranteed access to quality education (Diaz Pino, 2018). In the anime *Dragon Ball Z*, the main protagonist, Goku, defends the Earth against evil. Before using his ultimate move, his “Spirit Bomb,” he asks the citizens of Earth to lend him their energy in his bid to save the Earth from those seeking its destruction. During the Chilean protests, demonstrators engaged in a symbolic gesture in the spirit of the anime. The protestors passed about an enormous white sphere, “infusing” it with “spirit energy” to aid in the ongoing struggle and mimicking the sending of energy to Goku. Even more fascinating is that Goku himself asked the protestors for their assistance. A pre-recorded message from Goku’s voice actor was played, calling out to the crowd – “Listen to me everyone—it’s me, Goku. A strange force is putting the educational life of Chile’s inhabitants in danger. I’d like to request a bit of each of your energy so that every young person in this country can be guaranteed access to free, quality education. All you have to do is lift your hands” (Diaz Pino, 2018). Anime imagery was also used in the 2019 Hong Kong protests, with characters like the heroic protagonist Sailor Moon of *Sailor Moon* and Luffy of *One Piece*, shown defending children and protestors from police violence (Kovacic, 2024).

Beyond these dramatic examples, research on the COVID-19 lockdowns reveals that anime convention attendees rely heavily on anime conventions to maintain their social health (Alberto and Tringali, 2022). Nearly 70 percent of respondents stated that the closure of anime conventions affected their social lives negatively. “34% of respondents (n 408) reported that the absence of conventions “somewhat” affected them, while 35% of respondents (n 418) said the absence “noticeably” affected them.

A similar study during this time frame by Hoff (2024) found that cosplaying as anime characters online during lockdown allowed individuals to build and strengthen relationships. The Polygon Staff (2024) additionally found that among those who watch anime, two-thirds watch anime for “comfort and strength,” and nearly half watch anime “to pump themselves up.”

These examples reveal anime as a unique tool for community building and the sharing of ideas. Moreover, anime conventions, as social/potentially educational events, allow the discussion of these ideas in an open and friendly forum. Conventions are especially useful for outreach, as they allow presenters to interact with larger groups than those reached by more traditional outreach techniques.

2 Teaching and anime

Using anime as an instructional device is explicitly demonstrated in Waggoner (2024), Stirek (2024), and in the presentations of Rudes (2025) and Altiok (2025) at the JAMS@AX25 academic symposium. Waggoner uses anime to encourage students to engage in self-development using anime characters as models for analysis. Stirek’s course involves aspects of anime production, including art and story creation. Rudes (2025)

uses horror manga as a tool to teach social and emotional health. Altiok (2025) proposes using anime to address social tolerance and extremist beliefs by drawing on the concept of the “monster” as it is portrayed in anime.

Popular culture in educational instruction has been a subject of several studies. Duff (2003) examines the intertextuality or discursive hybridity (the blending of different genres or styles) associated with spontaneous pop-culture references in two Canadian high school humanities courses. Results of the study were mixed; while pop-culture references facilitated discussion among English-proficient students, they also alienated newcomers, thereby suppressing discussion. Andenoro and Ward (2008) studied leadership development by dissecting popular culture. The inclusion of popular culture enabled instructors to be more dynamic in their approach to education, enhancing their interactions with millennial students. Overall, the study’s findings revealed a positive impact on student education, particularly on their critical thinking and communication skills. In the article by Marsh (2006), data from a longitudinal study of the attitudes, beliefs, and experiences of preservice teachers regarding the use of popular culture in the educational sphere are subjected to a Bourdieuan analysis. The article concluded that the ingrained “habitus” of their curriculum suppressed the inclination to use popular culture in education, but also revealed some issues contributing to the ongoing debate of the role of popular culture in education, as it has some influence on how students perceive and interact within their environment.

Discussing science, technology, engineering, and mathematics (STEM) with anime is a relatively new concept. While this subject is mentioned in Risdianto et al. (2024), it primarily focuses on its use for informal learning and encompasses other genres, such as science fiction movies. However, this idea is compelling, since many anime fall within the science fiction or superhero genres. Superheroes provide an interesting framework because their abilities are rooted in physics. In science fiction anime, much of the action takes place in locales associated with or inspired by outer space. Moreover, anime in STEM aligns with other popular cultural references, including Star Wars and Star Trek. A notable example of merging education and popular culture is the book “The Physics of Superheroes,” first published in 2005. In this work, the exploits of familiar superheroes, such as Superman and the Flash, are used to introduce and explain fundamental physics concepts. Now in its second edition, this book has received widespread acclaim and been translated into multiple languages.

3 Science in comics and anime

Charles Day, in a 2018 *Physics Today* article titled “Physics in Comic Books” (Day, 2018) discusses the two highest-grossing movies of the year, *Avengers: Infinity War*, and *Black Panther*. In addition to their popularity, he points out not only the inclusion of scientists (especially physicists) but also the emphasis on them as central characters and heroes. His listing is a Who’s Who of characters: Tony Stark (A.K.A. Iron Man), T’Challa, the Black Panther of Wakanda, who also serves as the ruler of his nation, and Dr. David Bruce Banner, also known as the Incredible Hulk.

When Stan Lee started Marvel Comics in 1961, his goal was to make his characters relatable. While as heroes they are expected

to defend society against villains, they still have very human issues to deal with. An example of this type of character is Peter Parker, A.K.A. Spider-Man. Before his “accident,” Peter was an awkward High School Student, soon to be a college student. After the accident, he’s far more powerful, but still the awkward kid at heart. He’s also exceptionally gifted in science, so much so that he builds his own web-shooters in his comic and later Marvel Cinematic Universe (MCU) incarnation.

Emphasizing science in the comics has always been important. Reed Richards, the leader of the “First Family of Marvel,” The Fantastic Four, is portrayed as a polymath and one of the most intelligent people on Earth and in the universe. In the DC Universe, Bruce Wayne (Batman), while a brilliant athlete and a supreme hand-to-hand combatant, is respected even more for his expertise across multiple scientific fields and his deductive reasoning skills. Even in comics, proficiency in STEM fields is highly regarded.

There have also been efforts to engage in STEM outreach directly through comics. One example is the introduction of *Spectra: The Original Laser Superhero*, as part of Laserfest, a celebration of the fiftieth anniversary of the discovery of the laser. In a 2016 SPS Observer article, “*Comic Book Physics: Enlightening Science For All*,” Spectra’s origin and background are discussed. In addition, a seven-person panel convened at ComicCon directly addressed the issue of using comics for STEM education. The panel, moderated by Tracy Edmonds, consisted of several educators and industry members including:

- Becky Thompson - former head of APS outreach and author of *Spectra*
- Mairghread Scott -science fiction writer and script coordinator for the *Transformers Prime* Comic Series
- Jim McClain creator of the *Solution Squad* Math Comic

The panel discussed the efficacy of comics over traditional textbooks in engaging readers. One of the panelists, Mairghread Scott, stated that “science gets linked to the idea of “exceptionalism,”” which makes it seem exclusionary. In more traditional comics, only a few “geniuses” have their brilliant moments. In reality, science is more progressive and iterative, and collaborative, which is what STEM-focused comics seek to impart.

Traditionally, anime has also emphasized the power of science. A recent example is *Dr. Stone*. At the beginning of the anime series, an unidentified “wave” of energy washes over the Earth, petrifying the entire human race, setting the stage for the story. 3,700 years after this event, a polymath named Senku uses his scientific and engineering skills to bring humanity back from the Stone Age. He uses his know-how to make light bulbs using a vacuum tube and a piece of charred bamboo, accurately pointing out that Edison’s first filament was a piece of carbon paper.

Early on in anime, particularly in science fiction franchises, the role of a scientist is central to storytelling. In the *Macross Saga*, known in the United States as *Robotech*, Doctor Emil Lang’s role was crucial in adopting alien technology to defend Earth against Zentradi invaders. In an earlier series, *Space Battleship Yamato* (US name “*Star Blazers*”), Shiro Sanada, the Science Officer and Executive Officer of the Yamato, is often called upon for his expertise to help the crew out of difficult situations.

Another interesting feature of anime is the prominence of women in STEM roles. While Shuri seems to be the sole example of a female scientist in the MCU, the same cannot be said of anime. In “*Steins; Gate*,” Kurisu Makise, a young female researcher, is one of the main characters and the most scientifically competent in the story. In “*Rascal Does Not Dream of Bunny Girl Sempai*,” Rio Futaba, the sole member of the school science club, posits scientific explanations for some of the events that occur, and describes her bout of “adolescence syndrome” using principles of quantum teleportation. In a very recent anime series, “*The Apothecary Diaries*,” the main protagonist, Mao Mao (also called Xiao Mao because of her catlike characteristics), is portrayed as a sometimes aloof but brilliant chemist and detective.

Interestingly, manga, the Japanese counterpart to American Comics, found its way into STEM education and outreach. The NASA-supported Coupled Ion Neutral Dynamics Investigation (CINDI) mission featured several manga issues that described the science and instrumentation involved. In addition, at the Fall, 2010 American Geophysical Union General Assembly, a table in the exhibit hall featured one of the mission scientists, Dr. Angeline Burrell, cosplaying as the android dog-catching space girl CINDI and serving as the mission mascot (NASA, 2010). This effort received very positive feedback from both educators and NASA, particularly for its emphasis on female participation in STEM.

In many ways, anime seems to have a head start on overturning traditional roles. Strong female protagonists in anime are more common than in American Comics and are generally well-developed. In addition, members of the LGBTQ community play a significant role in anime fandom. Thus, anime’s popularity across diverse societal groups makes it an excellent tool for STEM education and outreach, as well as in other subjects.

4 “The Physics of Superheroes” survey course

In 2019, an opportunity arose to teach a class in conceptual introductory physics. The textbook chosen for the course was “*The Physics of Superheroes* 2nd edition” by Professor James Kakalios. A syllabus was composed (Gomez, 2019), using the outline of the book, and thus began the “Physics of Superheroes” class at St. Mary’s University in San Antonio, Texas. The class started as part of the St. Mary’s Core (SMC) curriculum, which aimed to provide students with a well-rounded educational experience. The first two chapters of the book focus on the exploits of Superman. The first unit discusses Newton’s laws of motion using the fact that in 1938, in Action Comics #1, Superman could not fly, but was abnormally strong. From this starting point, the laws are discussed using his ability to “leap tall buildings in a single bound.” Gravity is the focus of the second chapter, from the Newtonian perspective, and is used to explain his strength.

During the semester, multiple subjects are covered including:

- Impulse, momentum and the origin and effects of dissipative forces
- The properties of normal (baryonic) matter
- Fluid Mechanics and Simple Harmonic Motion
- Einstein’s theory of Special Relativity.

- Energy Conservation and the Laws of Thermodynamics
- Conduction, Convection, and Phase Transitions
- Electrostatics and Electrodynamics
- Electromagnetism and its connection to light
- Atomic Physics
- Quantum Mechanics
- Quantum Tunneling

One of the most interesting and entertaining lectures is the one on Einstein's Theory of Special Relativity. The hero investigated in this lecture is The Flash. In particular, length contraction and time dilation are concepts of extreme focus.

As a final project, students are assigned a hero or villain and a power. Then, using the physics they've learned during the semester, they prepare a 5-min presentation describing a mechanism by which their character's power can manifest. Levels of effort vary, but students who engage fully in the process produce amazing, imaginative presentations and seem to enjoy the work.

This course has since moved from the SMC curriculum and is now a physics course. The apex of popularity was 2019–2022, as the Marvel Cinematic Universe reached its crescendo. Additionally, streaming programs like "The Boys" and "Invincible" on Amazon Prime adopted a more adult-themed approach to superheroes, which increased viewership. Since that time, superhero-themed movies have declined in popularity.

However, the rising popularity of anime and its accessibility have warranted a new look at the medium. The flow and inspiration of this classwork inspired the "Physics of Anime" panel presentations. Starting in Spring of 2026, the course will change to "The Physics of Comics and Anime" and will feature new material. Teaching this course and attending panels at anime conventions inspired the "The Physics of Anime" panel presentation.

5 "The Physics of Anime" presentations

The first "Physics of Anime" Panel Presentation took place in 2021 at the San Japan Anime Convention in San Antonio, Texas. Since 2023, "The Physics of Anime" has appeared at the Journal of Anime and Manga Studies Symposium at Anime Expo (JAMS@AX). On all occasions, including the last presentation at Anime Expo 2025, this panel filled the presentation hall and had to turn away over 200 potential attendees at the door. A picture of the 2025 panel presentation is shown in [Figure 1](#).

The panel focuses on discussing physical phenomena using accurate or semi-accurate depictions in animated features. Using anime as a discussion tool is intended to lower the barriers to learning by inviting engaging conversation about the subject. For example, learning the rudiments of time dilation and length contraction for special relativity is more fun when it's done while discussing the trials and tribulations of Noriko Takaya in the 1988 anime OVA series *Gunbuster*. Other discussions in the panel have included:

1. Quantum Mechanics using "*Steins; Gate*" and "*Rascal Does Not Dream of Bunny Girl Sempai*" – *Steins; Gate* provides a framework to discuss the Many-Worlds Interpretation of

Quantum Mechanics, while *Rascal Does Not Dream of Bunny Girl Sempai* can be used to discuss quantum teleportation and the principles of measurement of a quantum system.

2. Special and General Relativity using "*Gunbuster*," "*Robotech*," and "*Battle of the Planets*" – *Gunbuster* provides excellent examples of time dilation and the effects of traveling at relativistic speeds. *Battle of the Planets* is used to discuss matter-energy conversion, and *Robotech* can be used to examine more exotic phenomena, such as space folding and its implausibility.
3. Electromagnetic Acceleration and Magnetic Levitation using "*Akira*" – *Akira* is an essential anime in the United States and around the world, so its inclusion is popular with most panel audiences. Kaneda's motorcycle is an iconic symbol of the anime, and its behavior is only explainable using the principles of magnetic acceleration and levitation.
4. The Electromagnetic Spectrum and the James Webb Space Telescope using "*Blue Submarine No. 6*" – The title vessel, *Blue Submarine No. 6*, navigates using the "Lorenzini System," analogous to the Ampullae or Lorenzini, used by sharks and other cartilaginous fish to detect the weak electric fields of other animals. Unlike other submarines that use sonar, *Blue Submarine No. 6* navigates and fights using the Electromagnetic Spectrum.
5. Lunar Surface Physics with "*Gundam*" – The problem with lunar dust. *Gundam* facilitates discussion of certain features of the lunar surface, including its interaction with the Solar Wind, behavior within regions of lunar swirls, and hazards to astronauts operating on the moon.
6. Space and Solar Physics using "*Planetes*" – Used in the latest instance of the panel, *Planetes*, set in the year 2075, presents accurate scientific storytelling alongside relevant social and industrial commentary. Prolonged Radiation Exposure and other space-based effects on humans are presented alongside very relevant concerns, such as space debris buildup and issues surrounding human colonization of the solar system.

In all the presentations, the format involved presenting the anime and physics reviews, followed by a 10–15-min "office hours" session in which the panelists answered questions about science, career choices, academic advice, and anime recommendations.

For example, the Original Video Animation (OVA) series "*Anno (1988)*" was used to discuss the theory of special relativity. In the second episode of the series, two events in particular facilitate the discussion of time dilation:

1. Noriko Takaya's (the series protagonist) father has been missing in action. In the second episode of the series, she encounters her father on the bridge of the Luxion, 7 years later. However, only 2 days have passed for him.
2. Later in the episode, a 12-s delay during a combat operation causes her to return to Earth 3 months over schedule.

Firstly, the discussion turns to the understanding that massive objects require infinite energy to move at light speed, which allows discussion of relativistic kinetic energy and how it differs from classical physics. After addressing the inaccuracies, the conversation turns to whether the physics is accurately treated,



FIGURE 1

The Physics of Anime Panel at JAMS@AX 2025. For the third consecutive year, the academic panel filled the lecture room. Photo by Billy Tringali.

which leads to a discussion of light cones and how moving at significant fractions of the speed of light alters how an individual experiences time.

There are also anime that directly address significant science issues in a very accurately. “Nakagawa et al. (2006)” is an animated series set in the year 2075. During this time, humankind has established habitats in Earth orbit and on the moon. A human-crewed mission to Jupiter is also planned and developed during the course of the series. Human space travel, a current issue of societal interest, is a central topic in the series, along with its hazards: space debris, radiation exposure, and the perils of space weather. In the most recent “Physics of Anime” panel presentation, the topic of space weather and its effects on terrestrial infrastructure was discussed, with examples including the Carrington event of 1859, the Great Geomagnetic Storm of March 1989, and the most recent Gannon Storm of May 2024.

Evidence of the panel’s effectiveness came from post-panel “office hours” attendance. All three post-panel discussion periods (2023, 2024, and 2025) lasted nearly twice as long as the predetermined time limit due to audience interest in the subject matter. The interest displayed in 2023 and 2024 prompted the panelists and the convener of the JAMS@AX panel series to include pre- and post-panel surveys with the 2025 presentation. The survey’s description and its results are in the following section.

6 The JAMS@AX 2025 surveys

The “Physics of Anime” surveys conducted at JAMS@AX2025 were administered via QR codes displayed on presentation slides. Thus, participation was entirely voluntary and limited only to panel attendees. Two surveys were administered, one before the panel and one after the panel. The after panel survey had only one question. The pre-panel survey consisted of ten questions. The questions were:

1. What is your age range?
2. Are you aspiring to become, or did you major in science, technology, engineering or mathematics?
3. Is this the first time you’ve been to Anime Expo?

4. Is this the first time you’ve attended a Physics of Anime lecture?
5. How interested are you in science?
6. How accessible do you think science is?
7. Given the opportunity, would you take a full-semester course on science if anime were the basis of discussion?
8. Rank your favorite genres of anime.
9. How many conventions do you attend, on average, per year?
10. What is the primary reason you attend anime conventions?

The post-panel survey posed a single question:

1. After having attended this lecture, how has your opinion on science changed?

The pre-panel poll had 262 respondents, while post-panel responses were reduced to 177, 85 fewer. The post-panel survey QR code shared during office hours ensured that responses were limited to actual panel attendees. The pre-panel and post-panel survey results are shown in the following sections.

7 Pre-panel survey results

7.1 Age ranges

Survey responses were limited to seven age categories: under 18, 18–24, 25–34, 35–44, 45–54, 55–64, and 65–74 years of age. Of these age ranges, 120 attendees came from the 25–34 years age group, which accounts for 46% of the respondents. The next largest was the 18–24 age group, with 93 attendees (35%). Figure 2 provides a visual representation of the age distribution of the panel attendees.

7.2 Aspiring practitioners of STEM?

The survey responses were limited to yes or no responses. Of the group, 66% (173 respondents) answered “yes” to this question, while 34% (89) responded “no.”

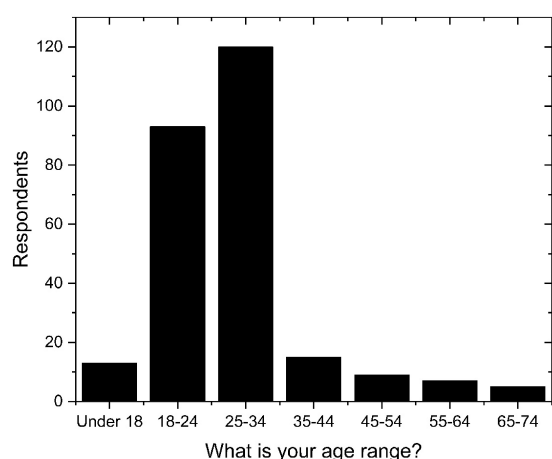


FIGURE 2

Age distribution of panel attendees. The majority of attendees came from the 18–24 and 25–34 age groups.

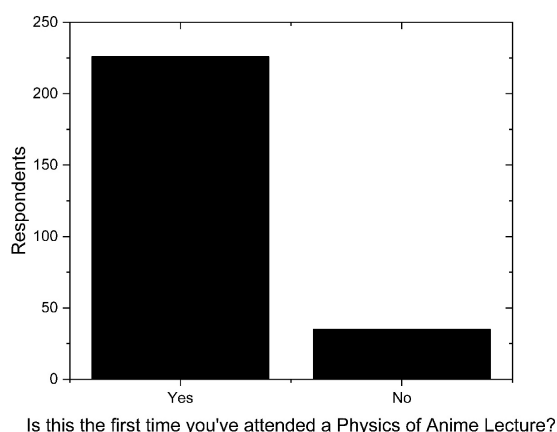


FIGURE 3

“Physics of Anime” panel first-time attendees. This instance of the panel was the first exposure for a significant fraction of the audience.

7.3 First time at Anime Expo? First “Physics of Anime” Lecture?

Again, survey responses were limited to “yes” or “no” for these two questions. Although not evenly divided, 44% of respondents indicated that this was their first time attending Anime Expo. 56% were return visitors.

However, a significant majority (226, 87% of attendees) answered that this instance was the first time they had attended the panel. Thirty-five respondents (13%) were return attendees. [Figure 3](#) displays the distribution between “first-time” and “returning” attendees to the “Physics of Anime” panel.

7.4 Interest in science?

Survey responses were limited to four choices: Very interested, Somewhat interested, Somewhat disinterested, and

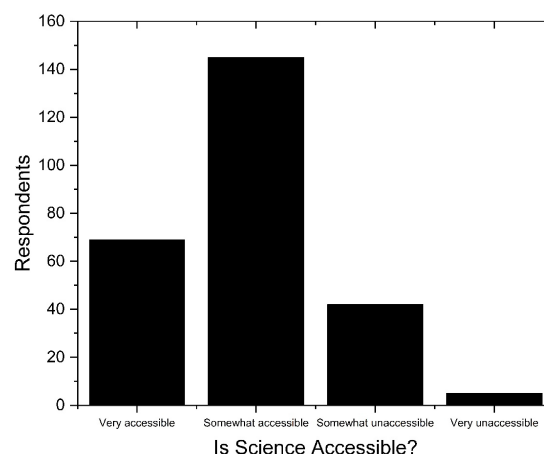


FIGURE 4

The accessibility of science. Before the panel presentation, more than half of the attendees perceived science as “Somewhat Accessible.” A significantly smaller fraction of the audience viewed science as unaccessible.

Very disinterested. Of the 262 responses, 65% indicated strong interest in science. 33% responded as “Somewhat interested,” while small portions –1% and 2%, respectively– responded as “somewhat interested” and “very disinterested.”

7.5 Is science accessible?

Survey responses were limited to “Very accessible,” “Somewhat accessible,” “Somewhat inaccessible,” and “Very inaccessible.” Of the 261 responses to this question, 26% responded with “Very accessible,” while 56% responded with “Somewhat accessible.” 16% responded with “Somewhat unaccessible,” and 2% with “Very unaccessible.” [Figure 4](#) provides a graphical representation of the differing attitudes toward science accessibility before the panel presentation.

7.6 Would you take a full-semester anime-discussion-based science course?

Survey responses were limited to “Yes” or “No.” Of the 260 responses to this question, a significant majority (206, 79%) responded with “Yes.” Fifty-four of the responses were “No.”

7.7 Favorite anime genres

Respondents were asked to rank the following anime genres: Action/Adventure, Comedy, Science Fiction, Drama, Horror/Thriller, Slice of Life, Isekai, and Sports. After tallying the 255 responses, Action Adventure anime emerged as the most popular genre, with 121 first-place votes (47% of respondents). The second most popular genre of the group was Science Fiction with 43 first-place votes (17% of respondents). In last place, with three first-place votes (and 121 last-place votes) was sports anime.

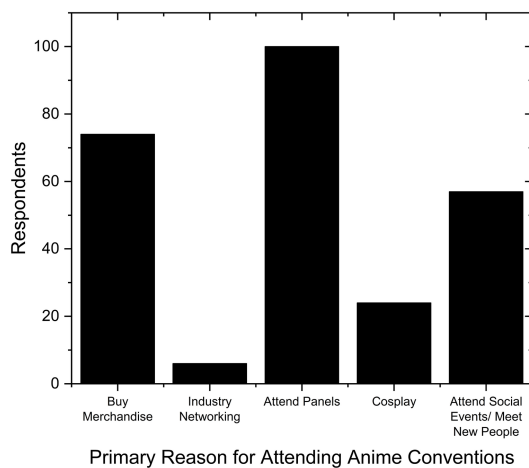


FIGURE 5

Primary reason for attending anime conventions. A large percentage of survey respondents indicated that “attending panels” was their primary reason for attending anime conventions.

7.8 How many conventions per year?

Responses were limited to 1, 2 – 3, 3 – 4, and “4 or more.” Of the 261 responses to this question, 165 (63%) responded with attending only one per year. 29% responded that they attend 2–3 per year. 5% of the respondents attended 3–4 times per year, and 3% attended more than four times.

7.9 Primary reason for attending anime conventions

Responses were limited to the following choices:

- Buy Merchandise
- Industry Networking
- Attend Panels
- Cosplay
- Attending social events/meeting new people

These survey results are shown graphically in [Figure 5](#).

Of the 261 responses, 100 (38%) selected “attend anime conventions to attend panels.” 28% and 22% responded with “buy merchandise” and “attend social events.” Of the remaining choices, 9% selected “cosplay,” while 2% selected “industry networking.”

8 Post-panel survey results

The post-panel survey asked whether or not science seemed more accessible after the panel presentation. Responses were limited to:

- I find science to be more accessible.
- I find science to be less accessible
- My opinion on science has not changed.

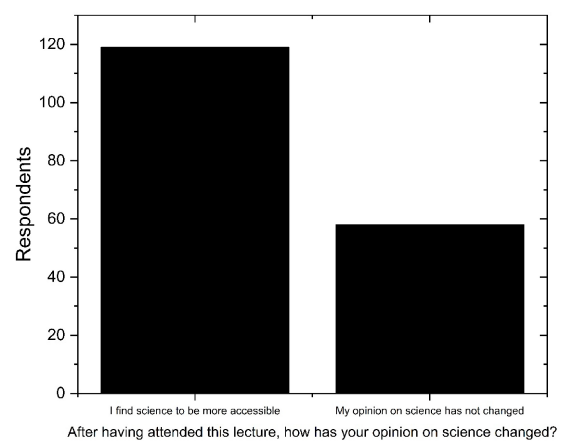


FIGURE 6

Following the panel presentation, more than two-thirds of attendees found science to be more accessible. No negative responses were recorded (not shown).

The post-panel survey results are shown in [Figure 6](#).

Of the 177 responses, 67% reported that they found science more accessible after attending the panel, while 33% did not change their opinion. None of the respondents reported that science became less accessible after the panel presentation. The distribution of these results is seen in [Figure 5](#).

9 Discussion of survey results

One of the more interesting survey findings is the number of first-time panel attendees. “The Physics of Anime” panel has occurred at Anime Expo since 2023, and while 35 indicated they were “return attendees,” a significant majority were first-timers. This finding suggests a growing reputation and popularity of the panel in the AX community.

Anime’s popularity among younger demographics (18–24 and 25–34 years olds) provides significant connectivity with current or future college students, including those aspiring to attend graduate school. In addition, the response to pre-panel question #7 (a science course using anime as a discussion device) was overwhelmingly positive.

Outreach is crucial in a society where scientific knowledge changes rapidly. However, scientists conventionally rely on technical language and jargon specific to their field. The challenge then is to make science more accessible and relatable to the public. Anime, as an outreach tool, provides presenters with a point of connection with individuals they would not otherwise interact with. In addition, the popularity of anime conventions and anime at comic conventions enables presenters to interact with large groups in a setting that is still considered discussion-friendly.

Of particular importance to this point are the results from pre-panel survey question #6 and the post-panel survey question. To recap, 145 panel attendees indicated that science was “somewhat accessible” before the panel presentation. However, 67% of the 177 respondents to the post-panel survey reported that they found science more accessible after the panel. This result presents an

encouraging turnaround in the attitude toward science, at least after the panel, which is crucial to fruitful science discourse.

10 Conclusion

Science education and outreach are complex undertakings, and when engaged, scientists often fall back upon technical language to describe their work. In response, the layperson or introductory student, unfamiliar with the language, sees the scientist as an information hoarder or as a member of the “white tower” academic community. The key is to establish a sense of commonality, or even camaraderie, between the communicator and the audience.

While popular culture has been engaged with extensively with a tool for potential STEM education, with articles in the Journal of Chemical Education highlighting video game examples like Fortnite’s “slurp juice” (Dietrich et al., 2021), and James Bond (Last, 1992) appearing as recently as 2012, and as historically as 1992, less attention has been paid to the physical site of the fan convention as a point of public scholarship and STEM outreach, the goal of this paper is to highlight the anime fan convention as a unique place for public scholarship and outreach.

Currently, there are no anime conventions in Europe or Japan that host academic tracks coordinated by academics. There is, however, an exciting initiative funded by the German Research Foundation regarding anime and data science. The Japanese Visual Media Studies Graph pulled hundreds of thousands of lines of data from many anime-related sites to create a complex, searchable database of anime-related data for information and data science-related projects¹. Ed Hoff, in his presentation at the JAMS@AX Symposium 2024, discussed the vital importance of anime and cosplay for the success of small businesses in rural Japan, noting that tourists visit these areas solely because they are associated with particular anime (Page 249)². But the real-world impact of anime is not only on American and European audiences, Cong Wan highlighted Chinese fan motivations to visit Japanese marathons due to their enthusiasm for the anime *Run with the Wind*³. And even Japanese fans of anime cannot escape its real-world reach, with Japanese fans of *Attack on Titan* traveling to the German town of Nördlingen due to its looking like fictional towns in the anime⁴.

Anime conventions, both large and small, attract patrons from diverse backgrounds. However, these patrons are united by their shared interest in a very popular, now very accessible medium. Anime conventions thus provide an excellent opportunity for public outreach and education, not limited to STEM fields, as shown by the diverse programming of the JAMS@AX academic panel series. However, the results of this research, combined with the panel’s popularity, demonstrate that anime is a practical and entertaining tool for making science and physics more accessible than ever before.

Statement of significance

The object of this article is to show how anime’s popularity and availability augment the effectiveness of STEM education and science outreach. Survey results from a recent panel at the Anime Expo convention are used to support the conclusions. In addition, sample anime are suggested as a starting point for interested parties.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found below: https://drive.google.com/drive/folders/1p8psaTGZZJ8B_h1YnYidSDp6ZrW2lLfw?usp=sharing.

Ethics statement

The results in this work were obtained from an anonymous survey administered by displaying QR codes before and after the panel presentation. Survey participation was voluntary and not coerced. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

Author contributions

RG: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. BT: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – review & editing. CB: Investigation, Methodology, Resources, Validation, Writing – review & editing. KS: Methodology, Resources, Writing – review & editing.

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¹ <https://jvmg.iuk.hdm-stuttgart.de/about/>

² <https://iopn.library.illinois.edu/journals/jams/article/view/1803/1473>

³ <https://www.mechademia.net/wp-content/uploads/2025/05/Mechademia-2025-Program-updated-20250527-FINAL.pdf>

⁴ <https://www.participations.org/17-02-14-thelen.pdf>

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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