International Journal of Educational Studies
Volume 8, Issue 3, pp. 66-77
2025

Influence of High School Students' Science Subject Preferences on Their Science Identities, Motivation in Science, and Values of Science

Rosa Aghekyan: *Rutgers Graduate School of Education (Rutgers GSE), United States.*
E-mail: rosa.aghekyan@gse.rutgers.edu

ABSTRACT: *This study aimed to investigate the impact of high school students' science subject preferences on their science learning, including science identities, motivation, and values of science. The participants included 3,454 high school students ranging from 9th to 12th grade, attending urban, suburban, and private schools across three different states. Quantitative data was collected through a survey instrument called SIEVEA and employed various statistical methods, such as descriptive analysis, predictive analysis (including one-way and two-way ANOVA), as well as correlation and Chi-square tests, to analyze the gathered data. The findings of this study revealed that students' science subject preferences play a significant role in shaping their science identities and the value they place on science. Moreover, notable differences were observed between urban and suburban students in terms of their science subject preferences. Although this research offers valuable insights into the variations in students' science subject preferences based on school type (urban versus suburban), further investigation is recommended. This additional research will aid in the development of enhanced curricula, identification of suitable resources, increased student engagement, and informed policy decisions.*

Key words: *Motivation, Science identities, Science subject preferences, Values of Science.*

1. Background

Understanding the factors that influence high school students' engagement in science is critical for developing effective educational strategies, particularly in an increasingly globalized and scientifically driven world. Among these factors, students' preferences for specific science subjects play a pivotal role in shaping their science identity, motivation, and the value they attribute to science. Research suggests that fostering a strong science identity and intrinsic motivation is essential for cultivating a scientifically literate society, capable of addressing complex international challenges (Shields & Rangarajan, 2013). Interestingly, a study conducted by Jackson et al. (2019) revealed that positive social recognition during conversations about scientific interests significantly impacted individuals facing external barriers, particularly women. For women with low or average science identities, such recognition predicted a greater interest in pursuing a science career over time, while this effect was less pronounced for women with high science identities or for men. Encouraging students to express their preferences for specific science subjects helps them connect personally with the content. When students identify with a field like biology, chemistry, or physics, they are more likely to see themselves as capable in that area (Carlone & Johnson, 2007). This sense of ownership fosters a positive science identity, which is essential for persistence in science, boosting both self-confidence and motivation. This aligns with the expectancy-value theory (Wigfield & Eccles, 2000), which suggests that students' beliefs about their competence and the value they place on an activity directly influence their persistence. As students feel more capable and invested in science, they are more likely to persist, ultimately enhancing their scientific literacy.

International Journal of Educational Studies
Vol. 8, No. 3, pp. 66-77
2025
DOI: *10.53935/2641533x.v8i3.373*
Email: rosa.aghekyan@gse.rutgers.edu

This study aims to investigate the relationship between high school students' science subject preferences and their science learning outcomes, specifically focusing on their science identities, motivation in science, and values of science. Furthermore, it examines how these relationships vary across different school settings, such as urban and suburban schools. Exploring this dynamic is especially relevant for understanding disparities in science education and how they may impact global scientific literacy.

To address these questions, this study utilizes a quantitative research methodology, analyzing data collected through the Science Identities, Expectations of Success in Science, Values of Science, and Environmental Attitudes (SIEVEA) survey instrument (Aghekyan, 2017; Aghekyan, 2019; Aghekyan, 2020). The survey captures diverse aspects of students' engagement in science, providing a comprehensive framework for examining how preferences and contextual factors intersect.

The significance of this study lies in its potential to reveal statistically significant correlations between students' subject preferences and their science identities and motivation. Additionally, by exploring the interests of high school students across diverse educational contexts, this research offers valuable insights into addressing inequities in science education and informs strategies for fostering greater inclusivity. These findings hold particular importance for international perspectives, as they underscore the need for globally relevant approaches to science education that accommodate diverse learning environments and preferences.

2. Literature Review

The significance of high school students' science identities, motivation, and values in shaping their science learning is widely recognized. Mao et al. (2021) emphasize the crucial relationship between students' attitudes toward science and their academic achievement in the subject. They argue that understanding this connection offers valuable insights into how students' perceptions of science influence their subject choices. This understanding is critical, as students' preferences and self-concept as "science people" have long been linked to their academic persistence and success in the sciences (Chen et al., 2021). Specifically, Chen et al. (2021) found that students who identify strongly as science-oriented are more likely to succeed in the field, although the mechanisms underlying this relationship are still not fully understood. One possible explanation is that a strong science identity helps foster a sense of belonging in the science classroom, which can be particularly beneficial for first-generation and racial-minority students, who may experience doubt about their place in the field of science (Chen et al., 2021). This aligns with findings from Vincent-Ruz and Schunn (2018), who highlighted that science identity plays a multifaceted role in influencing students' choices of science subjects, with gender often being a key factor in the selection of optional science subjects. Similarly, Rohandi (2017) emphasized the importance of making science education more relevant to students' lived experiences, suggesting that students' engagement in science increases when the curriculum reflects their interests and cultural context.

Additionally, the role of students' preferences in science subjects has been the subject of extensive research. Several studies have explored how individual traits, environmental factors, gender, cognitive abilities, and perceptions of teaching quality predict students' liking for school subjects, including science (Colley & Comber, 2003; Halpern et al., 2007; Lavrijsen et al., 2021; Madden et al., 2018). These studies show that factors such as intrinsic interest, perceived teaching quality, and access to resources significantly affect students' preferences for particular science subjects. However, limited research has examined how these preferences specifically influence students' science identities and motivation in science, and how these preferences vary across different school settings. Addressing this gap can provide a deeper understanding of how students' interests in science subjects are shaped by their environment and personal experiences.

The study of science subject preferences across different school types—urban versus suburban—is particularly important. Research by Basu and Barton (2007) indicates that urban youth develop a sustained interest in science when their educational experiences are directly connected to their vision of the future, particularly in terms of career aspirations. Similarly, Aschbacher et al. (2010) found that community context plays a pivotal role in students' career development, influencing their science identity and shaping their perceived ability to succeed in science-related careers. For students in urban areas, a direct connection between science education and their community's needs, such as environmental issues, can significantly impact their interest and persistence in science. This connection, however, is often less pronounced in suburban schools, where students may have more access to resources but may not see the same relevance between science topics and their daily lives.

International Journal of Educational Studies
Vol. 8, No. 3, pp. 66-77
2025
DOI: *10.53935/2641533x.v8i3.373*
Email: rosa.aghekyan@gse.rutgers.edu

The importance of exploring these differences lies in understanding how environmental factors shape students' science engagement. For instance, urban students might feel disconnected from science topics such as environmental issues (e.g., water quality and climate change) due to limited firsthand experiences. Roberts et al. (2021) found that this disconnection can reduce students' ability to internalize scientific concepts effectively. This suggests that urban students may need curricula that bridge the gap between abstract scientific concepts and their lived experiences. Furthermore, understanding how science preferences differ between urban and suburban students can help identify disparities in access to science education resources, which may contribute to broader inequities in educational outcomes.

One of the key implications of these findings is that science curricula should be modified based on the interests and preferences of students, considering the unique contexts of urban and suburban schools. Teachers and curriculum developers can create more engaging and inclusive science education by aligning instruction with students' interests. For example, science curricula that integrate local environmental issues, career opportunities, and students' cultural contexts can foster a greater sense of relevance and engagement. In turn, this can improve students' motivation, achievement, and persistence in science, and ultimately contribute to enhancing scientific literacy across different student populations.

In addition, understanding students' science preferences can inform educational policy decisions. As Nyutu et al. (2022) note, science educators often design curricula based on an idealized version of science instruction, but students' perceptions and interests may not align with this design. By recognizing students' preferences and experiences, educators can create science curricula that are not only more engaging but also more aligned with students' real-world contexts. This approach can improve motivation, participation, and long-term interest in science, particularly for students in underserved or underrepresented communities.

Moreover, examining the relationship between science preferences, science identities, and motivation in diverse school settings can help guide resource allocation. Policymakers and educational administrators can use this information to ensure that science programs, teacher training, and specialized resources are distributed equitably across different school types. This approach ensures that all students, regardless of their school setting, have access to high-quality science education that supports their academic and career aspirations.

Finally, this study contributes to the growing body of literature on the factors influencing science engagement, motivation, and career choice by examining how science preferences are distributed across urban and suburban schools. By considering the role of science subject preferences in shaping students' science identities and motivation, this research offers valuable insights into how educators can design curricula that foster greater engagement, achievement, and persistence in science education.

3. Research Questions

Here is the complete list of this study's research questions:

1. How do students' science subject preferences influence their science identities and motivation in science?
2. How do students' science subject preferences influence their values of science?
3. Do urban and suburban high school students view their science identities and motivation in science and values of science differently?
4. Do students' science subject preferences vary by school type: urban versus suburban?

4. Method

4.1. Participants

The target population for this study comprised high school students attending urban, suburban public, and private schools. To achieve diverse representation, multiple school districts in three states—New Jersey, Pennsylvania, and Connecticut—were contacted for participation. A total of 13 districts agreed to take part in the study, including students from seven suburban schools, five urban schools, and one private school.

The sample included 3,454 high school students who completed the survey, of which 3,099 provided complete responses used in the data analysis. The decision to exclude incomplete responses ensured the reliability and integrity of the dataset. To protect student privacy and encourage participation, no identifying information such as ethnicity, race, or other demographic data was collected, aside from gender. Data collection was conducted through an online survey, which provided flexibility for students to participate either at home or in school. This approach aimed to minimize barriers to participation and accommodate varied

International Journal of Educational Studies
Vol. 8, No. 3, pp. 66-77
2025
DOI: *10.53935/2641533x.v8i3.373*
Email: rosa.aghekyan@gse.rutgers.edu

schedules. Participation was voluntary and anonymous, and no IP addresses were collected to further guarantee confidentiality. The details of the study participants, including the distribution across school types, are presented in Table 1.

Table 1. Study Participants: By School, School Type and Gender.

		Participants			
School	**School Type**	**Total**	**Female**	**Male**	**Unknown Gender**
S1	Suburban	166	90	76	0
S2	Urban	231	115	116	0
S3	Urban	425	218	205	2
S4	Urban	64	27	36	1
S5	Suburban	27	18	9	0
S6	Suburban	143	74	69	0
S7	Suburban	55	32	22	1
S8	Private	41	0	41	0
S9	Urban	105	63	42	0
S10	Suburban	165	97	67	1
S11	Suburban	46	30	16	0
S12	Suburban	1,364	750	611	3
S13	Urban	267	154	113	0

Note: Data shows participants with complete answers.

4.2. Data Sources

The survey instrument SIEVEA (see Appendix) was administered by using the Qualtrics website. There were a total of 15 questions in the survey. The first survey item allowed the researchers to collect student gender data. The second question provided information with respect to participants' interest toward science subjects. Lastly, the remaining thirteen questions covered four survey constructs. These 13 questions were listed in no particular order. The survey utilized a 5-point Likert scale to capture student answers to those 13 questions. The answer choices were: strongly agree, agree, neither agree nor disagree, disagree and strongly disagree.

Since survey participants were high school students, the simplicity of the design was a priority. Among other reasons, the Likert-type scale was chosen so the survey format resembled a multiple-choice format test familiar to students. In addition to predefined, multiple choice questions, the second item provided a message box, in which students could type their favorite science subject if it was not present in the provided list. All questions used simple words and straightforward sentence structures. Although richer data could have been collected, the survey was restricted to a small number of questions, because of concern that students might become tired and fail to complete the survey or provide accurate answers.

Exploratory and confirmatory factor analyses were conducted prior to this study, in order to discover and confirm the survey's factor structure and validate the survey (Aghekyan, 2019). Likewise, the survey's validity and reliability were established using convenient and widely used measures proposed by Fornell and Larcker (1981). The composite reliability (CR) values of all survey constructs were greater than the acceptable threshold value of 0.7 and the average variance extracted (AVE) values used for establishing convergent validity exceeded 0.5 which is the required minimum value for ascertaining this validity.

4.3. Procedure

Since some research questions are related to measuring differences of certain variables between different groups of students, they can be answered using a one-way Anova with additional post hoc comparisons, using Tukey's procedure. Other questions can be answered using descriptive statistics and correlation analysis. Lastly, the research question related to differences in students' science subject preferences can be answered using Pearson's chi-squared test since this test is commonly used to decide whether there is a statistically significant difference between the expected and observed frequencies of multiple classes of a variable value.

International Journal of Educational Studies
Vol. 8, No. 3, pp. 66-77
2025
DOI: *10.53935/2641533x.v8i3.373*
Email: rosa.aghekyan@gse.rutgers.edu

5. Results

The results of data analyses for all research questions follow.

Research Question 1: How do students' science subject preferences influence their science identities and motivation in science?

A one-way analysis of variance indicated statistically significant differences between science identity and motivation scores of students with different subject preferences ($F = 80.308$ and $p < .000$).

Table 2 shows descriptive statistics (count, mean, standard deviation, and 95% confidence intervals) by favorite science subject. According to this data, the students who chose biology, physics and chemistry as their favorite science subjects held stronger science identities ($M > 1$) than the students who preferred Earth science, environmental science, forensics or other science subjects. The students with preference in physics had the strongest science identity and motivation ($M = 1.251$), whereas the students who favored Earth science had the lowest score ($M = .440$). The post hoc comparisons, using the Tukey's procedure, confirmed these observations by producing statistically significant ($p < .000$) mean differences between these groups.

Table 2. Descriptive Statistics of Students' Science Identities and Motivation in Science By Favorite Science Subject Means, Confidence Intervals and Standard Deviations.

				95% Confidence Interval	
Favorite Subject	**N**	**M**	**SD**	**Lower Bound**	**Upper Bound**
Biology	817	1.091	1.283	1.003	1.179
Chemistry	810	1.037	1.298	0.948	1.127
Other	265	.816	1.383	0.649	0.984
Earth Science	163	0.440	1.103	0.269	0.610
Environmental Science	135	0.516	1.293	0.296	0.736
Forensics	297	0.573	1.292	0.426	0.721
Physics	258	1.251	1.301	1.092	1.411
None	353	-0.616	1.177	-0.740	-0.493

Research Question 2: How do students' science subject preferences influence their values of science?

In order to answer this research question, a one-way analysis of variance test was conducted on students' values of science scores. The test produced statistically significant results ($F = 4.633$, $p < .000$).

According to descriptive statistics (see Table 3), the students who chose chemistry ($M = .062$) and physics ($M = .051$) as their favorite subjects valued science the most.

Table 3. Descriptive Statistics of Students' Values of Science by Favorite Science Subject Means, Confidence Intervals and Standard Deviations.

				95% Confidence Interval	
Favorite Subject	**N**	**M**	**SD**	**Lower Bound**	**Upper Bound**
Biology	817	0.017	0.812	-0.039	0.073
Chemistry	810	0.062	0.794	0.007	0.116
Other	265	-0.096	0.834	-0.197	0.005
Earth Science	163	0.011	0.791	-0.112	0.133
Environmental Science	135	0.024	0.824	-0.116	0.164
Forensics	297	0.046	0.770	-0.042	0.133
Physics	258	0.051	0.828	-0.051	0.152
None	353	-0.199	0.812	-0.284	-0.114

Note: Descriptive statistics used students' factor scores.

Research Question 3: Do urban and suburban high school students view their science identities and motivation in science and values of science differently?

A one-way analysis of variance test (see Table 4 and Table 5) showed no statistically significant differences between urban and suburban students regarding their science identities and motivation ($p = .461$) and values of science ($p = .222$).

International Journal of Educational Studies
Vol. 8, No. 3, pp. 66-77
2025
DOI: *10.53935/2641533x.v8i3.373*
Email: rosa.aghekyan@gse.rutgers.edu

Table 4. A One-Way ANOVA Summary School Type Differences - All Three Constructs.

Construct	Source	df	SS	MS	F	p
C1	Between-group	1	1.053	1.053	0.544	0.461
	Within-group	30056	50915.269	1.936		
	Total	30057	50916.322			
C2	Between-group	1	0.978	0.978	1.493	0.222
	Within-group	3.056	2.001.316	0.655		
	Total	3.057	2.002.294			

Note: C1 = Science Identities and Motivation, C2 = Science Values.

Table 5. Descriptive Statistics of Three Constructs by School Type Means, Confidence Intervals and Standard Deviations.

					95% Confidence Interval	
Construct		**N**	**M**	**SD**	**Lower Bound**	**Upper Bound**
C1	Urban	1.092	0.734	1.278	0.658	0.810
	Suburban	1.966	0.772	1.450	0.708	0.837
C2	Urban	1.092	0.024	0.799	-0.024	0.071
	Suburban	1.966	-0.014	0.815	-0.050	0.022

Note: C1 = Science Identities and Motivation, C2 = Science Values.

Research Question 4: Do students' science subject preferences vary by school type: urban versus suburban?

Chi-square test indicated that there were statistically significant differences between urban and suburban students' science subject preferences. The Pearson Chi-Square was 26.675 (df = 7) with p < .000. Students' science subject preferences by school type are summarized in Table 6.

Table 6. Students' Science Subject Preferences by School Type.

		Favorite Science Subject								
School Type		**Biology**	**Chemistry**	**Other**	**Earth Science**	**Environmental Science**	**Forensics**	**Physics**	**None**	**Total**
Urban	Count	261	252	113	59	50	125	97	135	1,092
	% within School Type	23.9%	23.1%	10.3%	5.4%	4.6%	11.4%	8.9%	12.4%	100%
	% within Favorite Science Subject	32.2%	31.4%	43.0%	36.6%	37.0%	43.0%	39.8%	38.6%	35.7%
	% of Total	8.5%	8.2%	3.7%	1.9%	1.6%	4.1%	3.2%	4.4%	35.7%
Suburban	Count	549	551	150	102	85	166	147	215	1,965
	% within School Type	27.9%	28.0%	7.6%	5.2%	4.3%	8.4%	7.5%	10.9%	100%
	% within Favorite Science Subject	67.8%	68.6%	57.0%	63.4%	63.0%	57.0%	60.2%	61.4%	64.3%
	% of Total	18.0%	18.0%	4.9%	3.3%	2.8%	5.4%	4.8%	7.0%	64.3%
Total	Count	810	803	263	161	135	291	244	350	3,057
	% within School Type	26.5%	26.3%	8.6%	5.3%	4.4%	9.5%	8.0%	11.4%	100%
	% within Favorite Science Subject	100%	100%	100%	100%	100%	100%	100%	100%	100%

International Journal of Educational Studies
Vol. 8, No. 3, pp. 66-77
2025
DOI: *10.53935/2641533x.v8i3.373*
Email: rosa.aghekyan@gse.rutgers.edu

Even though the differences by school type were statistically significant, they varied greatly by subject. For example, biology and chemistry were the topmost popular science subjects in both urban and suburban schools, with approximately equal popularity (23.9% biology and 23.1% chemistry in urban schools; 27.9% biology and 28.0% chemistry in suburban schools). Their popularity in suburban schools was about 4% higher than their popularity in urban schools. Conversely, forensics was more popular with urban students (11.4%) than with suburban ones (8.4%). Preferences in Earth science and environmental science were only slightly dissimilar, with less than a .5% difference.

6. Discussion

The data collected using the SIEVEA instrument was rich and very useful. It allowed for conducting multiple statistical tests in order to answer the research questions of this study.

According to the results, students' science subject preferences significantly influence their science identities and motivation in science. Moreover, students with preferences in biology, chemistry and physics have strong science identities and motivation in science. This outcome was intuitively predictable and appeared very reasonable. Students, who like challenging science subjects like physics or chemistry, should be both interested in science and highly motivated to learn science. Similarly, strong environmental attitudes should go along with a keen interest in learning about environment. Still, it is significant that this intuitive knowledge was confirmed by statistical analysis of a large, heterogeneous response data.

Likewise, there were statistically significant differences in students' value of science depending on their subject preferences. Here again there was an interesting result indicating that the students who prefer chemistry and physics had the highest value of science. This result was consistent with those for students' science identities and motivation in science where also chemistry and physics preference had the strongest influence on students' science identities and motivation.

Investigation of differences between urban and suburban students revealed a rather interesting outcome: there were no statistically significant variances in urban and suburban students' science identities and motivation and in how they value science. However, there were statistically significant differences between urban and suburban students' science subject preferences. Even though both urban and suburban students had a strong preference for biology and chemistry, forensics was much more popular with urban students than with suburban students.

Students' preferences for subjects like biology, chemistry, and physics play a crucial role in shaping their science identity and motivation. Therefore, it is highly valuable to incorporate these interests into educational practices. By aligning curricula with students' interests, educators can make science feel more engaging. Additionally understanding these preferences enables educators to offer customized support in subjects that capture students' interests, as well as those that are less captivating, helping all students grow and succeed. The lack of significant differences in science identities and motivation between urban and suburban students is an encouraging finding, suggesting equitable access to foundational science education across these groups of students. However, the notable differences in subject preferences, like urban students' stronger interest in forensics, open up compelling possibilities. By customizing science programs to include subjects like forensics in urban schools, we can make science more engaging for these students. This flexibility not only sparks interest but also encourages more students to pursue STEM fields, cultivating a future workforce that is both diverse and driven.

The collected data provided valuable and detailed insights, enabling a comprehensive examination of all four research questions outlined in the study. It allowed each research question to be analyzed in depth using a variety of statistical techniques. These findings offer a meaningful contribution to the field, enhancing understanding of the subject and laying a solid foundation for future research and practical applications.

Consistent with Alhadabi's (2021) research, this study demonstrates that students' preferences for specific science subjects play a critical role in shaping their science identities. Alhadabi (2021) also found that individual factors such as science self-efficacy, interest, and socioeconomic status had a more significant influence on science identity than school-level factors. Additionally, both studies indicate that students from low-SES public schools and minority groups tend to report lower science identities. Earlier, Kim (2018) explored how students develop their science identities through classroom interactions, with a focus on their perceptions of themselves as scientists. The study also highlighted how teacher-student interactions foster science identities by promoting knowledge-seeking, perseverance, and enthusiasm for science. In contrast, this

International Journal of Educational Studies
Vol. 8, No. 3, pp. 66-77
2025
DOI: *10.53935/2641533x.v8i3.373*
Email: rosa.aghekyan@gse.rutgers.edu

study suggests that the influence of subject preferences extends beyond engagement and enthusiasm, also shaping how students value science in broader societal contexts.

The findings of this study align with existing frameworks like expectancy-value theory and identity development models. Expectancy-value theory suggests that students' motivation and engagement are influenced by the value they place on a subject and their expected success in it. The study's results, which show that science subject preferences shape students' science identities and values, align with this theory, as students' preferences likely reflect their beliefs about the value of science and their ability to succeed in it. Similarly, the study also aligns with development models, which highlight how students' personal identities (in this case, their science identity) evolve through their experiences and preferences.

This study complements the previous research by examining the differences between urban and suburban students. Specifically, it highlights how external factors, such as school type, can influence students' science identities and motivation, emphasizing the crucial role of context in identity development. For instance, Chapman and Feldman (2016) found that diverse urban high school students who participated in an authentic science experience developed varying science identities. Another study by Guerra and Rezende (2017) indicated that Hispanic students, in particular, exhibited weaker science identities, potentially due to feeling marginalized within the school context. Conversely, a case study of urban high school science and math classrooms by Rocha et al. (2023) concluded that integrating supports, resources, and opportunities is key to shaping students' science identities, which include their interest, passion, knowledge, participation, and achievements.

This study addresses gaps in the literature by exploring how high school students' preferences for specific science subjects shape their science identities, motivation, and values, focusing on urban, suburban, and private school contexts. While previous research (Septiyanto et al., 2020; Kuchynka et al., 2022; Lee & Mun, 2023) has examined broad factors influencing science identity, motivation, and students' general attitudes toward science, this study provides a more nuanced understanding of how students' individual preferences for subjects such as biology, chemistry, and physics impact their overall engagement and connection to science. Furthermore, consistent with previous findings, the study highlights the role of school type (urban vs. suburban) in shaping students' science subject preferences and science identities, addressing a gap in understanding how contextual factors interact to influence students' science motivation and identities. Lastly, it is worth noting that while there has been research on high school students' science identity development and motivation, fewer studies have explicitly investigated how science subject preferences contribute to science identity and motivational constructs across diverse educational settings focused on science learning.

One key limitation of this study is that, although data on students' environmental attitudes were collected alongside their science identities, values, and expectations of success, these data were not analyzed. Future research should examine the correlations between high school students' environmental attitudes and their science subject preferences, particularly exploring differences between urban and suburban schools. Additionally, observational methods or longitudinal designs could offer valuable insights into how science identity evolves over time. Further studies should also investigate how subject preferences shape science identities within diverse cultural contexts and assess the impact of interdisciplinary science courses on student motivation.

7. Conclusion

This study demonstrated the effectiveness of the SIEVEA instrument. The data collected by this survey was used to investigate students' science identities, motivation in science, and values of science. It allowed for conducting a rich, quantitative research using various statistical tests and for exploring how students' school type, and favorite science subject affect the research constructs. The effects of students' attributes on the constructs were analyzed both independently and collectively in order to discover significant interactions.

Since sustainability is now an integral part of Next Generation Science Standards (NGSS, 2013), the scholars felt the need to question how effectively it is being taught in schools (Feinstein & Kirchgasler, 2015). They expressed doubts as to whether the political aspect of sustainability should and could be taught in environmental science classes. As such, they recommended collaboration between the science and social studies teachers in teaching students about sustainability challenges. Likewise, Wijsman et al. (2018) pointed out a positive association between secondary education students' favorite subjects and their performance. Furthermore, various researchers highlighted how the gender stereotypes of math and science impact students'

DOI: *10.53935/2641533x.v8i3.373*
Email: rosa.aghekyan@gse.rutgers.edu

career aspirations in STEM fields (Makarova et al., 2019) and female students' self-concept in STEM subjects (Ertl et al., 2017). The SIEVEA instrument serves not only as a valuable tool for exploring high school students' subject preferences and their science identities and motivation but also carries several positive implications. Among these outcomes is enabling curriculum writers to develop instruction tailored to students' individualized learning needs, aligning with their interests. This will also enable science educators to intervene early when they identify low motivation towards specific science subjects or a negative perception of science. Another advantage will be the appropriate allocation of the science budget, enabling schools and districts to decide where and how to allocate funds for resources, including laboratory equipment and modern technology. Furthermore, it is anticipated that the survey data will prove beneficial for fostering strong student-teacher relationships, as science teachers will work closely with students, recognizing their science preferences and motivations and employing strategies for improvement if necessary.

The study's results indicated that students' science subject preferences influence their science identities and how they value science. Additionally, it turned out that students' science subject preferences significantly vary by school type (urban versus suburban). These results can be used by both educational researchers and practitioners for developing instructional and teaching strategies, which can facilitate development of stronger science identities and increase students' motivation in science learning.

Since the SIEVEA survey was designed for high school students, it can be used to conduct longitudinal studies in the future. For example, the researchers can use the SIEVEA instrument with the same subjects once a year for 4 consecutive years. By collecting data from the same students in the 9th to 12th grades, it will be possible to explore how their science identities and motivation in science develop and transform while they go through high school. It will be interesting to find out if any noticeable and significant changes are taking place during the students' high school years. Another recommendation for future research is to conduct the SIEVEA survey twice a year: once at the beginning and once at the end of the year (Jovanovic & King, 1998). This will allow for determination of how students' science identities and motivation evolve as they progress through an academic year.

In summary, this study highlights the deep connection between students' subject preferences and their science identity, underscoring the importance of educational strategies that resonate with these interests. Aligning teaching methods with students' passions not only boosts motivation but also enhances the value they place on science, ultimately cultivating a more engaged and scientifically literate society. As Neil deGrasse Tyson insightfully stated, "Science literacy is the artery through which the solutions of tomorrow's problems flow."

Ethics Statement:

This research study has been approved by the Rutgers Institutional Review Board (IRB # E13-748). All survey participants provided their consent before answering the survey questions. The survey was conducted anonymously, and no personal names were collected, ensuring the confidentiality of each participant's responses.

Conflict of Interest:

The author declares that she has no conflict of interest.

Acknowledgment:

I would like to express my gratitude to my mentor, Dr. Angella O'Donnell, for her unwavering support and guidance throughout my journey. Her guidance provided me with the confidence and tools necessary to immerse myself in the research process and conduct a successful study. I am truly grateful for her mentorship and encouragement.

References

Alhadabi, A. (2021). Science interest, utility, self-efficacy, identity, and science achievement among high school students: An application of SEM tree. *Frontiers in Psychology*, 12, 634120. https://doi.org/10.3389/fpsyg.2021.634120

Aschbacher, P. R., Li, E., & Roth, E. J. (2010). Is science me? High school students' identities, participation, and aspirations in science, engineering, and medicine. *Journal of Research in Science Teaching*, 47(5), 564-582. https://doi.org/10.1002/tea.20353

Academia Publishing Group

International Journal of Educational Studies
Vol. 8, No. 3, pp. 66-77
2025
DOI: *10.53935/2641533x.v8i3.373*

Email: rosa.aghekyan@gse.rutgers.edu

Aghekyan, R. (2017). Exploring high school students' science identities, motivation in science, and environmental attitudes (Doctoral dissertation, Rutgers University-Graduate School-New Brunswick).
Aghekyan, R. (2019). Measuring high school students' science identities, expectations of success in science, values of science, and environmental attitudes: Development and validation of the SIEVEA survey. *Science Education International*, 30(4), 342-353.
Aghekyan, R. (2020). Validation of the SIEVEA instrument using the Rasch analysis. *International Journal of Educational Research*, 103, 101619. https://doi.org/10.1016/j.ijer.2020.101619
Basu, S. J., & Barton, A. C. (2007). Developing a sustained interest in science among urban minority youth. *Journal of Research in Science Teaching: The Official Journal of the National Association for Research in Science Teaching*, 44(3), 466-489. https://doi.org/10.1002/tea.20156
Carlone, H. B., & Johnson, A. (2007). Understanding the science experiences of successful women of color: Science identity as an analytic lens. *Journal of Research in Science Teaching: The Official Journal of the National Association for Research in Science Teaching*, 44(8), 1187-1218. https://doi.org/10.1002/tea.20237
Chapman, A., & Feldman, A. (2016). Cultivation of science identity through authentic science in an urban high school classroom. *Cultural Studies of Science Education*. https://doi.org/10.1007/s11422-015-9723-3
Chen, S., Binning, K. R., Manke, K. J., Brady, S. T., McGreevy, E. M., Betancur, L., Limeri, L.B., & Kaufmann, N. (2021). Am I a science person? A strong science identity bolsters minority students' sense of belonging and performance in college. *Personality and Social Psychology Bulletin*, 47(4), 593-606. https://doi.org/10.1177/0146167221991865
Colley, A., & Comber, C. (2003). School subject preferences: Age and gender differences revisited. *Educational Studies*, 29(1), 59-67. https://doi.org/10.1080/0305569032000067489
Ertl, B., Luttenberger, S., & Paechter, M. (2017). The impact of gender stereotypes on the self-concept of female students in STEM subjects with an under-representation of females. *Frontiers in Psychology*, 8, 703. https://doi.org/10.3389/fpsyg.2017.00703
Feinstein, N. W., & Kirchgasler, K. L. (2015). Sustainability in science education? How the Next Generation Science Standards approach sustainability, and why it matters. *Science Education*, 99(1), 121-144. https://doi.org/10.1002/sce.21188
Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39-50. https://doi.org/10.1177/002224378101800104
Guerra, A., & Rezende, F. (2017). Sociocultural influences on science and on science identities. *Cultural Studies of Science Education*, 12, 505-511. https://doi.org/10.1007/s11422-017-9812-3
Halpern, D. F., Benbow, C. P., Geary, D. C., Gur, R. C., Hyde, J. S., & Gernsbacher, M. A. (2007). The science of sex differences in science and mathematics. *Psychological Science in the Public Interest*, 8(1), 1-51. https://doi.org/10.1111/j.1529-1006.2007.00032.x
Jovanovic, J., & King, S. S. (1998). Boys and girls in the performance-based science classroom: Who's doing the performing? *American Educational Research Journal*, 35(3), 477-496. https://doi.org/10.3102/00028312035003477
Kim, M. (2018). Understanding children's science identity through classroom interactions. *International Journal of Science Education*, 40(1), 24-45. https://doi.org/10.1080/09500693.2017.1414433
Kuchynka, S. L., Reifsteck, T. V., Gates, A. E. (2022). Which STEM relationships promote science identities, attitudes, and social belonging? A longitudinal investigation with high school students from underrepresented groups. *Social Psychology of Education*, 25(4), 819–843. https://doi.org/10.1007/s11218-022-09705-7
Lavrijsen, J., Tracey, T. J., Verachtert, P., De Vroede, T., Soenens, B., & Verschueren, K. (2021). Understanding school subject preferences: The role of trait interests, cognitive abilities, and perceived engaging teaching. *Personality and Individual Differences*, 174, 110685. https://doi.org/10.1016/j.paid.2021.110685
Lee, G. G., & Mun, S. (2023). From science motivation to science identity: The mediating effect of science achievement according to gender. *Eurasia Journal of Mathematics, Science and Technology Education*, 19(10), em2221. https://doi.org/10.29333/ejmste/13018
Madden, A. D., Webber, S., Ford, N., & Crowder, M. (2018). The relationship between students' subject preferences and their information behavior. *Journal of Documentation*, 74(4), 692-721. https://doi.org/10.1108/JD-02-2017-0033
Makarova, E., Aeschlimann, B., & Herzog, W. (2019, July). The gender gap in STEM fields: The impact of the gender stereotype of math and science on secondary students' career aspirations. In *Frontiers in Education* (Vol. 4, p. 60). Frontiers. https://doi.org/10.3389/feduc.2019.00060
Mao, P., Cai, Z., He, J., Chen, X., & Fan, X. (2021). The relationship between attitude toward science and academic achievement in science: A three-level meta-analysis. *Frontiers in Psychology*, 12, 784068. https://doi.org/10.3389/fpsyg.2021.784068
NGSS Lead States. (2013). *Next Generation Science Standards: For states, by states*. Washington, DC: The National Academies Press. https://doi.org/10.17226/18290
Nyutu, E. N., Cobern, W. W., & Pleasants, B. A. S. (2022). The relationship between students' casual interest in science and their perceptions of the undergraduate laboratory environment. *Research in Science Education*, 52(4), 1261-1275. https://doi.org/10.1007/s11165-021-09971-3
Roberts, K., Wilcox, J., & Bahnson, A. (2021). Cultivating place. *Science and Children*, 58(4), 53-60.
Rocha, J., Cabral, B., Chen, E., Rodriguez, C., & Yancy, C. W. (2023). Integrative supports, resources, and opportunities—Exploring and expanding urban high school students' science identity: A longitudinal qualitative study. *Gifted Child Quarterly*, 67(1), 44-63. https://doi.org/10.1177/00169862221119209
Rohandi, R. (2017). Teaching and learning science: Students' perspective. *International Journal of Indonesian Education and Teaching*, 1(1), 16-31.
Septiyanto, A., Oetomo, D., & Indriyanti, N. Y. (2024). Students' interests and attitudes toward science, technology, engineering, and mathematics careers. *International Journal of Evaluation & Research Education*, 13(1), 379-389. https://doi.org/10.11591/ijere.v13i1.9232

International Journal of Educational Studies
Vol. 8, No. 3, pp. 66-77
2025
DOI: *10.53935/2641533x.v8i3.373*
Email: rosa.aghekyan@gse.rutgers.edu

Shields, P. M., & Rangarajan, N. (2013). *A playbook for research methods: Integrating conceptual frameworks and project management*. Stillwater, OK: New Forums Press.

Vincent-Ruz, P., & Schunn, C. D. (2018). The nature of science identity and its role as the driver of student choices. *International Journal of STEM Education*, 5(1), 1-12. https://doi.org/10.1186/s40594-018-0120-0

Wigfield, A., & Eccles, J. S. (2000). Expectancy–value theory of achievement motivation. *Contemporary Educational Psychology*, 25(1), 68-81. https://doi.org/10.1006/ceps.1999.1015

Wijsman, L. A., Saab, N., Warrens, M. J., van Driel, J. H., & Westenberg, P. M. (2018). Relations of autonomous and controlled motivation with performance in secondary school students' favoured and disfavoured subjects. *Educational Research and Evaluation*, 24(1-2), 51-67. https://doi.org/10.1080/13803611.2018.1488633

Appendix

SIEVEA Survey

1. What is your gender?
   - Female
   - Male
2. My favorite science subject is (pick one)
   - Biology
   - Chemistry
   - Earth Science
   - Environmental Science
   - Forensics
   - Physics
   - None
   - Other
3. Learning science in school will help me to succeed later in life.
   - Strongly Agree
   - Agree
   - Neither Agree nor Disagree
   - Disagree
   - Strongly Disagree
4. I am confident I can master the skills taught in my science class.
   - Strongly Agree
   - Agree
   - Neither Agree nor Disagree
   - Disagree
   - Strongly Disagree
5. I consider science topics very interesting and engaging.
   - Strongly Agree
   - Agree
   - Neither Agree nor Disagree
   - Disagree
   - Strongly Disagree
6. When it comes to learning science, I think of myself as a science person.
   - Strongly Agree
   - Agree
   - Neither Agree nor Disagree
   - Disagree
   - Strongly Disagree
7. My peers and teachers think that I am knowledgeable in science.
   - Strongly Agree
   - Agree
   - Neither Agree nor Disagree
   - Disagree

International Journal of Educational Studies
Vol. 8, No. 3, pp. 66-77
2025
DOI: *10.53935/2641533x.v8i3.373*
Email: rosa.aghekyan@gse.rutgers.edu

- Strongly Disagree

8. I am certain I can figure out how to do the most difficult science class work.
   - Strongly Agree
   - Agree
   - Neither Agree nor Disagree
   - Disagree
   - Strongly Disagree
9. I can use technology for learning science content.
   - Strongly Agree
   - Agree
   - Neither Agree nor Disagree
   - Disagree
   - Strongly Disagree
10. My friends and family recognize me as a scientist.
    - Strongly Agree
    - Agree
    - Neither Agree nor Disagree
    - Disagree
    - Strongly Disagree
11. It is important to me that I look smart in my science class.
    - Strongly Agree
    - Agree
    - Neither Agree nor Disagree
    - Disagree
    - Strongly Disagree
12. I would like to become more active on important environmental issues.
    - Strongly Agree
    - Agree
    - Neither Agree nor Disagree
    - Disagree
    - Strongly Disagree
13. One of my goals is to show others that I am good at science.
    - Strongly Agree
    - Agree
    - Neither Agree nor Disagree
    - Disagree
    - Strongly Disagree
14. It is important for all people to be engaged in vital environmental issues.
    - Strongly Agree
    - Agree
    - Neither Agree nor Disagree
    - Disagree
    - Strongly Disagree
15. I am interested in reading websites, articles or watching TV programs, documentary movies about the environmental issues.
    - Strongly Agree
    - Agree
    - Neither Agree nor Disagree
    - Disagree

- Strongly Disagree

International Journal of Educational Studies
Vol. 8, No. 3, pp. 66-77
2025
DOI: *10.53935/2641533x.v8i3.373*
Email: rosa.aghekyan@gse.rutgers.edu