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RESEARCH ARTICLE

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Syrian migrant students' attitudes toward science: A comparative analysis with their Turkish peers, Phase I

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Abstract

In the context of a cross-ethnic comparison, this study aimed to determine the attitudes of students from two different ethnic backgrounds (Turkish and Syrian) toward science according to various biological and parental variables. Methodologically, this study was conducted as a quantitative research using the survey method. Data were obtained from 574 Turkish and 321 Syrian migrant students between the ages of 8 and 16. Our findings clearly revealed that certain parental variables, but not gender and age, strongly influence attitudes toward science. It was found that children whose fathers are civil servants, who have more than 100 books at home, and who talk to their parents daily about school or school activities are more advantageous in their attitudes toward science. Hence, based on these results, it can be recommended that families be supported to provide their children with a better quality family environment regarding socioeconomic and psychological aspects to improve children's attitudes toward science regardless of age and gender.

KEYWORDS

attitudes, behavioral beliefs, descriptive survey model, middle school learners, migrant students, parental factor

1 | INTRODUCTION

As of December 31, 2021, Turkey, with the world's largest refugee population, hosts 3 million, 762 thousand, and 385 Syrians under temporary protection, nearly the population of a small European country (Atar et al., 2022). After the civil war in Syria in April 2011, the first wave of migration started with Turkey's unconditional open border policy for those fleeing the civil war in Syria. It continued intermittently until recently due to the prolonged war in Syria. According to the Turkish Ministry of National Education's report, 771,428 Syrian children continue their education, 35,707 of whom attend kindergarten, 442,817 primary schools, 348,638 secondary schools, and 110,976 high schools (Jusufbasic & Kenan, 2022). Thanks to the projects financed by the European Union (EU), the basic needs of Syrians, such as health, education, and protection, have been met. For instance, the entire budget of the Project on Promoting Integration of Syrian Kids into the Turkish Education System (P.I.K.T.E.S) run by the Ministry of Education has been granted by the EU under the Facility for Refugees in Turkey (FRiT; Gultekin, 2022). This project, which was in effect between 2016 and 2018, enabled the integration of Syrian children under temporary protection into the Turkish education system in 26 provinces with various educational processes supported by their language and culture. These studies have primarily revealed the barriers and problems (Taskin & Erdemli, 2018) encountered in the education process of those immigrant children and offered solutions. However, unlike previous studies, this study, which aims to describe children's attitudes toward

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science, can potentially reveal these children's future professional position within the sustainability framework. A body of research has consistently emphasized that children's attitudes toward science have a profound effect on their learning of and achievement in science and, therefore, on their decisions to pursue scientific studies and career choices in the future (Abd-El-Khalick et al., 2015; Ali et al., 2013; Badmus & Jita, 2023; Kurniawan et al., 2019; Mao et al., 2021; Oliver & Simpson, 1988; Osborne et al., 2003; Segarra & Julià, 2022).

Given the digital and robotic transformations of the current century, it is clear that the advances in science and engineering have a global impact on the quality of life in societies and the economic growth of nations. The most important source of advances in science and engineering, as Abd-El-Khalick et al. (2015) stated, is "qualified professionals in all scientific fields and domains, which in turn hinges on the preparation of highly qualified, diverse, and motivated learners in the sciences at every stage of the academic pipeline (Galama & Hosek, 2008)." Thus, there is no longer any doubt that science education is a pipeline that supplies the next generation of scientists, engineers, technology, and informatics experts. Effective and efficient flow in this pipeline depends on the positive attitudes toward science that students gain through school. Studies focusing on the reasons for students' inadequate tendency to choose and pursue a science major emphasize the importance of students' psychological characteristics, such as interests, attitudes, and perceived abilities, especially in precollege education (Edmonds et al., 2022; Regan & DeWitt, 2015; Zhao & Perez-Felkner, 2022). The affective variables not only trigger students' learning and achievement in science but also reflect the students' decisions to pursue scientific studies and career choices (Abd-El-Khalick et al., 2015; Moore & Burrus, 2019). Therefore, as Sasway and Kelly (2021) highlighted, promoting favorable attitudes toward science and increasing students' interest in pursuing scientific careers has become the primary goal of science education integrated with technology, engineering, and mathematics in almost all nations. In order to positively change students' attitudes toward science, researchers concentrate on the factors that affect those attitudes. Variables currently addressed in the related literature can be classified into (i) biological variables such as gender, age/grade level, and ethnicity; (ii) parental variables such as socioeconomic class/family economic level, father's and mother's profession, father's and mother's education level, science activities at home, and materials; (iii) school-related variables such as the use of a variety of teaching strategies and various science learning activities in the classroom and the factors related to the teacher or curriculum (Osborne et al., 2003).

The effect of ethnic or cultural differences on attitudes toward science has rarely been studied, possibly due to the difficulty of collecting data. In cross-national research, cultural groups are most often represented by geographic entities, that is, countries or regions. However, the immigrant population from different national backgrounds within a country in sociological studies can also be regarded as a case group from different ethnic–cultural backgrounds according to the host country's population (Kankaraš & Moors, 2012). Therefore, in the context of cross-ethnic differences, this study aimed to determine the attitudes toward science according to specific demographic characteristics of groups of students from two different ethnic backgrounds (Turkish and Syrian). For this purpose, the "Arabic-Speaking Students' Attitudes toward Science Survey" (ASSASS), developed by Abd-El-Khalick et al. (2015), was used as a measurement tool. Thus, the research question of this study was determined as "Do the attitudes of middle school students from Turkish and Syrian ethnic backgrounds toward science differ significantly according to specific demographic variables (gender, age, father's occupation, number of books in the house, and frequency of talking about school at home)?"

The theoretical background, which is stated to be a guide in developing the ASSASS tool (Abd-El-Khalick et al., 2015), is detailed in the next section.

2 | THEORETICAL FRAMEWORK

Attitude, as a psychological concept, refers to positive or negative tendencies of a set including emotions, beliefs, and behaviors toward an attitude object such as a person, an event, a place, or a thing (Minson & Dorison, 2022). It has long been assumed that attitudes have affective, behavioral, and cognitive dimensions (Kotzur et al., 2022). This traditional attitude trilogy that survived to the present day is actually rooted in Plato who intuitively grasped three conditions of humans: knowing, feeling, and acting (Shrigley et al., 1988). Knowing and feeling can be thought of as a condition potentially stored in human beings from external factors, and behavior can be thought of as their manifestation. However, empirical research specifically related to measuring attitude has failed to support the view of these three dimensions of attitude. Criticisms of these three dimensions of attitude have not completely eliminated the triple attitude view but created a perspective of cognitive, affective, and behavioral perspective rather than a dimension or component (Maio et al., 2018). For example, for individuals with a positive attitude toward the green environment, the cognitive aspect of their attitude refers to positive

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beliefs, thoughts, and attributes associated with the green environment. The affective aspect of their attitude is related to their feelings or emotions about the green environment. Their behavioral aspect of attitude also refers to behaviors or experiences associated with green environmental protection such as consuming less, choosing reusable over single-use, walking, biking, or carpooling, using less water, and conserve electricity (Zhang & Gibson, 2021).

Early theoretical approaches for attitude formation were based on the functionalist theory of attitudes by Katz (1966). According to this theory, individuals' attitudes toward certain objects are formed in the functional context in which they serve them. Attitudes in this theory were designed as instrumental constructs to serve the physical, social, and emotional needs of individuals. In this theory, there are five types of psychological functions (utilitarian, social-justice, value-expressive, ego-defensive, and knowledge) that constitute attitudes and are briefly described below (Katz, 1966). Individuals form favorable attitudes toward attitude objects that aid or reward them to achieve their basic goals with "the utilitarian function." This positive attitude toward any attitude object is attained by amplifying rewards and minimizing the punishments (Katz, 1960). The utilitarian functions of attitude are related to the desire to satisfy personal needs and desires to help people maximize utility (Katz, 1960). For example, one's attitude toward reading books can serve a utilitarian function because once the punishments (such as tough times in reading and comprehension) are removed, the reward, which will greatly advance their career goals, produces net pleasure for these readings. Favorable attitudes toward attitude objects that serve a "social-adjustive function" are concerned with status, popularity, and how they are viewed by others. For example, a reading club member's positive attitude toward reading may have resulted from the social-adjustive function. Katz proposed the application of social factors to a variety of functions but did not present it as a separate function in his theory. However, Smith et al. (1956) defined the social-adjustive function as a means of regulating relationships in social platforms.

The fact that individuals form positive attitudes toward a thing related to their own values or self-concept is the "value-expressive function" of attitude. For example, for a devout person, the attitude toward reading books, especially religious books, can serve value-expressive attitudes. Attitudes with a value-expressive function are generally related to the expression of people's abstract values (Katz, 1960). These attitudes do not provide direct, concrete rewards or punishments like utilitarian attitudes. Also, unlike social-adjustive attitudes, they are not related to the need of regulating social relationships (Smith et al., 1956). "Ego-defensive function" can develop in an individual as a result of unpleasant or negative experiences such as threats to self-esteem, personal failures, or bad behavior to protect oneself from undesirable truths. Ego-defensive attitudes are related to defending one's own self-esteem. For example, imagine a high-school graduate with a lower-class job who has a family and social circle of high professional status. This person may have a positive attitude toward reading books in defense of maintaining his or her self-esteem. Individuals form favorable attitudes toward a thing by the "knowledge function" of attitude to make the world more understandable. They seek to understand the world around them not because of their psychological, social, and cultural needs, but only because of the desire to know. For example, individuals can have a positive attitude toward reading books because of the knowledge function of attitude.

Social psychologists have concentrated on investigating attitudes by determining the underlying causes of an individual's voluntary behavior due to the difficulties in measuring the hypothetical construct of the attitude that cannot be directly observed. Therefore, both the psychological process between attitude and behavior and the cause–effect relationship between the two have been a growing research initiative within social psychology. The theory of reasoned action (TRA) developed by Fishbein and Ajzen (1974) is based on the concepts of "behavioral intentions," "attitude toward the behavior," and "subjective norm." According to this theory, the determinant internal factor that manifests behavior is behavioral intention. What underlies behavioral intention is "attitude toward that behavior" and "subjective norms" in the context of the expectancy–value theorem. Attitudes toward behavior are related to both the beliefs regarding behavioral outcomes (expectancy) and the evaluation of behavioral outcomes (value). On the other hand, subjective norms are related to the social norms that are normative beliefs in society associated with that behavior. More clearly, one's behavioral intention is affected by the way perceptions of their social environment toward this behavior. However, the weight of "attitude toward behavior" and "subjective norms" on behavioral intention may vary depending on the individual and the situation.

Because of criticisms of TRA that behavioral intention does not always lead to actual behavior, Ajzen (1985) elaborated TRA to better predict actual behavior and introduced the theory of planned behavior (TPB) in which behavioral intentions are influenced by three factors: attitude toward behavior, subjective norms, and perceived behavioral control. Perceived behavioral control refers to the strength of an individual's beliefs that they can perform a particular behavior. In this context,

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individuals percept and evaluate "how easy or difficult the performance or behavior is likely to be" depending on their own abilities to perform the behavior. Perception and evaluation of the individual's own ability associated with a behavior vary by environmental circumstances and the behavior. If individuals feel that they successfully perform a certain behavior, they are more likely to intend to perform it. Perceived behavioral control is based on self-efficacy theory and is associated with the concept of self-efficacy. Self-efficacy is the conviction that one can successfully execute the behavior to reach and accomplish a goal.

Consequently, TRA and TPB (Ajzen & Fishbein, 2005) have revealed the internal processes behind the behavior that emerges as an action until it turns into an action and the role or ratio of attitude in these internal processes. The instrument used in this study to measure attitudes toward science was developed by Abd-El-Khalick et al. (2015) under the guidance of TRA and TPB. The ASSASS was constructed and dimensioned according to major elements of the TRA and TPB by drawing on Ajzen and Fishbein's (2005) model. The details can be seen in table 1 on page 2644, and figure 1 on page 2646 of the article by Abd-El-Khalick et al. (2015).

3 | LITERATURE REVIEW

Many factors influencing attitudes toward science, such as ethnicity, gender, personality, structural, and school-related variables, have been identified extensively in the literature. The review study by Awan et al. (2011) from papers published in many countries examined the effects of nationality on students' attitudes to study science. They found that students in different parts of the world develop differing attitudes toward science. Students in developing countries have more positive attitudes toward science than students in rich and developed countries, especially in Japan and Korea. Studies emphasize that students with positive attitudes toward science are likelier to enter university after high school. This emphasis makes Modood's (1993) research on the entry of ethnic minorities into higher education in the university city of Oxford worth examining as a lens for this study. In his research, Woodrow (1996) collected evidence of differences in the preferences of different ethnic groups in British society for mathematics and science. His collections of data on the ethnic origins of applicants to higher education confirmed that diverse groups make other choices, with Asian and Chinese students choosing mathematics and science in more significant proportions than their white peers. Black students also showed such preferences but were more strongly attracted to the social sciences. Similarly, Taylor (1993) demonstrates a variety of discrepancies in both gender and race in their analysis of national data on higher education admissions, such as lower acceptance rates of women from minority ethnic groups compared with men of the same ethnic group.

What is clear from the extensive literature on gender effect on attitude toward science is that girls' attitudes toward science are significantly less favorable than boys'. This view is supported by Weinburgh's (1995) research, with a meta-analysis covering the literature between 1970 and 1991. This analysis examined gender differences in student attitudes toward science and correlations between attitudes toward science and achievement in science. Results of this analysis related to the gender differences in attitude as a function of science type indicate that boys show a more positive attitude toward science than girls in all kinds of science. The correlation between attitude and achievement for boys and girls as a function of science type indicates that for biology and physics, the correlation is positive for both but stronger for girls than for boys. Similar findings have appeared in a more recent report by Wan and Lee (2017) with the participants of 360 ninth graders in Hong Kong from 3 school groups. Their results reflected that male students demonstrated significantly more positive attitudes toward science in five dimensions (i.e., self-concept in science, enjoyment in science, learning science in and outside the classroom, and future participation), and school groups played a prominent moderating role in gender differences in students' attitudes toward science.

Numerous studies have documented the decline in attitudes toward science from age 11 onwards (Osborne et al., 2003). Even Murphy et al. (2006) compared primary school children's attitudes toward school science in Northern Ireland (UK) and Oman. They noted a marked decline in the enjoyment of school science by pupils in more senior primary classes.

Although there is no study in the literature that directly investigates the relationship between attitude toward science and parental variables such as the father's occupation, number of books in the house, and frequency of talking about school at home, these independent variables can be indirectly interpreted by factors such as parental involvement or parents' expectations and beliefs about transferring their academic wishes to their children. For example, Breakwell and Beardsell (1992) investigated how variance in science attitudes and involvement in science activities may be attributable to gender, parental, and peer influences upon 11- to 14-year-olds in the United Kingdom. They found that attitudes toward scientific change, involvement in scientific extra-curricular activity, liking and performance in

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TABLE 1 Demographic distribution of the students participating in the survey.

Demographic information of students	Turkish ($N = 574$)		Syrian ($N = 321$)	
	Frequency	Percent	Frequency	Percent
Gender				
Female	321	55.9	166	51.7
Male	253	44.1	155	48.3
Age				
8–10 years	113	19.7	51	15.9
11–13 years	411	71.6	213	66.4
14–16 years	50	8.7	57	17.8
Father's profession				
Employee	244	42.6	106	33.2
Artisan	110	19.2	43	13.5
Civil servant	60	10.5	21	6.6
Self-employed	121	21.1	72	22.6
Other	38	6.6	77	24.1
Number of books in their house				
0–10 pieces	86	15.0	118	36.8
11–25 pieces	133	23.2	101	31.5
26–100 pieces	242	42.2	72	22.4
100+	112	19.5	30	9.3
Frequency of talking about school at home				
Never	28	4.9	78	24.3
Once every 2 weeks	98	17.1	33	10.3
2 or 3 times a week	200	34.9	55	17.1
Every day	247	43.1	155	48.3

school science subjects, and participation in peer youth culture were indexed, in addition to estimates of the positive regard for science expressed by peers and parents. Hacieminoglu (2016) determined the relationships among the seventh-grade elementary students' attitudes toward science, their learning approaches, motivational goals, science achievement, and students' nature of science views with a sample of 3598 seventh-grade students. This study indicated that parents' income and education level significantly affected students' attitudes toward science. Using a longitudinal dataset of 2252 middle and high school students from two regions in the United States, Liu and Schunn (2020) investigated disparities between higher and lower S.E.S. students' participation in optional summer science experiences and postsummer science attitudes and skills. According to the study results, students with higher S.E.S. participated more in optional summer science experiences and had higher postsummer science attitudes and sense-making skills.

4 | METHODS

This quantitative research employs a descriptive survey model. The survey model aims to describe some characteristics of the population, such as abilities, ideas, attitudes, beliefs, and knowledge, with the help of data obtained from a sample selected from the population.

4.1 | Study group

With the permission of the ethics committees of the relevant institutions, the demographic information form and the scale were completed by 574 Turkish and 321 Syrian students studying in the fifth, sixth, seventh, and eighth grades of public secondary schools in different cities of Turkey. The demographic characteristics of 895 Turkish and Syrian immigrant students in total are given in Table 1.

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4.2 | Instrument

The first part of the data collection tool, which consists of two parts, includes the demographic characteristics used as independent variables and is given in Table 1. In this part of the form, there is a list of options that participants can either tick or leave blank. The second part of the data collection tool includes the ASSASS, which is the dependent variable of the research. ASSASS was developed by Abd-El-Khalick et al. (2015) to gauge Arab students in Grades 3–12 attitudes toward science. As a result of the analysis, Abd-El-Khalick et al. (2015) determined that ASSASS was supported by a robust, 5-factor model, which is consistent with the theories of reasoned action and planned behavior. The factors are "attitudes toward science and school science learning," "unfavorable outlook on science," "control beliefs about ability in science," "behavioral beliefs about the consequences of engaging with science," and "intentions to pursue science." The original version of ASSASS comprises 32 items. The five ASSASS sub-scales show robust reliabilities, ranging from 0.61 to 0.87, which can be seen in Table 4 on page 2656 of the article by Abd-El-Khalick et al. (2015). ASSASS, apart from other science attitudes scales, was specifically designed to assess precollege Arab students' attitudes toward science and their behavioral intentions to pursue science studies and related careers. The development and validation of ASSASS was conducted to determine the attitudes of students whose native language is Arabic and who live in different countries (for example, the United States) toward science. We used this scale because the native language of the Syrian migrant children in the sample of this study is also Arabic. 321 Syrian immigrant students completed the original Arabic or Turkish version of the scale according to their preferences.

The Turkish version of ASSASS was adapted to Turkish from the English version by Özkan et al. (2020). As a result of the confirmatory factor analysis on the Turkish version of the scale (Özkan et al., 2020), the 5-factor CFA model was consistent with the original factor structure. It was determined that all goodness-of-fit indexes showed a good fit ($\chi^2/df = 2.17$, RMSEA = 0.082, CFI = 0.89, GFI = 0.90, AGFI = 0.90, NFI = 0.90, CFI = 0.89). In the reliability analysis of the scale, whose construct validity was verified, the internal consistency coefficients of the "attitudes toward science and school science learning," "unfavorable outlook on science," "control beliefs about ability in science," "behavioral beliefs about the consequences of engaging with science," and "intentions to pursue science" factors were calculated respectively as 0.91, 0.85, 0.77, 0.66, and 0.63. The internal consistency of the whole scale was also calculated as 0.93 (Özkan et al., 2020).

4.3 | Data analysis

The data analysis obtained from students who filled out ASSASS was conducted using the IBM SPSS Statistic v.22 package program. Cronbach's alpha values of our reliability analysis for ASSASS and its subdimensions are shown in Table 2. The fact that the α coefficient of the scale and its subdimensions is above 0.70 indicates the consistency of all items in the scale and the homogeneity of the scale (Pallant, 2020).

The mean scores of Turkish and Syrian students on ASSASS and its subdimensions were normally distributed; therefore, parametric tests were used in the data analysis. The independent sample *t*-test was used to compare the scale scores of dual groups, such as nationality and gender, and the One-way analysis of variance test was used to compare the scale scores of the variables with more than two groups, such as age. Post hoc tests (LSD, Dunnet, Tukey HSD, or Duncan) were used to compare the differences between the groups. The analysis results were interpreted in the whole study based on the 0.05 and 0.01 significance levels.

TABLE 2 Cronbach's alpha values of the ASSASS and its subdimensions.

	Cronbach's alpha (Turkish)	Cronbach's alpha (Syrian)	*N*
Total ASSASS	0.794	0.784	32
Attitudes toward science and school science learning (*Attitude disposition*)	0.879	0.917	9
Unfavorable outlook on science (*Negative outlook*)	0.793	0.803	9
Control beliefs about ability in science (*Control beliefs*)	0.801	0.766	2
Behavioral beliefs about the consequences of engaging with science (*Behavioral beliefs*)	0.715	0.719	6
Intentions to pursue science (*Intention*)	0.764	0.841	6

Abbreviation: ASSASS, Arabic-Speaking Students' Attitudes toward Science Survey.

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5 | RESULTS

The comparison of the scores of Turkish and Syrian students regarding ASSASS and its subdimensions is shown in Table 3.

There is a significant difference between the ASSASS and sub-dimensions scores of Turkish and Syrian students ($p < 0.05$). Turkish students' total ASSASS and four subdimensions scores ("attitudes toward science and school science learning," "control beliefs about ability in science," "behavioral beliefs about the consequences of engaging with science," and "intentions to pursue science") are significantly higher than Syrian students. In addition, Turkish students' scores of "unfavorable outlook on science" are significantly lower than Syrian students.

5.1 | Gender and ASSASS scores

Table 4 presents the *t*-test results of Turkish and Syrian students' ASSASS scores by gender. According to Table 4, there is no statistically significant difference between the total ASSASS scores of males and females for both Turkish and Syrian students ($p > 0.05$).

5.2 | Age and ASSASS scores

Table 5 presents one-way ANOVA results of the ASSASS scores of students in different age groups for Turkish and Syrian students. According to Table 5, there is no statistically significant difference between the ASSASS total scores of students in various age groups for both Turkish and Syrian students ($p > 0.05$).

5.3 | Father's occupation and ASSASS scores

Table 6 presents the one-way ANOVA results of ASSASS scores for Turkish and Syrian students regarding their fathers' occupations.

According to Table 6, in the scores of "total-ASSASS," "attitudes toward science and school science learning," and "unfavorable outlook on science," there is a significant difference between the scores of students whose fathers have different occupations. This difference is in favor of those whose fathers are civil servants ($p < 0.05$). In the scores of "intentions to pursue science," there is no significant difference between the scores of students whose fathers have other occupations ($p > 0.05$). However, in only the Turkish students' scores of "control beliefs about ability in science," there is a significant difference between the scores of students whose fathers have different occupations. Because of this difference, those whose fathers are civil servants are again the most advantaged. In addition, in only the Syrian students' scores of "behavioral beliefs about the consequences of engaging with science", there is a significant difference between the scores of students whose fathers have different occupations, in favor of those whose fathers are civil servants as well.

TABLE 3 Comparison of ASSASS scores of Turkish and Syrian students.

	Nationality	*N*	Mean	*SD*	*t*	*p*
Total ASSASS	Turkish	574	3.85	0.62	6.89	0.000**
	Syrian	321	3.49	0.81		
Attitude disposition	Turkish	574	4.00	0.86	6.64	0.000**
	Syrian	321	3.55	1.04		
Negative outlook	Turkish	574	2.12	0.78	−5.53	0.000**
	Syrian	321	2.42	0.80		
Control beliefs	Turkish	574	3.90	1.01	6.92	0.000**
	Syrian	321	3.37	1.15		
Behavioral beliefs	Turkish	574	3.90	0.72	3.15	0.002**
	Syrian	321	3.74	0.74		
Intention	Turkish	574	3.51	0.81	6.76	0.000**
	Syrian	321	3.07	1.00		

Note: *t*, independent sample *t*-test.
Abbreviation: ASSASS, Arabic-Speaking Students' Attitudes toward Science Survey.
**$p < 0.01$.

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TABLE 4 Comparison of students' ASSASS scores by gender.

	Gender	*N*	Mean	*SD*	*t*	*p*
For Turkish students						
Total ASSASS	Female	321	3.89	0.60	1.84	0.066
	Male	253	3.80	0.65	1.82	
Attitude disposition	Female	321	4.06	0.81	1.97	0.049
	Male	253	3.92	0.91	1.94	
Negative outlook	Female	321	2.08	0.78	−1.40	0.163
	Male	253	2.17	0.77	−1.40	
Control beliefs	Female	321	3.93	0.92	0.75	0.452
	Male	253	3.86	1.10	0.74	
Behavioral beliefs	Female	321	3.95	0.71	1.58	0.115
	Male	253	3.85	0.73	1.57	
Intention	Female	321	3.53	0.72	0.68	0.499
	Male	253	3.49	0.91	0.66	
For Syrian students						
Total ASSASS	Female	166	3.55	0.84	1.24	0.216
	Male	155	3.43	0.77	1.24	
Attitude disposition	Female	166	3.59	1.10	0.72	0.474
	Male	155	3.50	0.98	0.72	
Negative outlook	Female	166	2.39	0.82	−0.91	0.366
	Male	155	2.47	0.78	−0.91	
Control beliefs	Female	166	3.41	1.20	0.73	0.467
	Male	155	3.32	1.09	0.73	
Behavioral beliefs	Female	166	3.80	0.73	1.49	0.136
	Male	155	3.68	0.76	1.49	
Intention	Female	166	3.17	1.01	1.76	0.079
	Male	155	2.97	0.98	1.77	

Note: *t*, independent sample *t*-test.

5.4 | Number of books in the house and ASSASS scores

It is clearly seen in Table 7 that there is a significant difference between the scores of students who have different numbers of books in their homes on ASSASS and all its dimensions. This difference exists for both Turkish and Syrian students and it is in favor of students who have 100 or more books at home ($p < 0.05$).

5.5 | Frequency of talking about school at home and ASSASS scores

Table 8 presents the one-way ANOVA results related to the relationship between ASSASS scores and the variable of "frequency of talking about school at home."

Table 8 presents that there is a significant difference between the scores of ASSASS and all dimensions for students with a different frequency of talking about school at home. This difference exists for both Turkish and Syrian students and it is in favor of students who talk about school most frequently at home ($p < 0.05$).

6 | DISCUSSION

According to scores of "ASSASS and its subdimensions", Turkish students' attitudes toward science are significantly higher than Syrian migrant students. There are few large-scale international pieces of research on the impact of ethnic or cultural differences on attitudes toward science to explain theoretically the reason for this significant difference. However, many

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TABLE 5 Comparison of ASSASS scores of students by age.

	Age (years)	*N*	Mean	*SD*	*F*	*p*
For Turkish students						
Total ASSASS	8–10	113	3.86	0.57	1.65	0.193
	11–13	411	3.87	0.62		
	14–16	50	3.70	0.76		
Attitude disposition	8–10	113	4.02	0.79	2.35	0.097
	11–13	411	4.03	0.86		
	14–16	50	3.75	0.99		
Negative outlook	8–10	113	2.16	0.80	0.49	0.615
	11–13	411	2.10	0.77		
	14–16	50	2.18	0.77		
Control beliefs	8–10	113	3.95	1.02	1.04	0.353
	11–13	411	3.91	0.98		
	14–16	50	3.71	1.18		
Behavioral beliefs	8–10	113	3.84	0.72	0.88	0.415
	11–13	411	3.93	0.70		
	14–16	50	3.84	0.87		
Intention	8–10	113	3.63	0.78	2.85	0.059
	11–13	411	3.51	0.80		
	14–16	50	3.30	0.91		
For Syrian students						
Total ASSASS	8–10	51	3.38	0.78	0.57	0.567
	11–13	213	3.51	0.79		
	14–16	57	3.54	0.90		
Attitude disposition	8–10	51	3.50	1.09	0.67	0.513
	11–13	213	3.59	1.00		
	14–16	57	3.42	1.15		
Negative outlook	8–10	51	2.48	0.73	0.87	0.421
	11–13	213	2.45	0.80		
	14–16	57	2.30	0.87		
Control beliefs	8–10	51	3.14	1.28	1.26	0.284
	11–13	213	3.40	1.05		
	14–16	57	3.45	1.35		
Behavioral beliefs	8–10	51	3.63	0.72	1.84	0.160
	11–13	213	3.73	0.75		
	14–16	57	3.90	0.74		
Intention	8–10	51	2.83	0.85	1.77	0.172
	11–13	213	3.12	0.99		
	14–16	57	3.13	1.12		

Note: *F*, one-way ANOVA.
Abbreviation: ASSASS, Arabic-Speaking Students' Attitudes toward Science Survey.

studies indicated that ethnic origin or cultural background significantly affects attitudes toward science, especially in connection with a career preference in science.

(Awan et al., 2011; Modood, 1993; Taylor, 1993; Woodrow, 1996). This connection reflects the culture of societies that value science-related professions more than trade, although science-based careers are less financially

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TABLE 6 Comparison of students' ASSASS scores according to father's occupation.

	Father's profession	*N*	Mean	*SD*	*F*	*p*	Differences
For Turkish students							
Total ASSASS	Worker(A)	244	3.75	0.64	4.99	0.001**	A < B,D,E < C
	Artisan(B)	110	3.87	0.58			
	Civil servant(C)	60	4.12	0.44			
	Self-employed(D)	121	3.87	0.64			
	Other(E)	38	3.96	0.67			
Attitude disposition	Worker (A)	244	3.87	0.95	5.11	0.000**	A < B,D < C,E
	Artisan(B)	110	4.03	0.79			
	Civil servant(C)	60	4.37	0.55			
	Self-employed(D)	121	3.99	0.81			
	Other(E)	38	4.24	0.78			
Negative outlook	Worker (A)	244	2.23	0.82	3.49	0.008**	A > B,D,E > C
	Artisan(B)	110	2.09	0.70			
	Civil servant(C)	60	1.83	0.57			
	Self-employed(D)	121	2.08	0.80			
	Other(E)	38	2.08	0.79			
Control beliefs	Worker (A)	244	3.74	1.10	3.37	0.01**	A,B,D < C,E
	Artisan(B)	110	3.99	0.89			
	Civil servant(C)	60	4.14	0.72			
	Self-employed(D)	121	3.92	0.96			
	Other(E)	38	4.16	1.05			
Behavioral beliefs	Worker (A)	244	3.87	0.76	2.21	0.066	-
	Artisan(B)	110	3.86	0.69			
	Civil servant(C)	60	4.16	0.57			
	Self-employed(D)	121	3.86	0.73			
	Other(E)	38	3.96	0.68			
Intention	Worker (A)	244	3.41	0.84	1.92	0.105	-
	Artisan(B)	110	3.57	0.78			
	Civil servant(C)	60	3.63	0.66			
	Self-employed(D)	121	3.61	0.79			
	Other(E)	38	3.54	0.92			
For Syrian students							
Total ASSASS	Worker (A)	106	3.39	0.83	3.29	0.011*	A,E < B,D < C
	Artisan(B)	43	3.73	0.82			
	Civil servant(C)	21	3.87	0.51			
	Self-employed(D)	72	3.54	0.75			
	Other(E)	77	3.34	0.83			
Attitude disposition	Worker (A)	106	3.42	1.05	2.98	0.019*	A,E < D < B,C
	Artisan(B)	43	3.83	1.00			
	Civil servant(C)	21	3.98	0.78			
	Self-employed(D)	72	3.65	0.99			
	Other(E)	77	3.36	1.10			
Negative outlook	Worker (A)	106	2.55	0.84	4.12	0.003**	A,E > B,D > C

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TABLE 6 (Continued)

	Father's profession	*N*	Mean	*SD*	*F*	*p*	Differences
	Artisan(B)	43	2.26	0.80			
	Civil servant(C)	21	1.90	0.38			
	Self-employed(D)	72	2.36	0.73			
	Other(E)	77	2.55	0.83			
Control beliefs	Worker (A)	106	3.29	1.20	0.35	0.839	-
	Artisan(B)	43	3.49	1.16			
	Civil servant(C)	21	3.45	1.17			
	Self-employed(D)	72	3.44	1.05			
	Other(E)	77	3.32	1.13			
Behavioral beliefs	Worker (A)	106	3.64	0.74	3.17	0.014*	A,E < B,D < C
	Artisan(B)	43	3.99	0.72			
	Civil servant(C)	21	4.09	0.71			
	Self-employed(D)	72	3.72	0.76			
	Other(E)	77	3.67	0.71			
Intention	Worker (A)	106	3.06	1.01	2.31	0.057	-
	Artisan(B)	43	3.37	1.02			
	Civil servant(C)	21	3.29	0.52			
	Self-employed(D)	72	3.09	0.94			
	Other(E)	77	2.84	1.05			

Note: *F*, one-way ANOVA; differences, post hoc tests.
Abbreviation: ASSASS, Arabic-Speaking Students' Attitudes toward Science Survey.
*$p < 0.05$; **$p < 0.01$.

profitable. Price and Peterson (2016) found that people in affluent societies have lower support for science than those in less affluent societies in their study on individual attitudes toward science across 47 diverse countries, using four theoretically driven measures of risk society. Nevertheless, it seems more logical that our current findings related to the lower attitudes of immigrant Syrian students toward science, compared with their Turkish peers, may be associated with their long-term strenuous life struggles and financial concerns because Breakwell and Beardsell (1992) revealed that a negative attitude to science is correlated with pupils coming from middle-class families.

Findings from this study do not support the assertion that boys have a more positive attitude toward science than girls, which has been put forward in numerous studies (Wan & Lee, 2017; Weinburgh, 1995). However, similar findings have appeared in the study by Said et al. (2016), in which ASSASS evaluated students' attitudes toward science in Qatar. Contrary to many studies in Western and European contexts, the absence of a gender effect may be associated with girls' higher motivational drive to succeed in science for possible socio-cultural or economic reasons (Said et al., 2016). Motivational variables such as expectancies of success, self-efficacy, science beliefs, perceptions, and so forth have a direct influence in earlier grades on girls' science enrolment behaviors, such as seeking knowledge with new experiences and engagement in scientific practices (Patrick et al., 2009). In addition, the absence of a gender effect in attitudes toward science for both Turkish and Syrian students also suggests that ethnic factors are not behind the potential success motivation of girls.

We found no statistically significant difference between the attitudes toward science of students in various age groups for both Turkish and Syrian students. Although the age variable has not been examined in depth in describing the attitude toward science in recent studies, it was reported in detail in the early 2000s that attitudes toward science generally decrease as age increases, especially from the age of 11 (Murphy et al., 2006; Osborne et al., 2003). Findings from this study depict a stable pattern in students' attitudes toward science and related factors as students' ages increase. The absence of the age effect is promising because it indicates students' undiminished intentions of engaging in science in the future related to "science interest, perceived ability in science, as well as beliefs about the utility and importance of science" (Said et al., 2016).

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TABLE 7 Comparison of students' ASSASS scores by "number of books in their house."

	Number of books in the house	*N*	Mean	*SD*	*F*	*p*	Differences
For Turkish students							
Total ASSASS	0–10 pieces$^{(A)}$	86	3.74	0.70	14.60	0.000**	B < A,C < D
	11–25 pieces$^{(B)}$	133	3.62	0.57			
	26–100 pieces$^{(C)}$	242	3.90	0.62			
	100+$^{(D)}$	112	4.11	0.50			
Attitude disposition	0–10 pieces$^{(A)}$	86	3.99	0.91	9.60	0.000**	B < A,C,D
	11–25 pieces$^{(B)}$	133	3.69	0.87			
	26–100 pieces$^{(C)}$	242	4.06	0.86			
	100+$^{(D)}$	112	4.25	0.70			
Negative outlook	0–10 pieces$^{(A)}$	86	2.45	0.95	16.35	0.000**	D,C < A,B
	11–25 pieces$^{(B)}$	133	2.32	0.74			
	26–100 pieces$^{(C)}$	242	2.04	0.73			
	100+$^{(D)}$	112	1.80	0.58			
Control beliefs	0–10 pieces$^{(A)}$	86	3.80	1.03	9.76	0.000**	B < A,C < D
	11–25 pieces$^{(B)}$	133	3.54	1.11			
	26–100 pieces$^{(C)}$	242	4.01	0.93			
	100+$^{(D)}$	112	4.15	0.90			
Behavioral beliefs	0–10 pieces$^{(A)}$	86	3.84	0.85	6.96	0.000**	B,A < C < D
	11–25 pieces$^{(B)}$	133	3.72	0.72			
	26–100 pieces$^{(C)}$	242	3.92	0.72			
	100+$^{(D)}$	112	4.13	0.54			
Intention	0–10 pieces$^{(A)}$	86	3.53	0.79	4.22	0.006**	B < A,C < D
	11–25 pieces$^{(B)}$	133	3.35	0.79			
	26–100 pieces$^{(C)}$	242	3.50	0.84			
	100+$^{(D)}$	112	3.72	0.72			
For Syrian students							
Total ASSASS	0–10 pieces$^{(A)}$	118	3.23	0.82	13.24	0.000**	A < B,C < D
	11–25 pieces$^{(B)}$	101	3.43	0.84			
	26–100 pieces$^{(C)}$	72	3.77	0.64			
	100+$^{(D)}$	30	4.05	0.50			
Attitude disposition	0–10 pieces$^{(A)}$	118	3.24	1.08	12.01	0.000**	A < B,C < D
	11–25 pieces$^{(B)}$	101	3.45	1.10			
	26–100 pieces$^{(C)}$	72	3.91	0.80			
	100+$^{(D)}$	30	4.23	0.61			
Negative outlook	0–10 pieces$^{(A)}$	118	2.74	0.76	17.85	0.000**	D,C < B,A
	11–25 pieces$^{(B)}$	101	2.47	0.84			
	26–100 pieces$^{(C)}$	72	2.07	0.61			
	100+$^{(D)}$	30	1.89	0.59			
Control beliefs	0–10 pieces$^{(A)}$	118	3.04	1.14	8.13	0.000**	A < B,C < D
	11–25 pieces$^{(B)}$	101	3.35	1.19			
	26–100 pieces$^{(C)}$	72	3.67	1.05			
	100+$^{(D)}$	30	3.97	0.74			
Behavioral beliefs	0–10 pieces$^{(A)}$	118	3.59	0.70	7.26	0.000**	A,B,C < D

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TABLE 7 (Continued)

	Number of books in the house	*N*	Mean	*SD*	*F*	*p*	Differences
	11–25 pieces$^{(B)}$	101	3.71	0.75			
	26–100 pieces$^{(C)}$	72	3.84	0.78			
	100+$^{(D)}$	30	4.25	0.54			
Intention	0–10 pieces$^{(A)}$	118	2.90	1.09	5.01	0.006**	A,B < C < D
	11–25 pieces$^{(B)}$	101	2.99	0.98			
	26–100 pieces$^{(C)}$	72	3.29	0.87			
	100+$^{(D)}$	30	3.54	0.73			

Note: *F*, one-way ANOVA; differences, post hoc tests.
Abbreviation: ASSASS, Arabic-Speaking Students' Attitudes toward Science Survey.
**$p < 0.01$.

We have extended previous studies on the relationships between socioeconomic factors and children's attitudes toward science (Gardner, 1975; Osborne et al., 2003) by providing additional parental variables such as "fathers' occupation," "the number of books in their house," and "frequency of talking about school studies." Our findings reveal that students whose fathers are civil servants are the most advantageous for Turkish and Syrian students. In contrast, those whose fathers are workers have no advantage in attitudes toward science. This raises questions that need to be answered: Why do children whose fathers are civil servants have significantly higher attitudes toward science than others? Moreover, what is the role of fathers who are civil servants in their children's positive attitudes toward science? Although no study in the literature questions this relationship, a "profile about the common characteristics" of families in which the father is a civil servant can provide a clue to discuss this relationship. Civil servant fathers in Turkey leave home at 8:30 in the morning to go to work and come home at 17:30 in the evening, except on weekends, and their jobs require routine/monotonic work obligations. In general, their wives are housewives or civil servants and have one, two, or three children. Civil servant fathers are generally high school or university graduates. Socioeconomically, they are middle-class families that can easily meet their basic education, health, and social needs but have economic limitations for a more luxurious/prosperous life. In addition, the most crucial feature of these middle-class families compared with upper- and lower-class families is that they always have the thought that "financial expenses for children's education is the most important future investment." For example, with this thought, they spend their holidays in a third-class hotel or with their grandparents in the countryside. However, they try to provide all their children's educational needs with the best opportunities.

Although the influence of the father's occupation on students' attitudes toward science, beyond any doubt, is an indirect effect, such relationships explain the expectations and beliefs of parents to transfer their academic aspirations to their children (Breakwell & Beardsell 1992). For example, a civil servant father who has always desired to be an engineer can contribute to his child's developing a positive attitude toward science and/or engineering. Adamuti-Trache and Andres (2008) have shown that parents have a significant influence in guiding their children to STEM fields of study, and students whose parents are college graduates are more likely to make decisions according to their parents' career guidance. Undoubtedly, for attitudes toward science, the father's job associated with income level is an essential factor that economically shapes the family environment, such as the availability or supply of educational materials (Hacieminoglu, 2016; Liu & Schunn, 2020). For example, a difference in attitude toward science is expected between children in a family that can afford a limited number of books and children growing up in a family that can afford to furnish a room in their home with science/robotics materials and books. Also, George and Kaplan (1998) provide concrete empirical evidence that parental involvement has significant effects on students' attitudes toward science mediated through science activities and library/museum visits. Our research results clearly show that Turkish and Syrian students with 100 or more books at home are pretty advantageous in attitudes toward science. Similar to our findings, Hu et al. (2018) found that family-related factors (book ownership, parent education) had significant correlations with students' attitudes toward science by analyzing a sample of 3600 fourth-graders from 132 Hong Kong schools. Moreover, recent studies providing substantial evidence for the positive effects of family-related factors on student learning outcomes also support our present

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TABLE 8 Comparison of Students' ASSASS Scores by "frequency of talking about school studies at home."

	Frequency of talking about school at home	*N*	Mean	*SD*	*F*	*p*	Differences
For Turkish students							
Total ASSASS	Never$^{(A)}$	28	3.45	0.59	14.44	0.000**	A,B < C,D
	Once every 2 weeks$^{(B)}$	98	3.59	0.65			
	2 or 3 times a week$^{(C)}$	200	3.89	0.61			
	Every day$^{(D)}$	247	3.97	0.56			
Attitude disposition	Never$^{(A)}$	28	3.54	0.95	9.09	0.000**	A < B,C < D
	Once every 2 weeks$^{(B)}$	98	3.72	0.96			
	2 or 3 times a week$^{(C)}$	200	4.05	0.85			
	Every day$^{(D)}$	247	4.14	0.76			
Negative outlook	Never$^{(A)}$	28	2.93	0.91	16.07	0.000**	A > B,C,D
	Once every 2 weeks$^{(B)}$	98	2.32	0.81			
	2 or 3 times a week$^{(C)}$	200	2.05	0.72			
	Every day$^{(D)}$	247	2.00	0.72			
Control beliefs	Never$^{(A)}$	28	3.59	1.23	6.48	0.000**	A,B < C < D
	Once every 2 weeks$^{(B)}$	98	3.56	1.09			
	2 or 3 times a week$^{(C)}$	200	3.97	0.95			
	Every day$^{(D)}$	247	4.02	0.94			
Behavioral beliefs	Never$^{(A)}$	28	3.68	0.76	8.69	0.000**	A,B < C < D
	Once every 2 weeks$^{(B)}$	98	3.62	0.77			
	2 or 3 times a week$^{(C)}$	200	3.94	0.75			
	Every day$^{(D)}$	247	4.02	0.64			
Intention	Never$^{(A)}$	28	3.60	0.98	5.84	0.001**	B < C < A,D
	Once every 2 weeks$^{(B)}$	98	3.24	0.87			
	2 or 3 times a week$^{(C)}$	200	3.50	0.81			
	Every day$^{(D)}$	247	3.63	0.73			
For Syrian students							
Total ASSASS	Never$^{(A)}$	78	3.13	0.86	8.08	0.000**	A < B,C < D
	Once every 2 weeks$^{(B)}$	33	3.41	0.83			
	2 or 3 times a week$^{(C)}$	55	3.63	0.73			
	Every day$^{(D)}$	155	3.64	0.75			
Attitude disposition	Never$^{(A)}$	78	3.12	1.15	6.65	0.000	A < B,C < D
	Once every 2 weeks$^{(B)}$	33	3.50	1.11			
	2 or 3 times a week$^{(C)}$	55	3.65	0.97			
	Every day$^{(D)}$	155	3.74	0.94			
Negative outlook	Never$^{(A)}$	78	2.83	0.82	11.48	0.000**	A,B > C,D
	Once every 2 weeks$^{(B)}$	33	2.57	0.83			
	2 or 3 times a week$^{(C)}$	55	2.22	0.65			
	Every day$^{(D)}$	155	2.26	0.76			
Control beliefs	Never$^{(A)}$	78	2.88	1.19	6.68	0.000**	A < B,C,D
	Once every 2 weeks$^{(B)}$	33	3.47	1.12			
	2 or 3 times a week$^{(C)}$	55	3.48	1.13			
	Every day$^{(D)}$	155	3.55	1.07			
Behavioral beliefs	Never$^{(A)}$	78	3.52	0.64	3.86	0.001**	A,B < C,D

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TABLE 8 (Continued)

	Frequency of talking about school at home	*N*	Mean	*SD*	*F*	*p*	Differences
Intention	Once every 2 weeks$^{(B)}$	33	3.65	0.60	3.21	0.023*	A < B,C,D
	2 or 3 times a week$^{(C)}$	55	3.86	72			
	Every day$^{(D)}$	155	3.83	0.80			
	Never$^{(A)}$	78	2.79	1.02			
	Once every 2 weeks$^{(B)}$	33	3.02	1.10			
	2 or 3 times a week$^{(C)}$	55	3.18	0.90			
	Every day$^{(D)}$	155	3.19	0.97			

Note: *F*, one-way ANOVA; differences, post hoc tests.
Abbreviation: ASSASS, Arabic-Speaking Students' Attitudes toward Science Survey.
*$p < 0.05$; **$p < 0.01$.

finding (Bouiri et al., 2022; Harju-Luukkainen et al., 2020; Ion et al., 2022; Tomul et al., 2021).

Finally, our results indicated that both Turkish and Syrian students who talk about school every day at home are much more advantageous than others in terms of attitudes toward science. This result agrees with the work of Iverson and Walberg (1982), who revealed that the socio-psychological environment and intellectual stimulation at home are more closely linked with children's learning outcomes than with family indicators of socioeconomic status. In this study, "frequency of talking about school studies at home" as a variable was considered as an indicator of parents' involvement in and interaction with children's learning in the context of social capital in Coleman's (1988) family theory. He suggested three components for family effects: economic, human, and social capital. Economic capital is related to the financial resources and assets of the family. While human capital refers to measured indicators such as the family's education level, social capital refers to the amount and quality of academically oriented interaction between parents and children.

7 | CONCLUSIONS

This quantitative research employing a survey model has reported a multivariate assessment of 895 students' attitudes toward science. The attitudes of students from two different ethnic groups (Turkish and Syrian) toward science were investigated with the effect of various biological and parental variables with a cross-ethnic comparison. Data were obtained from 574 Turkish and 321 Syrian migrant students between the ages of 8 and 16 using the ASSASS scale developed by Abd-El-Khalick et al. (2015) and adapted into the Turkish by Özkan et al. (2020). This research revealed that certain parental variables, but not gender and age, strongly influence attitudes toward science. It was found that children whose fathers are civil servants, who have more than 100 books at home, and who talk to their parents every day about school or school activities are more advantageous in their attitudes toward science. Therefore, in light of these results, it can be suggested that families be supported to provide their children with a better socioeconomic and psychological family environment to improve children's attitudes toward science, regardless of age and gender.

AUTHOR CONTRIBUTIONS

All authors contributed to the data collection, analysis, and writing of the article. The author(s) read and approved the final article.

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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflict of interest.

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