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Interest of middle school students toward life and earth sciences

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Abstract

Despite the importance accorded to life and earth sciences (LES) in the Moroccan curriculum, the unsatisfactory results achieved by middle school students in assessments are a cause for concern. Exploring their interest in this school subject seems essential, given its importance in stimulating their learning and success. Thus, this study aims to examine the interest of students in LES and the effect of gender, and grades obtained in LES on their interest to this school subject. The researchers used a questionnaire for data collection. Factor structure analysis revealed a 19-item questionnaire distributed into four dimensions: feeling, value, knowledge, and re-engagement. This questionnaire was administered to a sample of 970 Moroccan students in the third year of middle school. The results show that these students had a positive but low interest in LES. The participants demonstrated moderate levels of feeling, value, and knowledge associated with this school subject, but their re-engagement with it was low. In addition, the results reveal significant differences in interest in LES and its dimensions in favor of females and students with high grades. In conclusion, this study suggests the need to adopt appropriate measures to enhance Moroccan students' interest in LES.

Keywords: students' interest, life and earth sciences, middle school, scale

INTRODUCTION

Life and earth sciences (LES) school subject takes is an important place in the Moroccan educational system. It covers fields such as biology, geology and ecology, and provides students with a solid scientific knowledge background to understanding the world around them. However, the challenges of teaching this school subject still persist, despite the reforms initiated to improve its quality. Indeed, the results of program for international student assessment comparative evaluation highlight a significant gap between the performance of Moroccan 15-year-old students and their international peers in science, including LES (OECD, 2023). This indicates their poor ability to apply the knowledge and skills acquired at school to a variety of real-life situations and challenges. This raises questions about the quality of the physical learning environment in Moroccan schools (e.g., teaching resources, quality of teachers, etc.), as well as other less tangible aspects such as students' interest in learning LES. According to some research, there seems to be a correlation between students' interest and their academic performance (Laine et al., 2020; Potvin & Hasni, 2014b; Potvin et al., 2020). Therefore, it is reasonable to assume that there is a link between Moroccan students' low performance in LES and their level of interest in this school subject, as it is difficult to invest fully in learning without interest.

Interest has also been studied in the field of education by many researchers around the world. It is considered a motivational process that boosts learning and guides academic and career path (Harackiewicz et al., 2016; Hazari et al., 2020; Renninger & Hidi, 2016). However, it is worrying to note that numerous studies have revealed that students' interest in various science school subjects diminishes as they progress through their schooling; and physics and chemistry seem to be more affected than biology (Christidou, 2011; Hasni & Potvin, 2015; Krapp & Prenzel, 2011; Potvin & Hasni, 2014b, 2014a; Steidtmann et al., 2023). In particular, lower secondary school is a critical phase, as learning becomes more cognitively demanding (Barmby et al., 2008), and

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Contribution to the literature

- Measuring students' interest in LES seems important to better understand their rapport with this school subject.
- The study results show that the participants had a positive but low level of interest in LES. Participants had moderate levels of feeling, value, and knowledge of this school subject, as well as low levels of re-engagement. However, differences in this interest and its four dimensions according to gender and LES grades were statistically significant, favoring females and students with high grades.
- The study has implications for teaching and learning by informing stakeholders in education, particularly teachers, of the level of student's interest and the importance of taking appropriate measures to stimulate it.

probably adolescents pay more attention to other aspects of their lives rather than investing all their energy in learning (Krapp & Prenzel, 2011). However, in the Moroccan school context, there is a lack of research regarding students' interest in learning LES. Furthermore, there are no questionnaires designed to measure the level of this interest. In this regard, this study aims to examine the interest of Moroccan middle school students in LES. The reasons for this are, on the one hand, to explore whether the low level of student achievement is accompanied by a lack of interest in this school subject and, on the other hand, to add a corpus of knowledge around students' interest in the latter.

THEORETICAL FRAMEWORK

The presence of various conceptualizations of interest makes it difficult to agree on a common definition of this psychological concept, but one important point that distinguishes it from other psychological concepts like motivation and attitude is its content specificity (Krapp & Prenzel, 2011; Renninger & Hidi, 2011, 2016). In other words, interest is always associated with an object, which may be, for example, a specific subject, activity, or context. According to the synthesis published by Rowland et al. (2019), the four-phase model of interest development by Hidi and Renninger's (2006) is one of the most cited theories. This model describes the development of an individual's interest over time through four distinct and sequential phases: triggered situational interest, maintained situational interest, emerging individual interest, and well-developed individual interest.

Triggered situational interest (first phase) refers to the attention and temporary emotional and cognitive reactions elicited by external stimuli such as surprising information or visual effects. It requires minimal prior knowledge and can be ephemeral or persist and develop into maintained situational interest. This second phase is characterized by more focused attention and involvement over a certain period, contributing to the beginning of construction of a knowledge and value base linked to the object of interest. It is supported by the environment, as meaningful and involving activities. The maintenance of situational interest can also develop into individual emergent interest (third phase), marked by the start of a relatively stable, independent predisposition. It is characterized by more positive emotions towards the object of interest, accumulation of knowledge and values, and repeated re-engagement with curiosity questions. When this interest becomes more stable and durable, it refers to a well-developed individual interest (fourth phase), generally maintained internally. It is characterized by more positive feelings, an accumulation of knowledge, an increased valuation of the object of interest, and a predisposition to search for re-engagement opportunities constantly. This type of interest fosters the adoption of deeper strategies for engaging with the object of interest and enables perseverance in the face of difficulty or even frustration (Hidi & Renninger, 2006).

According to this model, interest is a multidimensional construct comprising characteristics of emotion, value, knowledge, and re-engagement with a specific object. The involvement and intensity of these vary from one phase to the next. This model generally distinguishes between two types of interest: situational interest (phase 1 and phase 2) and individual interest (phase 3 and phase 4). Situational interest can be described as a psychological state characterized by attention or an affective and cognitive reaction lived at a particular moment in response to external stimuli, whereas individual interest is an enduring predisposition to re-engage with a particular object over time (Hidi & Renninger, 2006; Renninger & Hidi, 2016). This model, therefore, provides a framework for assessing students' level of interest and suggests ways of supporting its development.

As interest is not directly observable, its complexity as a psychological concept reflects the diversity of methods and practices used to measure it in the school context. The synthesis by Potvin and Hasni (2014b) pointed out that most studies of interest in the school context are based on questionnaires. In this sense, Rowland et al. (2019) argue that questionnaires, composed of several items describing one or more aspects (dimensions) of interest, represent a good practice measure. However, their use requires the adoption of a theoretical framework to guide

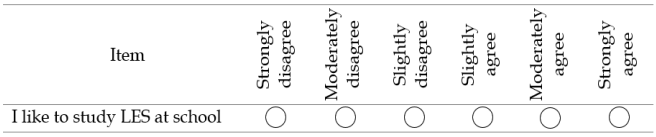

Figure 1. Likert-type structure used for scale items (Hasni & Potvin, 2015)

appropriate item selection and statistical evidence of validity and reliability to support their effectiveness as a measurement tool (Knekta et al., 2019). Therefore, the present study adopted Hidi and Renninger's (2006) model of interest development and focuses specifically on individual interest. It targets, therefore, to examine Moroccan students' interest in LES. Moreover, it attempts to answer the following research questions:

1. What is the level of students' interest in LES?
2. Are there any differences in students' interest towards LES by gender and grades obtained in it?

METHOD

Research Approach

This study objectives is to examine the interest of Moroccan students in the third year of middle school in the school subject LES. To this end, the researchers adopted a quantitative approach by conducting a questionnaire-based survey to collect data.

Research Instrument

Elaboration

The research instrument was a questionnaire (scale) composed of positive items that refer to indicators potentially characterizing individual interest as defined by Hidi and Renninger (2006). It consisted of the following four indicators (dimensions): positive feeling, personal value, stored knowledge and independent re-engagement associated with LES. The researchers made sure that the items were in simple, clear, and easy to understand language. In addition, the researchers chose that the scale should not be too long to keep students more focused and, thus, avoid biased responses. Some items included in the scale are adopted after consulting existing measurement tools (Hasni & Potvin, 2015; Knekta et al., 2020; OECD, 2017). They were rewritten and adapted to reflect the interest in LES rather than other things. As a result, 24 items were selected and were rated on a six-point scale ranging from "strongly disagree" (one) to "strongly agree" (six) (**Figure 1**). This scale included six items on feelings towards LES (e.g., I like to study LES at school), six items on personal value placed on LES (e.g., I am convinced that LES is important for my personal goals), six items on stored knowledge related to LES (e.g., I think I know a lot about environmental problems) and six items on independent re-engagement related to LES (e.g., I want to spend more time studying LES at school).

Validity

This scale was evaluated by experts (two secondary school teachers of LES and four higher education instructors) to ensure the clarity and relevance of the items. Following their recommendations, necessary revisions were made to problematic items without eliminating any, resulting in the initial version with 24 positive items. Then, the researchers carried out an exploratory factor analysis to reveal the factor structure of the scale. KMO value was 0.937, higher than the recommended value of 0.50 (Field, 2009), suggesting that the data collected was appropriate for factor analysis. Furthermore, the value of the Barltett test ($\chi 2$=2,755.915; $p<0.001$) was statistically significant, rejecting the null hypothesis of an identity matrix (Field, 2009). This indicates adequate correlations between items, which allows the use of exploratory factor analysis. Subsequently, principal component analysis with the Varimax orthogonal rotation method was used to check whether the scale items can be grouped into independent factors (Muijs, 2010). This rotation revealed the presence of four latent factors (dimensions) with a total of 19 items. However, the four factors of the scale explain 58.39% of the total variance (**Appendix A**), exceeding the threshold of 50.00% as recommended (Streiner, 1994). According to the significance of the items making up each factor and the theoretical framework adopted, the four factors in the final version of LES interest scale are named, as follows: F1 "feeling towards LES" (five items, I5, I6, I8, I16, and I19), F2 "value placed to LES" (five items, I1, I2, I3, I4, and I20), F3 "re-engagement related to LES" (five items, I7, I10, I17, I18, and I22) and F4 "knowledge related to LES" (four items, I9, I15, I23, and I24) (**Appendix A**).

Reliability

After verifying the factor structure, the analysis of the reliability of the scale and its dimensions was carried out using Cronbach's alpha coefficient. According to Nunnally (1978), a scale is generally considered reliable when the value of its Cronbach's alpha coefficient is greater than 0.7. However, the Cronbach's alpha value of the scale in this study was 0.914, which confirms its high reliability. In addition, the reliability of each factor was acceptable, with a value of 0.818 for the first factor, 0.800 for the second factor, 0.786 for the third factor and 0.724 for the fourth factor.

Participants & Data Collection

The participants in this study consisted of 970 third-year middle school students from 17 schools in the Province of Taza, Morocco. This number of students far exceeded the minimum size required for a

Table 1. Interest levels towards LES according to mean value intervals

Intervals	Level	Interpretation
[1.00 : 1.83[	Strongly disagree	High negative interest
[1.83 : 2.67[	Moderately disagree	Moderate negative interest
[2.67 : 3.50[	Slightly disagree	Low negative interest
[3.50 : 4.33[	Slightly agree	Low positive interest
[4.33 : 5.17[	Moderately agree	Moderate positive interest
[5.17 : 6.00]	Strongly agree	High positive interest

representative sample (Krejcie & Morgan, 1970), given that the target population was 8101 students. The mean age of the participants was 15.00±1.04 years. In addition, 512 students were females and 458 were males.

The survey was carried out in April and May 2022. Data collected included personal information (such as age, gender, and grades obtained in LES) and responses to items on LES interest scale. Participants were given 15 minutes to complete the paper questionnaire. They were assured that their responses to the questionnaire would remain anonymous and confidential.

Analysis of Research Results

For statistical analysis, the researchers used SPSS 26.00 software. Descriptive statistics (mean, standard deviation, and percentages) are performed on the data obtained from participants to measure their interest in LES. Additionally, parametric tests including t-test, ANOVA, Fisher's post-hoc analysis (LSD), and effect size (η^2) are used to reveal differences by gender and grades obtained in LES.

RESULTS

The results of the present study are presented in the following order:

(a) Students' interest in LES and

(b) Effect of gender and grades obtained on students' interest in LES.

Students' Interest in Life & Earth Sciences

Considering that the threshold between disagreement and agreement of the items is 3.50, the mean values of LES interest are subdivided into six intervals (**Table 1**). In the same way, the mean values of the dimensions of interest are subdivided.

The descriptive statistics (means, standard deviations and percentages) of students' interest in LES and its four dimensions are presented in **Table 2** and **Table 3**.

Table 3 shows that the mean interest score is 4.29, with a standard deviation of 1.04, indicating that students generally express a positive interest in LES, but it is low. Regarding the dimensions of interest, the highest mean score is for the "knowledge related to LES"

Table 2. Mean of interest in LES & its four dimensions

		N	M	SD	R
Interest		19	4.29	1.04	-
Dimensions of interest	Feeling	5	4.42	1.24	2
	Value	5	4.39	1.16	3
	Re-engagement	5	3.77	1.30	4
	Knowledge	4	4.67	1.01	1

Note. N: Number of items; M: Mean; SD: Standard deviation; & R: Rank

dimension at 4.67, followed by the "feeling towards LES" and "value placed on LES" dimensions, both with nearly identical mean scores of 4.42 and 4.39, respectively. However, "re-engagement related to LES" dimension has the lowest mean score (3.77).

Table 3 shows that students generally express a low interest in LES, with a mean score of 4.29. Among these students, 53.09% have a moderate to high interest in this school subject, 24.64% have a low interest, and 22.27% express a disinterest.

The mean score for the "feeling" dimension is 4.42 (**Table 2**), indicating that students express a positive and moderate feeling for LES. Concerning the five items of this first dimension, **Table 3** shows that they receive low to moderate mean values. The highest mean is 5.02 for item 5 (I am happy to acquire the knowledge of LES), and the lowest is 4.00 for item 8 (I am satisfied with my performance in LES). Moreover, 75.88% of students agree moderately to strongly that they are happy to acquire the knowledge of LES, and 61.03% like (moderately to strongly) to study LES at school. However, 57.22% agree moderately to strongly that they enjoy learning LES, and only 50.51% are moderately to strongly satisfied with their LES grades.

The score recorded for the second dimension "value placed on LES" is moderately positive (4.39). **Table 3** shows that the five items of this dimension receive low to moderate mean values. Item 4 (I am convinced that LES is important for my personal goals) recorded the lowest mean score among the items in this dimension (4.17), compared to item 20 (I see that learning LES is of great value for understanding the world around me), which recorded the highest average score of 4.77. Furthermore, 69.18% of the students favor (moderately to strongly) that learning LES is valuable for them to understand the world, and 57.21% agree (moderately to strongly) that learning LES improves their self-confidence. Whereas only 52.58% agree (moderately to strongly) that learning LES is important for their personal goals.

The third dimension "re-engagement related to LES" has the lowest score of 3.77, indicating that students express low re-engagement related to this school subject. **Table 3** indicates that the mean scores of the five items in this dimension vary from 3.37 to 4.23 for item 7 (I intend to work in a career related to LES in the future) and item 118 (When I have trouble understanding

Table 3. Means & percentages of scale items

		M	D (%)	SLA (%)	MA (%)	SA (%)
Interest		4.29	22.27	24.64	30.1	22.99
Feeling	I6-I like to study LES at school.	4.48	22.47	16.5	30.1	30.93
	I5-I am happy to acquire the knowledge of LES.	5.02	14.22	9.9	20.31	55.57
	I8-I am satisfied with my LES results.	4.00	34.85	14.64	27.73	22.78
	I16-I am interested in learning LES.	4.23	28.56	18.04	27.73	25.67
	I19-I enjoy learning LES.	4.37	25.98	16.8	24.64	32.58
Value	I4-I am convinced that LES is important for my personal goals.	4.17	31.96	15.46	24.85	27.73
	I1-I really see the value of studying LES for my future career.	4.27	27.42	16.8	31.65	24.13
	I20-I see the value of learning LES in understanding the world around me.	4.77	18.14	12.68	26.5	42.68
	I3-I think that learning LES improves my self-confidence.	4.33	25.57	17.22	29.79	27.42
	I2-The LES discipline is essential for me and for my academic success.	4.40	23.61	17.32	34.95	24.12
Re-engagement	I22-I try to solve the LES exercises, even if I am not asked to do so.	3.68	42.06	17.73	24.02	16.19
	I18-When I have trouble understanding something in LES, I try to understand it.	4.23	36.09	14.74	13.71	35.46
	I17-I want to spend more time studying LES at school.	3.77	38.87	20.72	22.06	18.35
	I7-I intend to work in a career related to LES in future.	3.37	52.68	14.12	14.33	18.87
	I10-Outside the classroom, I often talk about what I learn in LES.	3.81	36.08	22.06	24.64	17.22
Knowledge	I24-The knowledge about the organs of the human body attracts me to acquire.	4.88	15.68	12.37	24.43	47.53
	I23-What I learn in LES has broadened my knowledge of the world of living beings.	5.06	12.68	10.62	22.68	54.02
	I9-My knowledge of geological phenomena is extensive.	4.15	30.83	17.42	27.53	24.23
	I15-I think I know a lot about environmental problems.	4.59	17.94	18.45	32.27	31.34

Note. M: Mean; D: Disagree; SLA: Slightly agree; MA: Moderately agree & SA: Strongly agree

something in LES, I try to understand it), respectively. 41.86% of the students agree (moderately to strongly) to talk about LES outside the classroom, and 40.41% to spend more time studying LES. However, 40.21% of the students agree (moderately to strongly) that they would try to solve LES exercises, even if they are not asked and only 33.20% are in favor (moderately to strongly) of having the intention to engage in an LES-related occupation in the future.

The fourth dimension "knowledge related to LES" recorded a moderate mean (4.67). It appears in **Table 3** that the four means items of this dimension range from low to moderate. The item with the lowest mean score (4.15) in this factor is item 9 (My knowledge of geological phenomena is extensive).

However, item 23 (What I learn in LES expands my knowledge of the world of living beings) registers the highest mean value (5.06). Although only 51.76% of the students agree (moderately to strongly) that their knowledge of geological phenomena is extensive, more of them agree (moderately to strongly) that learning LES has broadened their knowledge of the world of living beings (76.70%), and that knowledge of the human body attracts them to acquire (71.96%).

Effect of Gender & Grades Obtained on Students' Interest in Life & Earth Sciences

Effect of gender

Females' and males' mean scores for interest in LES and its dimensions are calculated, and the effect of gender is explored (**Table 4**).

Table 4 shows that females present a moderate level of interest in LES (4.42), whereas males present a low level of interest (4.16). Similarly, females obtain higher mean scores than males for the four dimensions of interest, and the differences between the two sexes range from 0.13 for the dimension "knowledge related to LES" to 0.37 for the dimension "re-engagement related to LES". However, the dimension "re-engagement related to LES" receives the lowest mean for both females (3.95) and males (3.58), indicating their low re-engagement with this school subject.

The t-test result reveals a statistically significant effect of gender on interest ($p<0.001$) with a small effect size ($\eta^2=0.015$), indicating that females differ significantly from males in their greater interest in LES. Again, the effect of gender appears to have a significant influence on all dimensions of interest ($p<0.05$), favoring females

Table 4. Results of t-test: Effect of gender on interest in LES & its dimensions

		M (f)	M (m)	ΔM	t value	Sig.	ES
Interest		4.42	4.16	0.26	3.883	0.000	0.015
Dimensions of interest	Feeling	4.52	4.31	0.21	2.554	0.011	0.007
	Value	4.53	4.23	0.30	4.150	0.000	0.017
	Re-engagement	3.95	3.58	0.37	4.436	0.000	0.020
	Knowledge	4.73	4.60	0.13	1.967	0.049	0.004

Note. M (f): Mean (females); M (m): Mean (males); ΔM: Means difference; & ES: Effect size

Table 5. Results of ANOVA test: Effect of grades obtained on interest in LES & its dimensions

		M (gr1)	M (gr2)	M (gr3)	F	Sig.	ES
Interest		4.79	4.24	3.87	53.873	0.000	0.100
Dimensions of interest	Feeling	5.07	4.36	3.86	66.828	0.000	0.121
	Value	4.89	4.31	4.01	39.889	0.000	0.076
	Re-engagement	4.33	3.72	3.29	42.448	0.000	0.081
	Knowledge	4.91	4.66	4.44	13.212	0.000	0.027

Note. M (gr1): Mean (group1); M (gr2): Mean (group2); M (gr3): Mean (group3); & ES: Effect size

with a small effect size for the dimensions of "value placed on LES" (η^2=0.017) and "re-engagement related to LES" (η^2=0.020), and negligible for the dimensions of "feeling towards LES" (η^2=0.007) and "knowledge related to LES" (η^2=0.004).

Effect of grades obtained

According to the grades obtained in LES in the first semester, students are grouped into three groups, as follows: group 1=students with grades in the interval [14-20], group 2=students with grades in the interval [10-14[and group 3=students with grades in the interval [0-10[. It should be noted that 76.00% of students have grades above 10/20, and only 26.00% have grades between 14 and 20.

Comparing the means for the three groups of students shows that students in group 1 have a moderate level of interest in LES (4.79), followed by students in group 2 (4.24), while students in group 3 show a low level of interest with a mean score of 3.87. Once again, students in group 1 show a moderate level for each dimension of interest in LES, which is higher than in group 2 and group 3. Group 2 students have moderate scores for the two dimensions "knowledge related to LES" and "feeling towards LES" (4.44 and 4.36, respectively), and low scores for "re-engagement related to LES" (4.31) and "value placed on LES" (4.31 and 3.72, respectively). However, the students in group 3 express the lowest means for all the dimensions.

ANOVA test reveals a statistically significant effect of the grades obtained on students' interest in LES ($p<0.001$) with a moderate effect size (η^2=0.1) (**Table 5**). Similarly, it shows that these grades obtained have a statistically significant effect on each dimension of interest ($p<0.001$), with a small effect size (η^2=0.027) for the "knowledge related to LES" dimension and a moderate effect size for the other dimensions ($\eta^2>0.06$). The results of LSD post-hoc analysis reveal that the differences between the means of interest and its dimensions for each pair of student groups are statistically significant ($p<0.01$). This indicates that students with high scores in LES are significantly distinguished from their peers with lower scores by equally high interest, feeling, value, knowledge, and re-engagement in LES.

DISCUSSION

In this study, the researchers evaluate the interest of Moroccan students in LES using a questionnaire (scale) composed of items reflecting indicators of individual interest associated with this school subject. Exploratory factor analysis reveals the distribution of 19 items under four dimensions: sentiment, value, knowledge and re-engagement. In addition, the value of Cronbach's alpha (0.914) shows the high reliability of the scale. These results indicate that this scale is an instrument with satisfactory validity and reliability for measuring students' interest in LES. However, the use of this final scale, with a sample of 970 students in the third year of middle school, reveals important results and observations related to research questions.

The results indicate that these Moroccan students have a positive but low interest towards LES (4.29). In other contexts, interest is also positive as a sub construct in various scales that measure attitude toward Biology (Prokop et al., 2007; Vlckova et al., 2019; Zeidan, 2010). This positive result does not, however, lead all students to express the same agreement for all the items of the scale, see also its dimensions. There are always students who are more interested in one school subject than another and, consequently, there is a proportion of students who are not interested at all in LES. In fact, 22.27% of the participants are not interested in LES, while 53.09% show a moderate to high interest in it (**Table 2**). One explanation for this low interest may involve tension between this interest and interest in

other school subjects. In addition, the aspiration of many students to pursue literary studies in the future may influence their perception of the importance of this school subject and their interest in it. Other possible factors may include the learning environment (teachers, teaching methods, etc.) and learning difficulties. However, teachers are one of the important factors that can influence the perception of school subjects and the formation of students' attitudes in the classroom (Gelisli et al., 2017; Kubiatko et al., 2017). In addition, parental involvement is a factor in extrinsic motivation (Womack & Johnson, 2021).

According to the results related to the dimensions of interest, it appears that the participants have a moderate feeling towards LES (4.42). Although students' positive emotions towards this school subject are more frequent, some do not find pleasure in learning LES (25.98%) or feel not satisfied with their LES results (34.85%) (**Table 3).** Dan, (2021) suggests that teachers need to create relaxing and pleasant learning environments to develop students' interest. Thus, LES teachers have a crucial role to play in maintaining students' positive feelings. This includes, among other things, showing interest towards their students, presenting lessons in a fun and engaging way, and enabling their students to feel comfortable in class and able to succeed.

Similarly, participants placed a moderate value on LES (4.39). Although many of them agreed that this school subject is very useful to understand the world around them, quite a few disagreed that learning LES is important for their personal goals (31.96%) or improves their self-confidence (25.57%) (**Table 3**). Some researchers point out that the context in which science is taught in real-life situations is interesting for students (Badri et al., 2016; Hasni & Potvin, 2015; Hulleman & Harackiewicz, 2009). In this sense, it is worth noting that relevant classroom activities, which link to students' pre-existing interests and foster personality development and self-confidence are necessary to increase students' perceived value of LES.

Regarding the low re-engagement of students in LES (3.77), it should be noted that more than a third of the participants do not care about investing more time in learning LES (38.87%), do not discuss LES outside school (36.09%) or do not voluntarily solve LES exercises (42.06%) (**Table 3**). This can be attributed to many factors, including unstimulating and unengaging teaching methods, as well as students' lack of involvement and scientific curiosity. However, studies implementing active teaching approaches, such as inquiry, collaborative work, and extra-curricular learning (Dohn, 2013; Potvin et al., 2017; Rabgay, 2018), show encouraging results in terms of engaging students and boosting their interest in learning.

Concerning knowledge of LES, the students display a moderate level (4.67). They claimed to have more knowledge of life sciences (the world of living things, the human body, and the environment) than in geology (**Table 3**). This disparity may be due to the challenges encountered in learning geological concepts, as well as to the fact that the school program gives more importance in terms of time volume to life sciences courses. According to Hidi and Renninger (2006), knowledge is a strong indicator of personal interest in a subject. It is, therefore, crucial to make students understand the importance and relevance of LES to their daily lives and future career aspirations while teaching them strategies in order to help them assimilate knowledge and develop skills.

The results concerning the gender of the participants show that it has a significant effect on interest in LES ($p<0.05$), favoring females with a small effect size. It also has a significant effect on the feeling, value, re-engagement, and knowledge associated with this school subject, again favoring females (**Table 4**). These results are due, to some extent, to the fact that females are more disciplined in class, attracted to biology topics, or do better at school than males. Other studies have also reported differences in interest and preferences for Biology favoring females (Badri et al., 2016; Osborne & Collins, 2001; Prokop et al., 2007; Uitto, 2014; Uitto et al., 2006; Vlckova et al., 2019; Zeidan, 2010).

Regarding participants' grades obtained in LES, they appear to exert a significant influence on the interest in this school subject, favoring high-performing students with a small effect size. Moreover, its effect on its dimensions is significant, with a small effect size for the knowledge dimension and a moderate one for the other dimensions (**Table 5**). According to Bandura (1997), individuals prefer activities in which they feel competent and confident to those in which they feel less competent. The study by Potvin et al. (2020) highlighted the significant but weak predictive power of academic success on students' subsequent individual interest. Thus, students' achievements in the current study may affect their sense of competence and, therefore, their interest in LES.

CONCLUSIONS

This study aims to assess Moroccan students' interest in the school subject of LES. The results show that the participating students have a positive but low level of interest in this school subject. Their level of feeling, value, and knowledge about it is moderate, but their re-engagement is low. The results also reveal significant differences in interest in LES and its dimensions according to gender and grades obtained, favoring females and high-achieving students. These findings suggest the need for more effort to reduce the disparities observed while seeking to improve students' positive feelings, perceived value, knowledge, and, in particular, re-engagement with this school subject. This study adds

new knowledge about Moroccan middle school students' interest in LES and provides a basis for future research. However, it does have some limitations. First, the data collection method in this study is limited to quantitative data. Secondly, the validation of the questionnaire used is limited to exploratory factor analysis. In conclusion, further research should be carried out in the Moroccan school context in order to propose new results to the literature, this will provide stakeholders in education, especially teachers, with a more profound insight into students' interest in LES and the suitable methods to enhance it.

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APPENDIX A

Table A1. Factor loadings of final solution of scale

Items	F1	F2	F3	F4
I6-I like to study LES at school	0.702			
I5-I am happy to acquire the knowledge of LES	0.681			
I8-I am satisfied with my LES results	0.661			
I16-I am interested in learning LES	0.585			
I19-I enjoy learning LES	0.570			
I4-I am convinced that LES is important for my personal goals		0.671		
I1-I really see the value of studying LES for my future career		0.655		
I20-I see the value of learning LES in understanding the world around me		0.641		
I3-I think that learning LES improves my self-confidence		0.618		
I2-The LES discipline is essential for me and for my academic success		0.602		
I22-I try to solve the LES exercises, even if I am not asked to do so			0.766	
I18-When I have trouble understanding something in LES, I try to understand it	0.437		0.683	
I17-I want to spend more time studying LES at school			0.625	
I7-I intend to work in a career related to LES in the future			0.563	
I10-Outside the classroom, I often talk about what I learn in LES			0.531	
I24-The knowledge about the organs of the human body attracts me to acquire				0.786
I23-What I learn in LES has broadened my knowledge of the world of living beings			0.401	0.687
I9-My knowledge of geological phenomena is extensive				0.601
I15-I think I know a lot about environmental problems				0.529
Eigenvalue	7.606	1.335	1.212	0.940
Variance explained	40.031	7.027	6.379	4.949
Total variance		58.386		