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STEM Talk: Cultivating students' STEM affinity and careers

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ABSTRACT

The emergence of artificial intelligence tools like ChatGPT, while convenient, has inadvertently reduced students' engagement in critical thinking processes. This has led to waning interest in science, technology, engineering, and mathematics (STEM) fields, known for analysis and problem-solving. This study introduces "STEM Talk," an active research presentation competition fostering diverse intelligences through visuals, language, reasoning, anecdotes, and emotion. It examines STEM Talk's impact on 20 high school students' STEM interests and careers. Pre- and post-STEM affinity tests and interviews reveal STEM Talk's ability to notably boost affinity and reshape perceptions of STEM careers.

Keywords: STEM affinity, STEM career, STEM education, critical thinking process, research presentation

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INTRODUCTION

In recent years, the integration of artificial intelligence (AI) has revolutionized various aspects of our lives, offering unparalleled convenience and efficiency. However, a paradoxical challenge has arisen in the realm of education, particularly concerning students' interest in science, technology, engineering, and mathematics (STEM) areas. With the advent of AI tools like ChatGPT that can swiftly provide answers, a concerning trend has emerged–students' opportunities to engage in critical cognitive processes, such as reasoning, analysis, and problem-solving, have seemingly diminished, leading to a decline in their interest in STEM fields (Hill et al., 2010; Koul et al., 2017; Maltese et al., 2010; Piburn et al., 2016). This, in turn, has led to a diminished interest in STEM areas that traditionally thrive on deep analysis, reasoning, and problem-solving (Clark et al., 2016; Hwang et al., 2014). To mitigate this trend, educational strategies must be devised that strike a balance between leveraging AI for its benefits while actively promoting and nurturing students' engagement in cognitive processes that underpin STEM education (Miller et al., 2018).

STEM Talk as a Solution

In response to this challenge, the need for innovative solutions has become evident. One such solution is the novel concept of "STEM Talk," an active STEM research presentation competition that offers a versatile approach capable of catering to various intelligences through the integration of visual aids, spoken language, logical reasoning, personal anecdotes, and emotional appeals. This ensures that a wide spectrum of learners can effectively connect with the content and their peers (Gardner, 1983).

Furthermore, STEM Talk not only strives to stimulate curiosity but also aims to cultivate a sense of autonomy among participants. By introducing thought-provoking ideas and allowing individuals to engage with the content in a self-directed manner, STEM Talk fosters an environment, where learners are motivated to explore and inquire about STEM independently (Shah et al., 2019). Within the context of STEM research, incorporating AI tools like ChatGPT into conversations about research subjects facilitates a seamless fusion of harnessing AI's potential and ensuring meaningful engagement from all participants.

Crucially, STEM Talk encourages learners to actively engage with the material rather than passively absorbing information. This active approach is reinforced through elements such as interactive discussions, thought-provoking reflection prompts, and engaging activities. By prompting participants to think critically, respond thoughtfully, and engage in collaborative discussions about the ideas presented, these presentations serve as catalysts for fostering deeper understanding (Gleason & Leandro, 2022).

At the heart of the matter lies STEM Talk initiative, which seeks to reignite the flames of logical and critical thinking among high school students. This platform provides them with an avenue to articulate their thoughts, opinions, and discoveries in a comprehensive and reflective manner. Going beyond mere repetition of facts, the initiative encourages students to actively engage with their chosen STEMs, explore diverse perspectives, and construct compelling arguments grounded in evidence. In essence, this initiative mirrors the very essence of logical and critical thinking by promoting active inquiry and thoughtful expression.

The implementation of innovative strategies, such as STEM Talk initiative, is expected to hold the potential to address the challenge of diminishing engagement in critical cognitive processes. By incorporating active research presentations with their diverse engagement elements and, the initiative not only nurtures a vibrant learning environment but also instills a renewed enthusiasm for logical and critical thinking.

STEM Affinity

Students' STEM affinity refers to their level of interest, enthusiasm, and engagement in STEM and activities (Fredricks & McColskey, 2012). It encompasses their curiosity, motivation, and overall positive attitude towards these fields. Research consistently indicates that a strong STEM affinity positively correlates with higher achievement in STEM fields. When students are genuinely interested and motivated in these fields, they are more likely to invest time and effort in their studies, leading to improved learning outcomes (Guo & Jamal, 2019). A heightened affinity for STEM encourages students to actively seek out opportunities for exploration, experimentation, and problem-solving all of which contribute to deeper understanding and mastery of STEM matter (Hidi & Renninger, 2006; Trumbull et al., 2001).

Students with a robust STEM affinity tend to approach challenges with a growth mindset, viewing setbacks as learning opportunities rather than obstacles. This resilience and persistence play a crucial role in their achievement, as they are more willing to tackle complex problems and overcome difficulties that are inherent in STEM disciplines (Dweck, 2006; Paunesku et al., 2015). This positive mindset fosters a sense of self-efficacy, where students believe in their own capabilities to succeed in STEM-related tasks (Bandura, 1997; Schunk, 1991), thereby enhancing their affinity towards STEM fields.

Conversely, a lack of STEM affinity can hinder students' academic achievement in these fields. Disinterest or negative attitudes towards STEM STEMs may lead to disengagement, surface-level learning, and a reluctance to invest effort in understanding challenging concepts (Ainley & Ainley, 2011; Osborne et al., 2003). Without a strong affinity for STEM, students might perceive these STEMs as daunting or irrelevant to their future pursuits, which can result in lower achievement levels and decreased motivation to pursue advanced studies or careers in STEM (Archer et al., 2012; Osborne et al., 2003).

Educators play a vital role in cultivating students' STEM affinity and promoting their achievement in these disciplines. Providing hands-on, inquiry-based learning experiences, integrating real-world applications, and showcasing the relevance of STEM in various career paths can spark students' interest and enthusiasm (Hegarty-Hazel, 2019b; Honey & Hilton, 2011). Additionally, fostering a supportive and inclusive learning environment that encourages open discussions and collaboration can contribute to building a positive STEM affinity (Johnson et al., 2018; White, 2005).

Students' STEM affinity and their achievement in STEM fields are intricately intertwined. A strong STEM affinity positively influences academic success, as motivated and engaged students are more likely to invest in their learning and persist through challenges. Recognizing the importance of nurturing students' STEM affinity through effective pedagogical strategies is essential for promoting their achievement in STEM disciplines and preparing them for future opportunities in the ever-evolving world of science and technology.

Purpose of Study

This study is to assess the effects of STEM Talk on high school students' STEM affinities with the following research questions:

1. Does STEM Talk effectively contribute to the positive development of high school students' science affinities?
2. Does STEM Talk effectively assist high school students in fostering their aspirations for future careers within STEM fields?

By exploring the impact of STEM Talk on students' science affinities and their future careers in STEM fields, this study strives to contribute to the ongoing discourse on education in the digital age and reaffirm the value of logical and critical thinking as indispensable skills for our future STEM leaders.

LITERATURE REVIEW

Issues of Instant Access to Information

AI's rapid response capabilities present an environment, where obtaining answers has become effortless, removing the need for extended mental effort. This instant access to information can unintentionally discourage students from engaging with the mental complexities that STEM STEMs require. When the appeal of swift solutions overshadows the intrinsic satisfaction of solving intricate problems, students might find STEM fields less attractive, leading to a decline in their interest.

Research by Anderson and Dron (2011) suggests that the ease of AI tools can reduce motivation for deep thinking. This phenomenon, known as the "shallowing hypothesis," means that easily acquiring information diminishes the incentive to analyze and think critically. As a result, students may miss out on the gratification of grappling with difficult concepts and deriving insights through their own mental efforts.

Moreover, studies by Barlow et al. (2020) emphasize the importance of active cognitive engagement for sustaining interest in learning. When students actively reason, analyze, and solve problems, their curiosity is sparked, creating a stronger connection to STEM. However, the immediate answers provided by AI tools can hinder this engagement, ultimately reducing students' desire to explore STEM topics.

The cognitive shift brought about by AI tools also affects the development of essential cognitive skills necessary for STEM involvement. Researchers like Vosoughi et al. (2018) argue that fostering analytical thinking and problem-solving skills requires practice and engagement. Nevertheless, when AI tools offer instant solutions, students miss the chance to refine these skills, resulting in a reduced interest in STEM that demands these cognitive abilities.

Active Research Presentation as a Solution

STEM Talk initiative, which emulates technology, entertainment, design-style presentation format, aligns with educational theories that underscore the importance of active engagement and critical thinking. This active research presentation initiative encourages high school students to transcend rote learning and instead explore diverse perspectives, construct evidence-based arguments, and express their ideas articulately. By engaging in these processes, students not only enhance their communication skills but also cultivate the core tenets of logical and critical thinking, as highlighted by educational scholars (Halpern et al., 2012; Heller et al., 2016).

Active research presentations encompass a variety of pedagogical principles and educational theories to engage learners effectively. By catering to diverse intelligences, nurturing curiosity, and autonomy, strategically using AI tools, promoting active engagement, and fostering critical thinking, these presentations create a dynamic and enriching learning experience. The active research presentations are carefully designed to accommodate diverse learning styles and intelligences, ensuring that a wide spectrum of learners can effectively engage with the content. This approach aligns with Silvia's (2020) structure of human abilities, which posits that individuals possess various cognitive strengths and preferences. Incorporating visual aids caters to visual learners, spoken language appeals to auditory learners, logical arguments resonate with analytical thinkers, personal stories engage those who connect with emotions, and emotional appeals capture the attention of empathetic individuals.

In addition, the active research presentations strategically aim to pique curiosity and foster a sense of autonomy among participants. According to the intrinsic and extrinsic motivation (Froján-Parga et al., 2020), when learners feel a sense of choice and self-direction, their intrinsic motivation is enhanced. By presenting thought-provoking ideas that stimulate curiosity, active research presentations encourage participants to take ownership of their learning journey, driving them to explore further and engage in self-directed inquiry.

Balancing the use of AI tools like ChatGPT with engagement strategies is crucial in active research presentations. Leveraging AI for research can provide speakers with accurate and timely information, enhancing the quality of their content. However, excessive reliance on AI can risk overshadowing the essence of the presentation. By weaving AI-generated insights seamlessly into the narrative, speakers maintain a balance between technological assistance and their own engagement with the material.

One of the hallmarks of active research presentations is their emphasis on active learning. This approach aligns with pedagogical principles that prioritize learner engagement and interaction. Active research presentations deviate from passive information dissemination by incorporating discussions, reflection prompts, and interactive activities. These strategies encourage participants to critically analyze the presented ideas, respond to thought-provoking questions, and engage in meaningful discussions with peers, thereby fostering a deeper understanding of the content.

METHOD

Participants

The project involved the participation of twenty high school students from diverse geographical locations across the United States. These locations included Boston, California, Idaho, Illinois, Maryland, New York, Seattle, Texas, Virginia, and Washington D.C. The inclusion of students from such a broad spectrum of regions aimed to ensure a diverse and representative sample for the project.

To participate in the project, these twenty students willingly provided their consent. This consent signifies their agreement to be actively involved in the project's activities, surveys, or any other elements integral to the research. Obtaining consent is a fundamental ethical practice in research, ensuring that participants are fully informed about the nature of the project, its objectives, and any potential risks involved. It also emphasizes the voluntary nature of their involvement, allowing participants to make an informed decision about whether they want to be part of the study.

The geographical diversity of the participants not only enhances the project's external validity by capturing a broad range of perspectives but also adds depth to the research findings. By obtaining consent, the project acknowledges and respects the autonomy of each participant, fostering an ethical and inclusive research environment.

STEM Talk

STEM Talk is designed to empower high school students in grade 9 through grade 11 by offering them a platform to share their knowledge on various topics within the realms of STEM. The primary goal is to enhance their diverse interests in STEM areas by integrating AI, instill a renewed enthusiasm for logical and critical thinking with their public speaking and leadership skills and foster their careers in these areas.

STEM Talk offers four distinct themes that participants can choose from for their presentations:

1. **The universe beyond our sight:** This theme encourages students to delve into microscopic worlds that are invisible to the naked eye. They are expected to explore the impact of these microscopic entities on humanity, the intricate ecosystems they are a part of, and their own unique insights about the future interactions between humanity and the microscopic world.
2. **Into the unknown:** Under this theme, students are tasked with exploring novel topics that build upon existing scientific discoveries. They are challenged to predict the future trajectory of these topics and present original and thought-provoking ideas that engage the audience's interest.
3. **The world of the future:** This theme focuses on modern technology's significant impact on society. Participants are required to analyze both the positive and negative effects of this technology and speculate on how it might shape the future direction of humanity and the world at large.
4. **In the search for the truth:** This theme emphasizes creating a safe and inclusive environment for the future society, particularly for minority individuals. Participants are encouraged to address the importance of fostering inclusivity and providing a welcoming space for everyone.

The competition consists of two rounds:

1. **1st round: 3-minute talk video competition:** Participants are required to submit a 3-minute talk video on their chosen theme. The top ten students are selected based on their video submissions and six of them were invited to proceed to the next round.
2. **2nd round: 5-minute live competition through Zoom:** The top-6 finalists compete live on Zoom, delivering a 5-minute presentation followed by a 2-minute Q&A session. **Figure 1** showcases one of the videos for the 1st round performance and **Figure 2** depicts the 2nd round performance through Zoom.

Procedure

This study was proceeded by following the four key objectives:

Figure 1. One example video clip for 1st round competition (Source: Field study)

Figure 2. 2nd round competition through Zoom (Source: Field study)

a. **Recruitment:** The researchers encompassed nationwide recruitment to involve high school students from diverse backgrounds.

b. **Performance:** The researchers organized STEM Talk in which participants actively engaged in STEM activities, by allowing them to use AI tools for fostering practical learning experiences. They took the pre-survey before their production of the speech video.

c. **Production:** Participants were actively engaged in producing speech videos for STEM Talk, with researchers providing guidance throughout the process. Upon submitting their speech videos, participants were invited to complete a post-survey. Subsequently, online interviews were conducted exclusively with the students who received awards at the culmination of the project.

d. **Contribution:** The project's significance extended to contributing to the advancement of STEM knowledge and enhancing students' affinity for STEMs. This was achieved by disseminating the research findings and curriculum products generated through STEM outreach programs to a wide audience of educators and stakeholders.

Data Collection Tools

The evaluation of the effectiveness of the programs implemented involved a comprehensive assessment process designed to measure various aspects of participants' engagement. The assessment was conducted through a series of pre- and post-affinity tests, administered both before and after their involvement in STEM Talk event. Additionally, participants underwent online interviews at the conclusion of the event to gather qualitative insights into their experiences.

The collected data were multifaceted, incorporating both quantitative and qualitative elements. The quantitative aspects focused on science affinities and included measurements related to science interest, attitudes, self-efficacy, and science identity. These elements were assessed using a STEM affinity test, the questions of which are outlined in **Appendix A**. This test was adapted from Adams et al. (2006) and demonstrated a high level of internal consistency, as indicated by a Cronbach's alpha coefficient of 0.779 (Adams et al., 2006). The utilization of a well-established test with demonstrated reliability enhances the validity of the quantitative data collected.

In addition to the quantitative measures, qualitative insights were gathered through online interviews, the details of which are provided in **Appendix B**. These interviews aimed to capture the participants' subjective experiences, perceptions, and reflections on their engagement with STEM Talk event. The combination of quantitative and qualitative data allows for a more comprehensive understanding of the impact of the programs on participants' attitudes, interests, and self-efficacy in the realm of science. This thorough assessment strategy not only provides a robust foundation for evaluating program effectiveness but also ensures a holistic understanding of participants' experiences and perceptions in the context of STEM education.

RESULTS

This study employed a mixed methods approach for both data collection and analysis. To evaluate the effects of STEM Talk project on the participants, we utilized established and dependable instruments. These instruments were administered as pre and posttests for a STEM affinity assessment, supplemented by interviews designed to capture the impact of STEM Talk experience on the twenty participating high school students.

Analysis of STEM Affinity

20 high school students participated in both pre- and post-test assessments to evaluate their STEM affinity. The outcomes of STEM affinity assessments have been detailed in **Table 1**.

STEM identity

According to t-test results, only the fourth question ("I see myself as a STEM professional") had a significant change ($p<0.05$). Nonetheless, comparing pre- and post-survey STEM identity results, participants' belonging in STEM remained consistently positive. Pre-survey data showed strong encouragement from teachers, family, and friends to pursue STEM, with a positive self-view. In the post-survey, STEM identity average score was 4.235 out of 5.000, indicating sustained positivity. Overall, results suggest participants' STEM identity and belonging were consistently positive, nurtured by supportive teachers, family, and self-belief. STEM Talk effectively fostered a positive environment for their STEM identity and belonging.

Self-concept of ability

Based on t-test results, only the first question shows significant change, with no alterations in the other two questions at $p<0.05$. Participants consistently maintain positive STEM self-perception. Pre-

Table 1. Results of pre- & post-STEM affinity test

Category	Question	Pre-	Post-	t	p	SL (0.05*)
STEM ID	My teachers encourage me to do STEM.	4.588	4.455	-1.982	0.059	NS
	My family & friends encourage me to do STEM.	4.529	4.545	0.238	0.815	NS
	I am good at STEM.	4.412	4.273	-1.449	0.160	NS
	I think of myself as a STEM professional.	4.235	3.909	-2.186	0.039	S
Self-concept of ability	How good at STEM are you?	4.500	4.182	-2.789	0.011	S
	If you were to rank all students in your class from worst to best in STEM, where would you put yourself?	4.667	4.455	-1.936	0.065	NS
	Compared to most of your other school subjects, how good are you at STEM?	4.579	4.364	-2.042	0.053	NS
STEM value	How important is it that you learn STEM?	4.737	4.818	1.316	0.202	NS
	How interesting is STEM to you?	4.632	4.727	1.380	0.184	NS
	How important do you think STEM will be to you in future?	4.700	4.818	0.832	0.415	NS
Personal interest	I think about STEM I experience in everyday life.	4.316	4.455	-1.286	0.211	NS
	I am not satisfied until I understand why something works way it does.	4.450	4.455	-0.073	0.942	NS
	I study STEM to learn knowledge that will be useful in my life outside of school.	4.500	4.364	1.309	0.202	NS
	I enjoy solving STEM problems.	4.316	4.455	-1.286	0.211	NS
	Learning STEM changes my ideas about how world works.	4.389	4.636	-1.938	0.065	NS
	Reasoning skills used to understand STEM can be useful in my everyday life.	4.632	4.545	0.779	0.446	NS
Attitudes toward STEM	STEM is fun.	4.471	4.364	1.184	0.252	NS
	I do not like STEM, and it bothers me to have to study it.	1.667	1.727	-0.741	0.466	NS
	I would like to learn more about STEM.	4.333	4.455	-1.046	0.305	NS
	If I knew I would never get to STEM class again, I would feel sad.	3.778	4.000	-1.899	0.071	NS
	STEM is interesting to me, & I enjoy it.	4.421	4.400	0.210	0.836	NS
	STEM makes me feel uncomfortable, restless, irritable, & impatient.	1.765	1.545	1.642	0.117	NS
	STEM is fascinating & fun.	4.333	4.545	-1.721	0.100	NS
	Feeling that I have towards science is a good feeling.	4.211	4.273	-0.846	0.407	NS
	When I hear word STEM, I have a feeling of dislike.	1.778	1.545	1.952	0.065	NS
	STEM is a topic, which I enjoy studying.	4.222	4.455	-2.191	0.040	S
	I feel at ease with STEM, & I like it very much. I feel a definite positive reaction to STEM.	4.312	4.364	-0.464	0.647	NS
	STEM is boring.	1.611	1.455	2.378	0.028	S

Note. SL: Significance level; NS: Not significant; & S: Significant

survey, they rate themselves highly in STEM competence, believe they outperform peers, and find STEM less challenging than other subjects.

Yet, self-perceived STEM abilities slightly decrease from pre- to post-survey, attributed to STEM Talk challenges, project duration, and complexity (Brown et al., 2018; Lee & Smith, 2019; Yahaya, 2009).

STEM value

The t-test results indicate no significant changes in any of the questions at the conventional significance level of $p<0.05$. Nevertheless, both in the pre- and post-survey, participants consistently attributed high value to learning STEM, found it intriguing, and recognized its future significance. Participants' perceived importance and interest in learning STEM exhibited a slight increase from the pre-survey to the post-survey. These positive shifts suggest that participants might have become more engaged and intrigued by STEM following their involvement in STEM Talk project.

Personal interest

None of the questions exhibited significant changes at $p<0.05$. However, the pre- and post-survey data illuminate robust personal STEM interest, enjoyment in comprehending concepts, and a conviction in practical STEM knowledge beyond school. While some queries slightly improved and others declined, a more profound exploration, aligned with prior research, can yield a holistic understanding. Personal STEM interest is shaped by content delivery, hands-on encounters, and relevance (Ainley & Ainley, 2011; Osborne et al., 2003).

"Thinking about STEM in everyday life" and "STEM changing ideas about the world" witnessed slight enhancements, resonating with the correlation between real-world associations and heightened interest through STEM dialogue (Dweck, 2006; Hegarty-Hazel, 2019a; Honey & Hilton, 2011; Paunesku et al., 2015). The consistent 4.455 mean score for "Understanding how things work" suggests sustained personal interest. Curiosity propels STEM interest, as seeking comprehension nurtures engagement (Fredricks & McColskey, 2012; Vu et al., 2019).

The decline in "studying STEM for real-world utility" denotes evolving perspectives. Emphasizing real-world impact during STEM Talk might reestablish relevance (Hegarty-Hazel, 2019a; Honey & Hilton, 2011). Marginal decreases in "enjoying solving STEM problems" and "reasoning skills' usefulness in everyday life" could correlate with problem complexity during STEM Talk. Challenges should be captivating yet manageable (Bandura, 1997; Schunk, 1991; Osborne et al., 2003; Trumbull et al., 2001).

In conclusion, the analysis of personal STEM interest underscores its multifaceted character. Despite minor fluctuations, integrating real-world significance, practical application, and transformative learning is pivotal in comprehensive STEM education. By amalgamating insights from STEM Talk with prior research, educators can grasp the dynamics of personal STEM interest and devise interventions for enduring engagement and positive outcomes.

Analysis of attitudes

In the t-test analysis, question 10 ("STEM is a topic, which I enjoy studying") and 12 ("STEM is boring") exhibited statistically significant changes in attitudes towards STEM at $p<0.05$. Assessing the attitudes

Table 2. Responses to online interview

Question	Responses
STEM affinity	My experience with STEM talk initiative was truly eye-opening. Sessions allowed me to explore STEM subjects in a more interactive & engaging way. Before STEM talk, I had a mild interest in STEM, but after participating, my interest skyrocketed. STEM Talk presentations & Q&A sessions showed me real-world applications of STEM, making it much more exciting. STEM Talk sessions were not only engaging but also incredibly motivating. They helped me connect theoretical concepts to real-life situations, which boosted my interest in STEM & made me want to learn more. My self-efficacy in STEM tasks improved through STEM Talk project that provides guidance & challenges for me to tackle complex problems I would not have considered before. During STEM Talk, there was a time to think about how STEM impacts everyday life, which shifted my attitude towards STEM subjects. I realized how relevant they are, which made me more enthusiastic about learning them. STEM Talk changed my identity as a learner. I used to see STEM as something for 'smart' people, but now I see myself as someone who can excel in these fields with the right attitude & effort. STEM talk inspired me to explore STEM topics on my own. I started watching documentaries, reading articles, & even trying out some simple experiments at home. Interacting with presenters & judges during STEM Talk was invaluable. Their insights, experiences, & encouragement opened my eyes to different aspects of STEM ^ motivated me to dig deeper into subjects.
Future careers in STEM	STEM Talk gave me a clearer perspective on vast career opportunities in STEM. It showed me that STEM is not just about working in a lab but can lead to exciting and impactful professions. Participating in STEM Talk broadened my understanding of potential STEM careers. Presentations introduced me to different fields I had not considered before. After STEM Talk, I started seriously considering a STEM career. Sessions opened my eyes to the potential of making a positive impact in world through science & technology. Interactions during STEM talk inspired me to consider specific STEM-related career paths. Hearing from peers was incredibly motivating. One of speakers at STEM Talk talked about her journey in bioengineering, which directly resonated with my aspirations. It showed me that my dreams of contributing to healthcare through STEM are achievable. STEM Talk helped me connect dots between what I learn in school & its application in real-world careers. It made me realize how important STEM education is for building a strong foundation. After STEM Talk, I started looking for internships & workshops related to my interests in STEM. It motivated me to actively seek out opportunities to further explore & prepare for a future career.

toward STEM section in both pre- and post-surveys, participants demonstrated a predominantly positive stance towards STEM, albeit with variations in specific attitudes. In the pre-survey, many participants favored STEM, finding it enjoyable and expressing interest in delving deeper. They also expressed disappointment at the thought of missing future STEM classes. However, distinct attitude variations emerged. Some lacked affinity for STEM, finding it challenging. This duality suggests a subset with less favorable STEM attitudes, perhaps harboring reservations. Importantly, the positive attitude towards STEM observed in the pre-survey seemed fortified in the post-survey. Overall, participants maintained a constructive outlook, finding STEM captivating. Their inclination to explore it further and attachment to STEM classes endured, now influenced by project participation. The project appears to have enhanced their positive outlook, reinforcing interest and engagement in STEM subjects.

Analysis of Interview

Eight participants who were awarded at STEM Talk responded to the interview. Their responses are in **Table 2**.

Responses to STEM affinity

The participants' responses reflect a consistent pattern of positive transformation in their STEM affinity because of their engagement with STEM Talk initiative. Through interactive sessions, real-world applications, and mentorship, the participants underwent significant shifts in their attitudes, interests, and self-perceived capabilities within STEM.

One participant noted that their experience with STEM Talk was "truly eye-opening." This sentiment emphasizes the program's ability to broaden participants' perspectives and introduce them to novel aspects of STEM. This sentiment is supported by the participant's observation that the sessions allowed them to explore STEM subjects in a more interactive and engaging manner.

Several participants indicated that their interest in STEM was significantly enhanced by their involvement in STEM Talk. The sessions exposed them to the practical relevance of STEM and illustrated real-world applications, transforming their mild curiosity into a heightened enthusiasm. The correlation between increased engagement and real-world connections aligns with research that underscores the importance of contextual relevance in fostering interest in STEM.

The transformative impact of STEM Talk on self-efficacy is evident through participants' comments. They mentioned the boost in their confidence to tackle complex problems, attributing it to the guidance and challenges that STEM Talk provided. This finding resonates with research indicating that exposure to challenging tasks and supportive environments can positively influence individuals' self-efficacy beliefs.

Participants also highlighted the role of STEM Talk in reshaping their attitude towards STEM subjects. The recognition of the practical implications of STEM in everyday life triggered a change in perception, leading to increased enthusiasm for learning. This shift aligns with educational theories emphasizing the importance of connecting learning to real-life contexts to enhance motivation.

An intriguing aspect of the responses is the transformation of participants' identities as learners. STEM Talk facilitated a shift from perceiving STEM as exclusive to "smart" individuals to identifying themselves as capable and motivated learners in these fields. This transformation in self-perception is indicative of the program's success in instilling a growth mindset and dispelling limiting beliefs.

Furthermore, STEM Talk's impact extended beyond the sessions, inspiring participants to explore STEM independently. This self-driven exploration through documentaries, articles, experiments, and AI tools suggests that the program ignited a genuine curiosity and self-directed learning approach.

Lastly, interactions with peers and judges were highlighted as invaluable. Participants acknowledged the role of these interactions in providing diverse insights, experiences, and encouragement. This collaborative learning environment aligns with educational principles emphasizing the importance of social interactions in fostering deeper understanding and motivation.

In conclusion, the participants' responses collectively paint a compelling picture of the transformative impact of STEM Talk initiative on their STEM affinity. The program's ability to evoke enthusiasm, increase self-efficacy, foster real-world connections, and shape learners' identities underscores its efficacy in promoting positive changes in participants' engagement with STEM.

Responses to future careers in STEM

The participants' responses collectively highlight the significant impact of STEM Talk initiative on their perception of future careers in STEM. The program played a pivotal role in expanding their awareness of the diverse and impactful opportunities within STEM field, ultimately motivating them to consider STEM-related careers more seriously.

A recurring theme in the participants' responses is the revelation of the broad spectrum of career possibilities in STEM. STEM Talk was instrumental in dispelling the narrow perception of STEM as confined to laboratory work. Participants recognized that STEM encompasses dynamic and impactful professions that extend beyond traditional lab settings. This realization aligns with the program's aim to showcase the diverse range of career paths available in STEM.

Also, participating in STEM Talk led to a broader understanding of potential STEM careers for several participants. The presentations exposed them to fields they had not previously considered, broadening their horizons, and enabling them to envision pathways they might not have explored otherwise. This aligns with research indicating that exposure to a variety of STEM disciplines can influence career aspirations.

Further, several participants indicated that their participation in STEM Talk prompted them to seriously contemplate pursuing a STEM career. Their presentations emphasize the potential for positive societal impact through science and technology, igniting a sense of purpose and aspiration to contribute to the world through STEM. This transformation underscores the program's efficacy in motivating participants to envision themselves as future STEM professionals.

Moreover, STEM Talk bridged the gap between theoretical learning and real-world career applications. Participants recognized how STEM education serves as a foundation for future careers and plays a crucial role in building essential skills. This newfound understanding underscores the program's success in illustrating the tangible value of STEM education in preparing for future career endeavors.

Lastly, STEM Talk's influence extended beyond the event, motivating participants to actively seek out opportunities for further exploration. Participants were inspired to take proactive steps, such as seeking internships and workshops, to enhance their exposure to STEM-related experiences. This proactive approach indicates the program's efficacy in motivating participants to take tangible actions towards their STEM career aspirations.

In conclusion, the participants' responses collectively emphasize that STEM Talk initiative had a transformative effect on their perceptions of future STEM careers. By broadening their horizons, providing relatable role models, and highlighting the societal impact of STEM, the program successfully motivated participants to seriously consider and actively pursue STEM-related career paths.

CONCLUSIONS & IMPLICATIONS

In a world where the flames of logical and critical thinking among high school students often wane, STEM Talk initiative seeks to reignite those flames. This platform provides students with an avenue to not only express their thoughts, opinions, and discoveries but also to do so comprehensively and reflectively. Going beyond the mere repetition of facts, the initiative encourages active engagement with various STEM subjects, exploration of diverse perspectives, and the construction of compelling arguments grounded in evidence (Duschl, 2008; Osborne et al., 2003; Perkins et al., 1993). In essence, this initiative mirrors the very essence of logical and critical thinking by promoting active inquiry and thoughtful expression (Lipman, 1991).

The implementation of innovative strategies, such as STEM Talk initiative, holds the potential to address the challenge of diminishing engagement in critical cognitive processes. By incorporating Active research presentations with their diverse engagement elements and AI integration, the initiative not only nurtures a vibrant learning environment but also instills a renewed enthusiasm for logical and critical thinking (Bereiter & Scardamalia, 2006; Resnick et al., 1991; Wolpert-Gawron, 2012).

The conclusions drawn from STEM affinity test results and the insights gathered through the interviews collectively emphasize the substantial positive impact of STEM Talk initiative on participants' STEM affinities and their perceptions of future careers in STEM. STEM affinity test results provided valuable quantitative data that, when combined with the qualitative insights from the interviews, offered a comprehensive understanding of participants' experiences. The test revealed fluctuations in personal interest and self-concept of ability, indicating the complex and dynamic nature of STEM affinities.

However, the interview responses shed light on the factors contributing to these changes and allowed for a deeper exploration of participants' perspectives. The analysis of participants' responses to the interview questions provided compelling evidence of STEM Talk's influence on improving STEM affinities. Participants shared how their experiences were genuinely transformative, describing how the sessions exposed them to interactive and engaging ways of exploring STEM topics. The interviews revealed that STEM talk played a crucial role in enhancing participants' personal interest in STEM, inspiring them to see STEM in a more exciting and relevant light. The program's emphasis on real-world applications, hands-on experiences, and interactive discussions facilitated a shift in participants' attitudes towards STEM subjects.

Similarly, the interview responses demonstrated STEM Talk's powerful impact on participants' perceptions of future careers in STEM. Participants attested to the program's effectiveness in broadening their understanding of the vast array of STEM career opportunities beyond conventional lab settings. The presentations and interactions with peer students showcased the practical and impactful aspects of STEM careers, inspiring participants to seriously consider pursuing such paths. Several participants even embarked on proactive endeavors, such as seeking internships and workshops, to further explore and prepare for their future STEM careers.

The combined results of STEM affinity test and the interviews underscore that STEM Talk initiative successfully catalyzed positive shifts in participants' STEM affinities and their outlook on STEM careers. By promoting engagement, interaction, and relatability, the program succeeded in fostering a more holistic and enthusiastic approach to STEM learning and future endeavors.

The implications of these findings extend beyond the immediate scope of the program. STEM Talk has demonstrated its potential to play a pivotal role in addressing the broader challenges of nurturing STEM interest and attracting students to STEM careers. By showcasing the practical relevance and societal impact of STEM, the program contributes to equipping the next generation with the mindset and skills needed to excel in an increasingly STEM-driven world (Honey & Hilton, 2011; National Research Council, 2011; President's Council of Advisors on Science and Technology, 2010).

However, to comprehensively harness the benefits of AI integration in active research presentation and STEM Talk, further investigation is essential. Future studies could delve into the optimal ways of integrating AI tools, such as ChatGPT, into STEM presentations to enhance engagement and learning outcomes. This could involve examining the customization of AI-generated content to align with different audience preferences and learning styles. Additionally, exploring the long-term effects of AI-enhanced presentations on participants' sustained interest in STEM and their subsequent career choices would provide valuable insights.

Furthermore, understanding the ethical considerations and potential biases introduced by AI-generated content in STEM Talk is crucial. Future research could investigate the transparency of AI-generated information, ensuring accuracy and promoting responsible AI usage in educational settings.

In conclusion, STEM Talk initiative has showcased its capacity to significantly enhance participants' STEM affinities and shape their perceptions of STEM careers. Through engaging sessions, interactive discussions, and exposure to real-world applications, the program has successfully sparked a transformative journey of exploration, curiosity, and aspiration among participants. This, in turn, contributes to fostering a future generation of STEM enthusiasts and professionals who are poised to drive innovation and make meaningful contributions to society, where we live with AI.

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APPENDIX A: STEM AFFINITY TEST

Please indicate the degree to which you agree or disagree with each statement below by circling appropriate letters to the right of each statement.

SA: Strongly Agree

A: Agree

UN: Uncertain

D: Disagree

SD: Strongly Disagree

****

STEM Identity

Q1. My teachers encourage me to do my STEM.

Q2. My family and friends encourage me to do my STEM.

Q3. I am good at my STEM.

Q4. I think of myself as a professional in my field.

Personal Interest Scale

Q5. I think about my STEM I experience in everyday life.

Q6. I am not satisfied until I understand why something works the way it does.

Q7. I study my STEM to learn knowledge that will be useful in my life outside of school.

Q8. I enjoy solving problems related to my STEM.

Q9. Learning my STEM changes my ideas about how the world works.

Q10. Reasoning skills used to understand my STEM can be useful in my everyday life.

Self-concept of Ability

Q11. How good at your STEM are you?

Q12. If you were to rank all the students in your classroom from the worst to the best in your STEM, where would you put yourself?

Q13. Compared to most of your other school STEMs, how good are you at your STEM?

Attitude Toward STEM

Q14. Your STEM is fun.

Q15. I do not like my STEM and it bothers me.

Q16. During STEM class, I am usually interested in STEM.

Q17. If I knew I would never get to STEM class again, I would feel sad.

Q18. STEM is interesting to me, and I enjoy it.

Q19. STEM makes me feel uncomfortable, restless, irritable, and impatient.

Q20. STEM is fascinating and fun.

Q21. The feeling that I have towards STEM is a good feeling.

Q22. When I hear the word, STEM that I am teaching, I have a feeling of dislike.

Q23. STEM is a topic that I enjoy studying.

Q24. I feel at ease with STEM, and I like it very much. I feel a definite positive reaction to STEM.

Q25. STEM is boring.

APPENDIX B: INTERVIEW

1. How did your science affinities (interest, self-efficacy, attitudes, & identity) change before and after participating in STEM Talk?
2. How did STEM Talk help you to promote your future careers in STEM fields?