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Students' Ability to Distinguish Fact Vs Fiction from A Science Fiction Film

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Abstract

In an age where media consumption is pervasive, students are frequently exposed to speculative fiction films that blur the lines between science and fantasy. The ability to critically assess these depictions is essential for developing scientific literacy and analytical thinking. This study investigates students' ability to distinguish fact from fiction in speculative fiction films and examines the role of prior scientific knowledge in this process. A quasi-experimental design was employed with 40 students divided into two groups of 20 each. Both groups watched the bullet curve sequence from the film Wanted (2008) and answered questions about the realism of the scene. One group received instruction on Newton's laws of motion prior to viewing, while the other did not. The research aimed to determine whether prior knowledge of scientific facts influences students' ability to distinguish fact from fiction and to explore if film exposure interacts with such knowledge. Results were analyzed using a t-test, revealing a significant relationship between scientific knowledge and the ability to discern realism in speculative fiction. The findings suggest that prior knowledge of scientific concepts enhances students' critical thinking and media literacy, highlighting the importance of integrating science education with media analysis.

Keywords*: Science Fiction, Student Understanding of Science, Experimental Research, Fact vs Fiction, Science Education.*

I. Introduction

Science fiction films have always been a source of fascination for students and young audiences. These films often blend imaginative storytelling with scientific concepts, sometimes making it hard to separate factual information from fictional elements. While these movies are meant for entertainment, they can influence the way students perceive science. For instance, some may believe fictional technologies or events shown in movies are real, leading to misunderstandings about science.

The idea for this study came from the observation that students often discuss science fiction movies with excitement but sometimes confuse fictional elements with actual scientific facts. Teachers and educators have also noticed that such movies shape students' understanding of science, sometimes in ways that are not accurate. This raises the question: how well can students differentiate between what is fact and what is fiction in such films? This research aims to explore this ability and understand whether science fiction films impact students' knowledge of science.

1.1 Fact vs Fiction

The distinction between fact and fiction has always been a critical aspect of understanding any form of storytelling, particularly in the realm of science fiction. Fact refers to information or events that are based on objective reality and supported by scientific evidence, while fiction involves imaginative or speculative elements that may not align with reality. Science fiction films often merge these two realms, presenting futuristic technologies, space exploration, and advanced scientific phenomena alongside entirely fabricated narratives. While this combination makes these films captivating, it also creates challenges in distinguishing what is real from what is purely imaginative.

Separating fact from fiction in science fiction films can be particularly complex for students. These films often incorporate real scientific principles but exaggerate or modify them to fit the storyline. For instance, concepts such as time travel, interstellar travel, or genetic modification are rooted in scientific theories but are often dramatized beyond what is currently possible or scientifically accurate. This blending of truth and imagination can make it difficult for students to discern what is achievable based on current scientific understanding and what remains speculative or fictional.

1.2 Background and context of the research

In an era of misinformation, distinguishing fact from fiction is critical for students, particularly when interpreting science fiction films that blur scientific accuracy. Research suggests factual knowledge (e.g., understanding Newtonian physics) aids in differentiating real science from fiction in media. Sci-fi films influence viewers' beliefs about science and technology (Nisbet, Brossard, & Kroepsch, 2003) and shape understanding of scientific concepts (Durant, Evans, & Thomas, 1989), emphasizing the need to study how prior knowledge interacts with media interpretation. Exposure to sci-fi films impacts attitudes toward science and technology (Nisbet et al., 2003), highlighting their potential role in promoting scientific literacy and STEM interest. Investigating how factual knowledge shapes students' ability to discern accuracy in sci-fi films can inform science education and media literacy programs.

1.3 Objectives of the study

The topic of this study directly addresses the main objective of this study. **The main objective of this study is to measure the relation between the factual knowledge of students and their ability of detecting facts and fiction in the visual media.** A quasi-experimental design is employed to collect the data. This study is an attempt to measure the strength of the mental shield

that science education provides to students when countering the misinformation. There is no doubt that science fiction inspires real life technology, but at the same time, it attracts unwanted harm when people try to imitate what's been shown in the film or Television.

Following are the main objectives of this study:

1. To study the effectiveness of theoretical knowledge on students' ability to distinguish fact vs fiction from a science fiction film.
2. To analyze the students' ability to differentiate between facts and fictional concepts in science fiction films.

1.4 Statement of the problem and research questions

The problem addressed in this research paper is whether factual knowledge about science concepts affects students' ability to distinguish fact from fiction in science fiction films. Given the importance of media literacy and scientific literacy in the 21st century, it is important to investigate how students make sense of science fiction films and the role of prior knowledge in this process.

Research has shown that students' prior knowledge can play an important role in their ability to differentiate fact from fiction in media. In particular, understanding of scientific concepts such as Newton's laws of motion may be relevant for interpreting the scientific accuracy of science fiction films. Previous research has suggested that science fiction films can impact viewers' beliefs and attitudes about science and technology (Nisbet, Brossard, & Kroepsch, 2003), highlighting the need for further research into how students make sense of these films. Furthermore, understanding how prior knowledge and beliefs impact students' interpretation of science fiction films can have important implications for science education and media literacy.

This research will address the following research questions:

(1) Does prior knowledge of scientific facts have a significant effect on students' ability to distinguish fact from fiction in science fiction films, as measured through experiment?

(2) How does exposure to the science fiction films affect students' ability to differentiate fact from fiction in the post-test, and is there an interaction effect between exposure to the film and prior knowledge of science concepts?

1.5 Significance of the study

The results of this study enable us to know more about students' ability to distinguish fact and fiction from a science fiction film. It will help educators to build study material for making science learning more interesting for students and enabling their critical thinking. The study attempts to

provide a basic understanding of students' ability to distinguish fact and fiction displayed in a science fiction film based on their previous knowledge of scientific concepts. It is no hidden truth that science in sci-fi media leads to real life inspirations. For students' better understanding of science and technology, it is our duty to create models that will ease the process of learning and at the same time be interesting.

The study of science fiction films provides insights into how science and technology are perceived in popular culture, influencing societal attitudes (Nisbet et al., 2003; Yacoubian, Bou-Mikael, & Farajallah, 2017). Understanding how students interpret these films can help educators use them to promote scientific literacy and STEM interest. By examining the role of factual knowledge in distinguishing fact from fiction, this research contributes to improving science education and media literacy programs.

1.6 Overview of the research design and methodology

The purpose of this study was to investigate the impact of factual knowledge on students' ability to distinguish between fact and fiction in a science fiction film. The research design utilized was an experimental design, specifically a posttest-only control group design. **The study was conducted at a private coaching center in Aligarh district of Uttar Pradesh in the month of July 2023**. Since the study was more like an extension to the ongoing study, verbal consent was taken from the director of the coaching center.

II. Literature Review

The relationship between science fiction films and students' understanding of science has been explored by several researchers. Studies have shown that science fiction movies often present a mix of factual scientific concepts and fictional elements, making it difficult for young viewers to separate reality from imagination

Science fiction has significantly influenced cultural attitudes, scientific literacy, and educational practices. Suvin (1979) describes the genre as one of "cognitive estrangement," wherein it challenges audiences' existing beliefs and perspectives. Gunn (2000) further emphasizes that science fiction serves as an inspiration for individuals, particularly young audiences, by presenting science and technology in an engaging and thought-provoking manner. By showcasing futuristic concepts and innovative technologies, science fiction motivates people to explore scientific possibilities and pursue careers in STEM fields.

The influence of science fiction on students' understanding of science has been a subject of extensive research. Dhingra (2003) examines the role of television-mediated science in shaping students' perceptions of the nature of science. The study highlights how different television genres, including fictional programming, contribute to students' understanding of scientific concepts. Ongel-Erdal, Sonmez, and Day (2004) explore the potential of science fiction movies as a pedagogical tool, noting that while they can enhance student engagement and motivation, they may also contribute to alternative conceptions and misunderstandings of scientific principles.

The potential for science fiction to create misconceptions about science has been studied in various contexts. Barnett et al. (2006) examine the impact of the science fiction film *The Core* on middle school students' understanding of Earth science concepts. The study finds that exposure to scientifically inaccurate content in fiction can reinforce misconceptions, highlighting the need for educators to address these inaccuracies in classroom discussions. Barnett and Kafka (2007) explore the pedagogical benefits of incorporating science fiction movies into introductory science courses. They present instructional strategies that use film scenes to engage students in critiquing the scientific validity of popular media representations.

Beyond its impact on science education, science fiction plays a crucial role in shaping cultural and political attitudes. Buker (2009) argues that science fiction introduces audiences to alternative worldviews, challenging traditional norms and inspiring social change. The genre frequently addresses themes of political ideologies, justice, and equality, encouraging critical engagement with real-world issues. Additionally, it raises awareness of social justice concerns such as discrimination and human rights violations by embedding these issues within speculative narratives.

The role of narrative transportation in influencing audiences' acceptance of scientific inaccuracies has been explored by Barriga, Shapiro, and Fernandez (2010). Their study investigates how the perceived centrality of science within a movie, as well as the gender of the viewer, affects the evaluation of incorrect scientific information. Findings suggest that men are more likely to detect inaccuracies when science is central to the plot, whereas women are more inclined to identify errors when science is presented peripherally and the story emphasizes relational elements.

Science fiction's contribution to science communication and public engagement has been widely acknowledged. Chan (2014) highlights its effectiveness in introducing complex scientific concepts to general audiences by presenting them in accessible and engaging narratives. Brode (2015)

discusses the impact of *Star Trek* in promoting diversity and multiculturalism, depicting an inclusive future where individuals of different races and genders work together as equals. Similarly, Brake (2018) explores how *The Martian* has reignited public interest in space exploration by portraying realistic scientific problem-solving. Likewise, *District 9* has been recognized for its allegorical depiction of xenophobia, using science fiction to encourage discussions on social and political issues.

Science fiction has also been examined in the context of digital and media-based learning. Wang, Chang, and Li (2007) investigate the impact of 2D versus 3D media representation on students' spatial visualization skills. Their study finds a medium effect size favoring 3D-based media, suggesting its potential for enhancing learning experiences. Prestiadi, Maisyaroh, and Zulkarnain (2020) explore the effectiveness of online learning through video-based instructional media, demonstrating improvements in student performance. Saputri, Marzuki, and Suyato (2022) conduct a quasi-experimental study on enhancing student understanding of Pancasila values, while Marithasari, Barus, and Resmayasari (2023) assess the impact of pre-test and post-test strategies in improving English communication skills among students.

The collective findings from these studies reinforce the role of science fiction as an educational and cultural force. While it has the potential to enhance scientific literacy and inspire curiosity, it also poses challenges related to the perpetuation of misconceptions. Therefore, educators and media consumers must critically engage with science fiction content to maximize its benefits while mitigating its potential drawbacks.

III. Methodology

The methodology employed in this study aimed to assess students' ability to distinguish fact from fiction in a science fiction film. A total of 40 participants from class 11th at a private coaching center in Aligarh district, Uttar Pradesh, took part in the research. A quasi-experimental design was utilized, where one group of participants received treatment in the form of a Chapter on Newton's laws of motion, while the other group did not receive any intervention. The study was conducted in July 2023, providing insights into the impact of specific educational strategies on students' discernment of factual versus fictional content in film.

3.1 Dependent and Independent variable

The independent variable in this study is the prior knowledge of students about the scientific concept. The film "Wanted" (2008) was used as an exposure material to assess the impact of factual

knowledge on students' ability to distinguish fact from fiction. Both groups were exposed to clips from science fiction films while the treatment group was also exposed to additional classes on the concept of laws of motion.

The dependent variable in this study is the students' ability to distinguish fact from fiction in the film, which was measured after exposure to the film. The study assessed the students' ability to differentiate between fact and fiction by administering a posttest, which presented a series of questions based on the film's content.

3.2 Hypothesis

Based on the extensive literature review and identification of dependent and independent variables in this study, one hypothesis is formed:

$H_0$1: There is no significant difference in the ability of students who have studied Newton's laws of motion and those who have not studied Newton's laws of motion to distinguish fact from fiction in science fiction films.

H_a1: Students who have studied Newton's laws of motion will demonstrate a greater ability to distinguish fact from fiction in science fiction films compared to those who have not studied Newton's laws of motion.

3.3 Posttest-only control group design

The study utilized a quasi-experimental design to investigate the effect of prior knowledge on students' ability to distinguish fact from fiction in the science fiction film "Wanted" (2008). This design involved the use of a control group, which was not exposed to the treatment (i.e., the chapter on laws of motion), and a treatment group, which was exposed to the treatment.

As noted by Campbell and Stanley (1963), the posttest-only control group design is appropriate when the researcher cannot randomly assign participants to groups, and when the selection of participants is not based on matching criteria. The design can help minimize the influence of extraneous variables that may affect the results, as the control group serves as a comparison group for the treatment group. The design is particularly useful in studies where random assignment is not possible, as it allows researchers to compare the effects of a treatment by creating two groups that are comparable in all aspects except for the treatment.

G1	X+Y	O1
G2	X	O2

G1 represents a sample group of participants in the treatment group.

G2 represents a sample group of participants in the treatment group.

X represents treatment, which in this experiment is sci-fi film Wanted (2008).

Y represents the treatment, which in this experiment is knowledge of facts on Newton's laws of motion.

3.4 Participant's Description and selection criteria

Forty Class XI students were divided equally into a treatment group (students who studied the laws of motion) and a control group (students who did not). This selection ensured that both groups were similar in age and educational level but differed in their prior knowledge of laws of motion. The study aimed to examine how this prior knowledge affected their ability to distinguish fact from fiction in clips from the film *Wanted* (2008).

3.5 Science fiction film "Wanted" (2008)

The film *Wanted* (2008) features the fictional "bullet curve" concept, where a marksman bends a bullet's path—a scenario that contradicts Newton's laws of motion. Advanced visual effects in the film create this illusion. In the study, students were asked whether curving a bullet is possible to assess how their prior knowledge of physics influences their ability to distinguish fact from fiction.

3.6 Procedure for conducting experiment

The experiment was conducted at a coaching center in Aligarh after informing the science teacher and obtaining permission from the center's director, while keeping the students unaware to prevent bias. Two groups of 20 students each were used: the treatment group received instruction on the laws of motion, and the control group did not. Both groups were then shown clips from the science fiction film *Wanted* on a large screen and subsequently took a test. The study employed a quasi-experimental posttest-only control group design, where the independent variable was the students' prior knowledge of laws of motion and the dependent variable was their ability to distinguish between fact and fiction as presented in the film.

3.7 Data collection and analysis

Following the viewing of film clips, both the experimental and control groups undertook a test specifically designed to assess their aptitude in differentiating between scientific fact and fiction as portrayed in the film.

The test contained the following four questions:

1. Is it possible to curve a bullet in real life?
2. Which law of Physics does the Buller Curve sequence follow or violate?

3. Is it possible to curve other objects like balls and arrows?
4. Can you define Newton's First Law of Motion?

A t-test was employed to evaluate the performance of the experimental and control groups on the test. This statistical analysis is used to assess whether there exists a significant difference between the mean scores of two groups. The objective of the t-test was to ascertain whether the factual knowledge intervention had a noteworthy influence on the experimental group's capacity to differentiate between fact and fiction in the film. A significance level of $p < 0.05$ was established for the test, signifying that outcomes with a p-value below 0.05 would be deemed statistically significant.

IV. Results

4.1 Descriptive statistics for the variables

A total of 40 students participated in this study. 16 were female and 24 were male. 18 of the 20 participants in the treatment group answered question 1 correctly. While only 14 were able to answer the same question as the control group. 1 mark was also granted to all participants who tried to give a somewhat okay explanation of the scientific concept. Mean score for the control group was .80, while mean score for the Treatment group was 1.20. The standard deviation for each group was 0.52315 and 0.61559 respectively.

4.2 Test for differences between the groups

A t-test was conducted using SPSS to test the hypothesis that there is no significant difference in scores between two groups. The null hypothesis was that the mean scores for the two groups were equal. The level of significance was set at $p < 0.05$, which corresponds to a confidence level of 95 percent. The obtained p-value was .033, which is below the significance level. As a result, the null hypothesis is rejected, and it can be concluded that there is a statistically significant difference in scores between the two groups. This indicates that the intervention had an impact on the experimental group's ability to differentiate between fact and fiction in the film, as compared to the control group.

T-Test

Group Statistics

	GROUP	N	Mean	Std. Deviation	Std. Error Mean
SCORE	CONTROL	20	.8000	.52315	.11698
	TREATMENT	20	1.2000	.61559	.13765

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means							
						Significance				95% Confidence Interval of the Difference	
		F	Sig.	t	df	One-Sided p	Two-Sided p	Mean Difference	Std. Error Difference	Lower	Upper
SCORE	Equal variances assumed	.530	.471	-2.214	38	.016	.033	-.40000	.18064	-.76569	-.03431
	Equal variances not assumed			-2.214	37.037	.017	.033	-.40000	.18064	-.76600	-.03400

Based on the mean score, it can be stated that alternate hypothesis (H_a1) is accepted.

4.3 Findings related to research questions

RQ1: Effect of Prior Scientific Knowledge on Distinguishing Fact from Fiction in Sci-Fi Films

Results clearly state that prior knowledge of science facts positively aids students in distinguishing facts from fiction in a science fiction film. Demands of science fiction films have grown tremendously in recent years in India and the youth is the major consumer for it. These results give great insight for the inclusion of science fiction films in aiding science learning. Prior knowledge of scientific facts not only helped students to distinguish facts from fiction but also triggered sort of technological curiosity among students. After completion of the posttest, students had a very healthy discussion on the truth of the questions asked on the test.

RQ2: Sci-Fi Films and Fact-Fiction Differentiation: Role of Prior Science Knowledge

While observing the students during exposure with sci-fi films, it was clearly noted that none of the students initially thought about connecting the phenomenon in the media with basic science. It was only when presented with the test, participants started to think about science laws. Clearly, the group with better knowledge of facts was well able to guess the possibility of truth from fiction film. Better understanding of science will no doubt prevent people from attempting or mimicking bad science in film. Students were asked another question (Question 3) to establish a connection between their empirical knowledge of similar phenomenon and fiction in film. Almost all students were able to correctly answer this question. The reason behind this was that daily life observation is more effective than any theory, law, or model taught. There is no doubt that clips from these films can really work as a great assisting tool in science education. Participants were full of excitement throughout the study as it was a different and more interesting experience for them.

V. Discussion

5.1 Summary of the study

This study examined students' ability to distinguish fact from fiction in a science fiction film. Forty students were divided into a control group (no prior instruction) and a treatment group (taught Newton's laws of motion). Both groups watched clips from *Wanted* (2009) featuring the concept of curving bullets and then completed a four-question test. Data analysis using SPSS and a t-test showed a significant difference ($p = 0.033$), leading to the rejection of the null hypothesis. The findings indicate that students with prior knowledge of Newton's laws were better at distinguishing fact from fiction than those without.

5.2 Implications of the findings

The study's findings have important implications for science education, suggesting that science fiction films, combined with prior scientific knowledge, can enhance students' ability to distinguish fact from fiction. This supports the integration of such films into curricula to foster interest in science and critical thinking. The study also emphasizes the role of media in creating an engaging learning environment, encouraging discussions about scientific concepts. Additionally, these findings highlight the need for media literacy education, helping students become more critical consumers of scientific information and contributing to a more scientifically informed society.

5.3 Limitations of the study

Despite providing valuable insights, this study has limitations. The small sample size of 40 students may affect the generalizability of the findings, as a larger sample could provide a more comprehensive analysis. Additionally, the study focused solely on *Wanted* (2008), limiting the applicability of the results to other science fiction films, which may vary in scientific accuracy and present different challenges in distinguishing fact from fiction.

VI. Conclusion

The study suggests that integrating scientific concepts into science fiction discussions can enhance students' ability to distinguish fact from fiction. Educators can use science fiction films as teaching tools to make learning more engaging, encourage critical thinking, and demonstrate the relevance of science in everyday life. This approach fosters a more interactive and motivating learning environment, highlighting the benefits of incorporating popular culture into science education to improve student outcomes.

This study underscores the link between scientific knowledge and the ability to differentiate fact from fiction in science fiction films. The findings indicate that students with prior knowledge of scientific principles, such as Newton's laws of motion, are better equipped to assess the accuracy of cinematic portrayals. While the study provides valuable insights, its limitations—including a small sample size and focus on a single film—must be acknowledged. Nevertheless, it serves as a foundation for further research into the role of popular culture in science education.

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