

The Status of Moroccan High School Students' Environmental Knowledge



Hassan Laaloua

Ibn Zohr University, Morocco

ABSTRACT: This paper examines the status of Moroccan high school students' environmental knowledge. It aims to test the level of students' knowledge regarding a range of factual and conceptual knowledge of topics related to local and global environmental issues which high school students are supposed to know. The study adopted a quantitative research design and the research sample was made of 524 female and male students belonging to eight public and private high schools in the city Agadir and the suburbs. The descriptive statistics of the knowledge test's scores revealed that students demonstrated insufficient degrees of environmental knowledge both at the levels of factual and conceptual questions. Meanwhile, the results were also indicative of the absence of positive or negative correlations between students' environmental knowledge and their age, gender, stream, school type and grade. Finally, this paper suggests ways to boost students' environmental knowledge to improve their pro-environmental attitudes and behaviors.

KEYWORDS: Environmental education, environmental knowledge, students, Morocco.

INTRODUCTION

More than any time before, the world cannot overlook the emergent need to reconsider human behavior towards nature and the environment and positively respond to startling challenges such as the issue of natural resources, energies, global warming, climate change, and pollution. Given the generally held fact that schools can be critical in shaping our thoughts and behaviors (Henderson & Tilbury, 2004; Kollmuss & Agyeman, 2002), this study intends to delve into the ways environmental education (EE) knowledge is disseminated among high school students in Morocco. It is true that Morocco, at very high levels, including the 2011 constitution and the officially proclaimed strategies and plans, demonstrates its readiness and determination to provide a healthy and suitable environment for all the citizens. It is also legitimate to admit that both the state and civil society appear to be engaged in several colossal projects whose main aim is to spread EE, sustainability, and green culture on a large scale. However, we need to acknowledge that the Moroccan educational system has mismatched students' environmental needs and educational goals (Agorram et al., 2009; El Batri et al., 2020; El Batri et al., 2019; El Moussaouy et al., 2014; Riouch & Benamar, 2018). This situation germinates from the fact that EE has not taken sufficient space in the educational system, including curriculum design and planning, teacher training, and instructional material. We contend that both the environmental content and the way it is infused in the curricula prove to be inadequate to keep up with the rising requirements of today's learners to make them more aware, knowledgeable, and concerned about the issues of the environment. In this respect, the general tendency in society seems to reveal that people do not show sufficient concern and positive attitudes toward the environment preservation and sustainability. There is still a prevailing refusal to acknowledge how crucial EE is to environment preservation and to consider school as an influential institution to bring about the desired environmental change.

The problem that this study addresses remains socially, economically, culturally, and educationally persistent because the issue of environmental degradation can be seen as lifethreatening to all species. Therefore, doing research in this area is highly needed to contribute to the ongoing systematic course of actions to preserve the environment and natural resources. Likewise, we acknowledge that school and education can sensitize people, especially the young generation, about environmental issues and prepare them to conveniently treat the environment through instilling ways to promote green lifestyles, pro-environmental attitudes, and environment-friendly behaviors (Hungerford & Volk, 1990). In this context, this study attempts to investigate the status of environmental knowledge amongst Moroccan high school students. It aims to scrutinize the extent to which Moroccan high school students are informed about the most important environmental issues in their country and the world. It also looks at the possible correlations between students' demographic variables and the levels of their environmental knowledge. Therefore,

The Status of Moroccan High School Students' Environmental Knowledge

this investigation of students' environmental knowledge remains central to our understanding of people's attitudes and behaviors towards the environment.

To achieve these objectives this study attempts to answer the following research questions:

1. To what extent are Moroccan high school students knowledgeable about the basic environmental issues and problems?
2. Are there any correlations between Moroccan high students' environmental knowledge and their age, gender, stream, level, and type of school?

Before embarking on the details of this study, it is noteworthy to provide brief definitions of the most important key terms:

Environmental Education was defined by UNESCO and IUCN in 1970 as the process of recognizing values and clarifying concepts to develop skills and attitudes necessary to understand and appreciate the inter-relatedness among man, his culture, and his biophysical surroundings. EE also entails practice in decision-making and self-formulation of a code of behavior about issues concerning environmental quality (p. 11)

According to the world's first intergovernmental conference on EE, which was organized by the United Nations Education, Scientific, and Cultural Organization (UNESCO) in cooperation with the U.N. Environment Program (UNEP) in Tbilisi in 1977, the essential categories of EE objectives are:

Awareness: to help social groups and individuals acquire an awareness and sensitivity to the total environment and its allied problems.

Knowledge: to help social groups and individuals gain experience and understanding of the environment and its associated problems.

Attitudes: to help social groups and individuals acquire a set of values and feelings of concern for the environment and the motivation for actively participating in environmental improvement and protection.

Skills: to help social groups and individuals acquire the skills for identifying and solving environmental problems.

Participation: to provide social groups and individuals with an opportunity to be actively involved at all levels in working toward the resolution of environmental problems

Environmental Knowledge is the ability to understand the different elements of the environment, which means that all types of knowledge relevant to people's lives and the environment can be included in environmental knowledge. Morris (2016) distinguishes between four different elements of environmental knowledge: *know what*, *know why*, *know-how*, and *know who*. Environmental knowledge is, thus, an essential element in promoting people's EE, enhancing their potential contribution to sustainability, and improving their environment friendly behaviors (Vicente-Molina et al. 2013; Michelsen & Fischer, 2017). In this respect, young learners need to be equipped with sufficient elements of EE, in schools and elsewhere, to enrich their environmental knowledge (Otto & Pensini, 2017). Therefore, investigating high school students' degrees of environmental knowledge may help identify the strong and weak sides of the situation to find solutions to improve it. This study, along with similar ones, can help diagnose and treat some afflictions that affect the environment.

METHODOLOGY

This study adopted a quantitative research design. The aim was to test to what extent Moroccan high school students are knowledgeable about very important environmental issues in Morocco and the world. Based on convenience sampling, the research sample was constituted of 524 male and female students belonging to eight public and private high schools in Agadir and the suburbs. The study used a questionnaire which targeted all the three levels of high school students: 10th, 11th, and 12th grades (the common core, the 1st year baccalaureate, and the 2nd year baccalaureate). Moreover, the study sample attempted to cover the most important high school majors/streams namely sciences, humanities, technology, and professional baccalaureate. To collect data, an environmental knowledge test was elaborated in a Likert scale questionnaire to collect quantitative data about students' levels of environmental knowledge. The test consists of 19 questions, nine of which target students' conceptual knowledge and ten questions test students' factual knowledge. The conceptual and factual questions were adopted from similar questionnaires developed in other studies (Clarke, 1996; Maloney et al., 1975; Richmond & Morgan, 1977). The 19 items of the knowledge test assessed the respondents' factual and conceptual knowledge of topics covering different aspects of the environment and the questions were designed to touch upon a broad perspective of global and local EE issues. The selected questions took into consideration the nature of knowledge that Moroccan high school students learn formally at school or informally via other media in society. The first 14 items (from item 1 to 14) were in the form of five multiple-choice answers, one of which is 'Not Sure' (sequenced from 'a' to 'e'). The other 5 items (from 15 to 19) included three options: 'True', 'False' or 'Not

The Status of Moroccan High School Students' Environmental Knowledge

Sure'. Only one answer is correct for each item and is assigned *one* point when chosen by the respondents while the incorrect answers are assigned *zero* point. Thus, the total score is 19 points. To analyze the collected data, descriptive statistics were used to determine the *mean*, *mode*, and *standard deviation* of the respondents' answers on the 19-point score test.

RESULTS

First, we will present the statistical results of the respondents' answers to the environmental knowledge items in percentages. Then, the total statistics of the whole section is displayed, including the Mean, Mode, and Standard Deviations to gain a comprehensive view regarding Moroccan high school students' level of environmental knowledge.

Table 1. Students' Answers to Environmental Knowledge Test Items

1. Do you think most air pollution in our cities comes from?				
a. Cars (8%)	b. Jet aircraft (28,4%)	c. Industrial plants (22,3%)	d. Refuse disposal (26,5%)	e. Not sure (14,7%)
2. Do you think mercury has most often been found at unacceptable levels in?				
a. Fruit and vegetables (29,4%)	b. Seafood (11,5%)	c. Beef (15,6%)	d. Drinks (15,6%)	e. Not sure (25,6%)
3. Which one of the following does not reduce pollution by cars?				
a. Properly tuned engines (14,3%)	b. Super grade petrol (13,9%)	c. Low lead petrol (26,7%)	d. Propane (LPG) engines (22,7%)	e. Not sure (22,3%)
4. Do you think ecology is best described as the study of:				
a. The relationship between humans and the environment (31,7%)	b. The relationship between organisms and the environment (28,6%)	c. The environment (20,8%)	d. Recycling of products (9,4%)	e. Not sure (9,5%)
5. Which one of the following does not decompose in sea water:				
a. Garbage (15,5%)	b. Tin cans (11,6%)	c. Plastic bags (37,2%)	d. Chemical fertilizers (17,9%)	e. Not sure (17,7%)
6. Do you think the Greenhouse Effect is best described as				
a. Excess radiation from the sun causing changes in weather patterns including the El Nino effect (17,4%)	b. The destruction of the ozone layer by CFC's atmosphere by build-up of gases, preventing re-radiation and heat loss (20,8%)	c. Thinning of the ozone layer over the polar regions causing serious diseases including cancers (20,8%)	d. the warming of the Earth's atmosphere by build-up of gases, preventing reradiation and heat loss (23,1%)	e. Not sure. (17,9%)
7. Which one of the following do you think is responsible for the build up most of the lead in our atmosphere?				
a. Cars (10,7%)	b. Aircraft (29,8%)	c. Industrial plants (15,1%)	d. Burning refuse (25,4%)	e. Not sure (19,1%)

8. How long do you think DDT (a long-lasting insecticide) takes to deteriorate into harmless chemicals?				
a. It never does (24%)	b. 10-20 months depending on the weather (29,2%)	c. hundreds of years (13,4%)	d. anywhere from several days to several years (22,5%)	e. not sure (10,9%)
9. The main damage to the ozone layer is caused by:				
a. ultra-violet rays (8,8%)	b. Carbon dioxide (23,3%)	c. chlorofluorocarbons (21,8%)	d. nitrogen oxides (13%)	e. not sure (33,2%)
10. Basic chemical materials would be locked up and would not be available for reuse by plants and animals if it were not for the activities of:				
a. decomposer organisms (27,9%)	b. photosynthetic organisms (8,2%)	c. herbivores (5,3%)	d. carnivores (7,3%)	e. not sure (51,3%)
11. Most of the radiation to which people are exposed is due to:				
a. The normal hazards of work (11,8%)	b. TV sets and watches (24,2%)	c. medical sources (e.g., X-rays) (9,7%)	d. natural sources (29,8%)	e. not sure (24,4%)
12. Most of the oxygen found in the earth's atmosphere is the result of:				
a. The slow decomposition of silica (SiO ₂) in the earth's crust (19,3%)	b. the action of volcanoes (9,9%)	c. the photosynthetic action of plants (18,1%)	d. the splitting of water molecules (H ₂ O) in the oceans (11,1%)	e. not sure (41,6%)
13. Which of the following materials is not biodegradable?				
a. Leaves (5%)	b. bread (4,8%)	c. wood (14,9%)	d. glass (54,4%)	e. not sure (21%)
14. Most of the electrical energy used in Morocco is produced by:				
a. Hydro-power stations (39,7%)	b. coal-burning power stations (4%)	c. oil-burning power stations (33,2%)	d. solar power stations (17%)	e. not sure (6,1%)
15. The interaction of environmental, biological, and social factors determines the size of the human population.				
a. True (23,1%)	b. False (32,4%)	c. Don't know (44,5%)		
16. In any environment, one component like water, air or food may limit the type of life which can survive.				
a. True (40,8%)	b. False (16,8%)	c. Don't know (42,4%)		
17. Living things are interdependent on one another and with their environment.				
a. True (76,3%)	b. False (10,1%)	c. Don't know (13,5%)		

The Status of Moroccan High School Students' Environmental Knowledge

18. Natural resources are equally distributed with respect to land areas and political boundaries.

- a. True (9,9%) **b. False (56,1%)** c. Don't know (34%)

19. Wildlife refuges and undisturbed natural areas may be of value in protecting endangered species and perpetuating endangered species and perpetuating gene pools.

- a. True (48,5%)** b. False (9,2%) c. Don't know (42,4%)

Table 1 indicates the percentages which represent the students' answers to each environmental knowledge test item. Within the table, each question is followed by multiple choices which suggest possible answers along with their corresponding percentages. The correct answer is highlighted in **bold** letters to distinguish it from the incorrect alternatives.

As shown in Table 1, only 3 items, namely 13, 17 and 18, were correctly answered in a considerable rate which exceeds 50% of the respondents. Items 5 and 13 are intended to test students' factual knowledge about degradable materials by asking them whether plastic and glass are degradable materials or not. It is noticed that 37,2% and 54,4% of the participants managed to find the correct answer to the two questions respectively. This may indicate that students are to some extent knowledgeable about the type of materials which can decompose in nature albeit in an insufficient manner. Items 16, 17, 18 and 19 receive relatively considerable portions of the respondents' correct answers ranging between 40,8% and 76,3%. These items are mostly concerned with testing students' conceptual environmental knowledge. The questions target issues related to the components of the environment, biodiversity, and the geopolitical distribution of natural resources. The percentages suggest that only moderate numbers of students understand a few concepts about the issues mentioned earlier.

Contrariwise, the percentages of the students who could answer the remaining 13 items correctly are apparently very low. Items 1, 2, 3, 7, 8, 9, 10, 11 and 12 which target assessing students' environmental factual knowledge focus mainly on the different types of pollution (air pollution, soil pollution, water pollution), food contamination, ecosystems and cycles, and the components of the environment. The low percentages of correct responses are suggestive of a mediocre level of students' environmental factual knowledge. Likewise, items 4, 6, 14, and 15 which aim to assess students' environmental conceptual knowledge are concerned with defining ecology and greenhouse effect as well as sources of energy in Morocco and the relationship between environment and human population. The results of these items reveal that most of the students lack adequate knowledge of many basic environmental concepts which high school students are supposed to know.

Building on the percentages of the chosen correct answers throughout the items constituting the test, it is generally noticeable that students were not able to demonstrate a sufficient degree of environmental knowledge both at the factual and conceptual levels. In the same line of thought, other more detailed statistics confirm this conclusion.

Table 2. Total Results of Students' Answers to Environmental Knowledge Test Items

Valid	524
Missing	0
Mean	5,7061
Mode	6,00
Std. Deviation	2,70002

As Table 2 demonstrates, the Mode 6 as the most recurrent score among the respondents along with the low Mean 5,706 (much lower than the average score 9,5/19 points) and the relatively high SD = 2,700 obviously demonstrate a low level of students' environmental knowledge and prove that more efforts should be invested to promote Moroccan high school students' factual and conceptual environmental knowledge.

To get a lucid view of the situation of Moroccan high school students' environmental knowledge, Figure 1 serves as a visual illustration of the respondents' test scores. It is quite remarkable that only 47 participants (8,76%) managed to pass this test and gain more than the average (9,5/19 points). However, the great majority of the participants (91,24%) failed to reach the average. In this regard, 477 participants seem to lack adequate elements necessary for answering the questions of the proposed environmental factual and conceptual knowledge test.

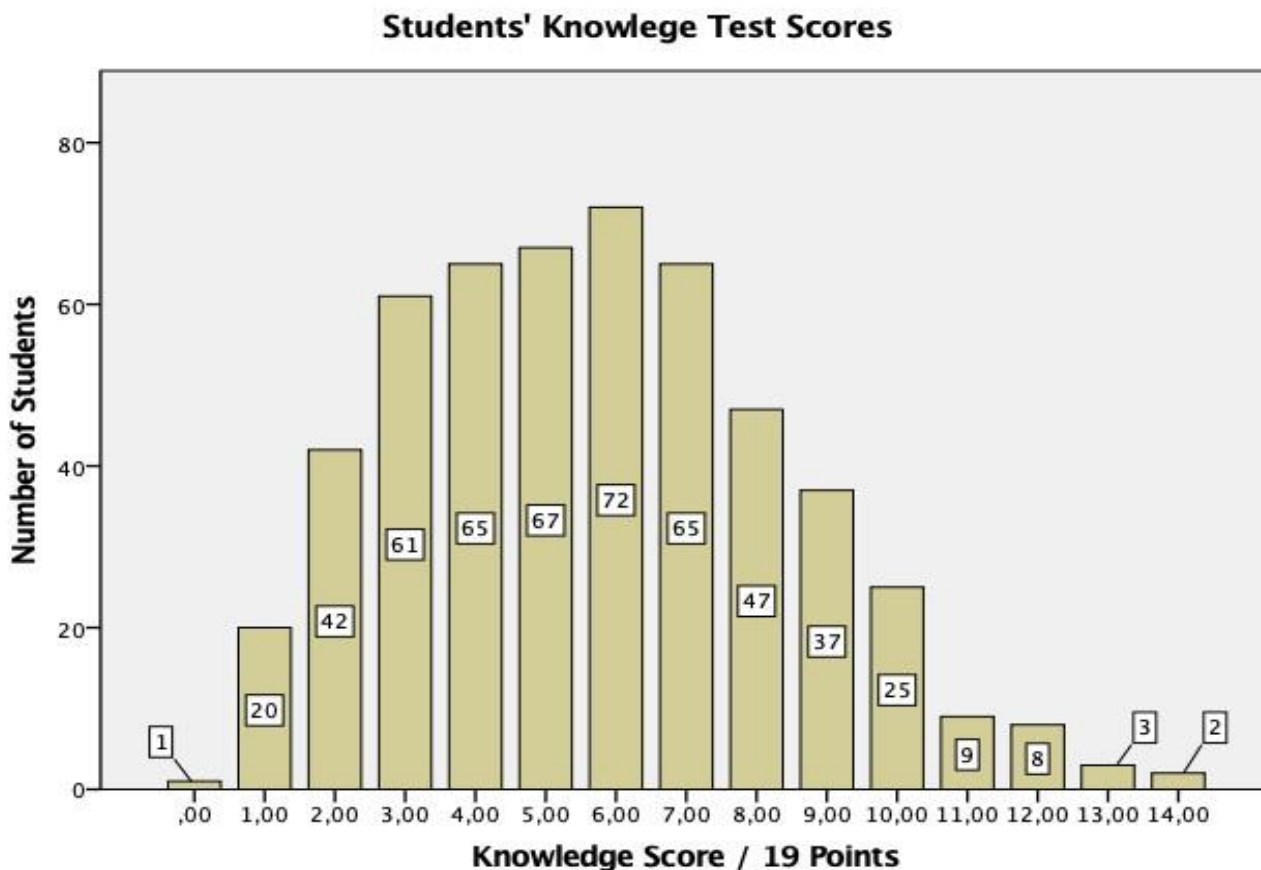


Figure 1. The Distribution of the Respondents According to their EE Knowledge Test Scores

It is evident from the preceding data analysis that Moroccan high school students appear to be deficient in environmental knowledge. Thereafter, students' environmental factual and conceptual knowledge remain below the average since most of the students were unable to answer environmental knowledge test items in a correct way. The upcoming statistics demonstrate the levels of correlations between students' environmental knowledge and their age, gender, stream, level, and type of school.

Correlations between students' environmental knowledge and their age, gender, stream, level, and type of school.

As Table 3 demonstrates, there is no significant correlation between the students' environmental knowledge and their stream ($r = 0.033$; $p \text{ value} = 0.448 > 0.05$), age ($r = 0.017$; $p \text{ value} = 0.702 > 0.05$) and gender ($r = 0.047$; $p \text{ value} = 0.280 > 0.05$). Besides, there is a significantly weak correlation between students' environmental knowledge and their school grade ($r = 0.156$; $p \text{ value} = 0.000 < 0.01$) as well as their school type ($r = 0.202$; $p \text{ value} = 0.000 < 0.01$).

The Status of Moroccan High School Students' Environmental Knowledge

Table 3. Correlations between Students' Environmental Knowledge and their Age, Gender, Stream, Level, and Type of School

		Total mean of students' EE Knowledge	School Grade	Stream	Gender	Age	School Type
Total mean of students' EE attitudes	Pearson Correlation	1	,156**	-,033	-,047	,017	,202**
	Sig. (2- tailed)		,000	,448	,280	,702	,000
	N	524	524	524	524	524	524
School Grade	Pearson Correlation	,156**	1	,282**	,065	,424**	,129**
	Sig. (2- tailed)	,000		,000	,137	,000	,003
	N	524	524	524	524	524	524
Stream	Pearson Correlation	-,033	,282**	1	-,025	,368**	-,484**
	Sig. (2- tailed)	,448	,000		,572	,000	,000
	N	524	524	524	524	524	524
Gender	Pearson Correlation	-,047	,065	-,025	1	,046	,030
	Sig. (2- tailed)	,280	,137	,572		,295	,486
	N	524	524	524	524	524	524
Age	Pearson Correlation	,017	,424**	,368**	,046	1	-,174**
	Sig. (2- tailed)	,702	,000	,000	,295		,000
	N	524	524	524	524	524	524
School Type	Pearson Correlation	,202**	,129**	-,484**	,030	-,174**	1
	Sig. (2- tailed)	,000	,003	,000	,486	,000	
	N	524	524	524	524	524	524

** . Correlation is significant at the 0.01 level (2-tailed).

These results are indicative of the absence of a positive or negative correlation between students' EE knowledge and their age, gender, stream, school type and grade. In other words, the poor level of students' environmental knowledge remains applicable to all their categories of age, gender, stream, school type and grade without any apparent influence of these variables on their EE knowledge.

DISCUSSION

Students' Environmental Knowledge

The statistical results of this test revealed a low level of students' environmental knowledge (Mean 5,706 is much lower than the average 9,50 and SD= 2,700 is relatively high). In this respect, nearly half of the participants gave correct answers to the questions

The Status of Moroccan High School Students' Environmental Knowledge

related to factual knowledge about degradable materials like plastic and glass. Similarly, students showed significant levels of knowledge concerning conceptual information about issues such as the components of the environment, biodiversity, and the geopolitical distribution of natural resources. Overall, the statistics suggested that only moderate numbers of students succeeded in recognizing a few concepts about the environmental issues mentioned earlier. These issues are usually classified as general knowledge that is disseminated via mass media nowadays, and most common people would be familiar with them regardless of their level of education. Thus, the impact of the school curricula and programs on students' environmental knowledge seems to be lacking here.

Conversely, the test scores showed that the levels of Moroccan high school students' factual knowledge about environmental issues like the different types of pollution, food contamination, ecosystems and cycles, and the components of the environment are low to very low. Similarly, the results related to students' environmental conceptual knowledge concerned with the definitions of ecology and greenhouse effect, sources of energy in Morocco, and the relationship between humans and the environment demonstrated an absence of adequate comprehension of many basic concepts. The low scores of the students' environmental knowledge test (91,24% failed to reach the average) are alarming and indicative of the inefficiency of the educational system to teach students basic environmental topics and issues. Environmental knowledge is important in determining the type of EE awareness, attitudes, skill, and participation. The research found a high level of correlation between knowledge and actual commitment (Liere & Dunlap, 1981)

Previous research in environmental knowledge demonstrated that high students' environmental knowledge is limited (Clarke, 1996). The study investigated environmental attitudes and knowledge held by 11th-grade students in Queensland in Australia and found that the knowledge scores were judged lower than the available scores at that time. Australian students achieved 50% in the knowledge scores, whereas Moroccan students' scores did not exceed 8,96%, which is suggestive of the huge gap existing between the two countries in terms of students' EE knowledge. In the same way, Kuhlemeier et al. (1999) disclosed that many Dutch "students lacked knowledge regarding environmental topics such as energy usage; soil, air, and water pollution; recycling; agricultural activities; tourism; transportation; and recreation." (p. 10). Another study, which investigated Lebanese secondary school students' environmental knowledge and attitudes (Makki, Abd-El-Khalick, & Boujaoude, 2003), found that students lacked common environmental concepts relevant to their everyday lives. The results in Makki et al.'s (2003) study are consistent with the results in this study. The participants in the two studies scored low in the environmental knowledge test and held moderate levels of pro-environmental attitudes. Students' environmental knowledge test scores were frequently reported low among high school students in different countries regardless of their level of development. In the USA, a survey of high school students' environmental knowledge revealed that the levels of knowledge were disappointing because only one-third of the participants could answer the average of test questions correctly (Gambro & Switzky, 1996). Similarly, Arcury (1990) reported that the participants did not score well in the knowledge test he used in a survey (based on the NEP scale) to measure environmental attitudes and knowledge in Kentucky, USA.

That said, the level of Moroccan high school environmental knowledge resonates with other low levels recorded in numerous studies in different contexts in the world. The statistical results of this thesis indicated a low level of the students' environmental knowledge, but this issue is quite common in other cases with different degrees of course. In this regard, curriculum designers, textbook writers, teachers, and all other educators need to invest extra effort to raise these low levels of environmental knowledge. Raising the level of knowledge could help students adopt more positive environmental attitudes and improve their behavioral actions toward the evergrowing environmental problems and challenges.

Correlations between Students' Environmental Knowledge and their age, gender, stream, school grade, and school type.

The statistical results indicate that there are no strong positive or negative relationships between the student's low levels of environmental knowledge and their demographic and educational variables (Table 3).

- There is no significant correlation between students' environmental knowledge and their age, gender, and stream
- There is a significant weak correlation between students' environmental knowledge and their school grade and school type

The promotion of students' environmental knowledge is, presumably, essential for raising their positive environmental attitudes and behavior. Students' levels of knowledge are expected to change in accordance with their school grades, streams, and other variables like age and type of school. However, the results of this study indicate that relationships between students' environmental knowledge and their age, gender, stream, school type, and grade are either absent or weak. These levels of correlation suggest that the noticed poor levels of students' knowledge are not related to any of these variables but can be attributed to other external factors, namely the school curricula and other individual and societal factors (Bergman, 2015). Other researchers (Arcury, 1990; Clarke, 1996 & Makki et al., 2003) agreed on the insignificance of the correlation between students' environmental knowledge and their sociodemographic variables. Therefore, it is relevant to underscore the observed research

The Status of Moroccan High School Students' Environmental Knowledge

result which indicated that both students' environmental attitudes and knowledge are detached from the influence of their age, gender, stream, school grade, and school type.

CONCLUSION

The scored results of students' environmental knowledge test would contribute to the awakening of the youth's potential abilities and talents to thrive for more sustainable and environmentfriendly lifestyles and mindsets. The observed low levels of environmental knowledge would also trigger more attention to revisit the school curricula for reform and enrichment. Ultimately, researchers and educators are invited to play more prominent roles to grant EE research a proper position in Moroccan academia and the process of education reform. Similarly, designing structured environmental knowledge tests is recommended for future researchers. Such standardized and valid instruments could facilitate the tasks of the researchers and yield reliable results when used in various contexts in Morocco. Teachers are also key factors in instilling EE attitudes and knowledge. Pre-service training and professional development need to address the teachers' EE knowledge and skills to help them plan, perform and assess activities related to the promotion of students' environmental knowledge, awareness, attitudes, skills, and participation. The noticed low levels of students' environmental knowledge and attitudes in this study could be amended by establishing extra-curricular EE programs where different stakeholders may be involved. Such programs are recommended to consider in their planning and execution the global and national plans and strategies of environment protection and improvement. Moroccan high schools can encourage students to participate in innovative projects bearing in mind the state's current policies in clean energies and environment preservation.

REFERENCES

- 1) Agorram, B., Caravita, S., & Valente, A., Luzi, D. & Margnelli, N. (2009). Knowledge and values in science textbooks concerning complexity in ecological systems and environmental problems: A cross-cultural study on secondary school manuals. *US-China Education Review*, 6(2), 25-37.
- 2) Arcury, T. (1990). Environmental attitude and environmental knowledge. *Human Organization*, 49(4), 300-304.
- 3) Bergman, B. G. (2015). Assessing impacts of locally designed environmental education projects on students' environmental attitudes, awareness, and intention to act. *Environmental Education Research*, 22(4), 480–503. <https://doi.org/10.1080/13504622.2014.999225>
- 4) Clarke, B. (1996). Environmental attitudes and knowledge of year 11 students in a Queensland high school. *Australian Journal of Environmental Education*, 12, 19-26. <https://doi.org/10.1017/S0814062600001580>
- 5) El Moussaouy, A., Abderbi, J. & Daoudi, M. (2014). Environmental education in the teaching and the learning of scientific disciplines in Moroccan high schools. *International Education Studies*, 7(4), 33-46. <https://doi.org/10.5539/ies.v7n4p33>
- 6) El-Batri, B., Alami, A., Zaki, M., & Nafidi, Y. (2019). Extracurricular environmental activities in Moroccan middle schools: Opportunities and challenges to promoting effective environmental education. *European Journal of Educational Research*, 8(4), 1013-1028.
- 7) El-Batri, B., Alami, A., Zaki, M., & Nafidi, Y. (2020). Environmental education in Moroccan primary schools: Promotion of representations, knowledge, and environmental activities. *Ilkogretim Online*, 19(1).
- 8) Gambro, J. S. & Switzky, H. N. (1996). A national survey of high school students' environmental knowledge. *The Journal of Environmental Education*, 27(3), 28–33. <https://doi.org/10.1080/00958964.1996.9941464>
- 9) Henderson, K. & Tilbury, D. (2004). Whole-school approaches to sustainability: An international review of sustainable school programs. Australian Government: Australian Research Institute in Education for Sustainability. http://aries.mq.edu.au/projects/whole_school/files/international_review.pdf
- 10) Kollmuss, A. & Agyeman, J. (2002). Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research*, 8:3, 239-260, <https://doi.org/10.1080/13504620220145401>
- 11) Kuhlemeier, H., Van Den Bergh, H., & Lagerweij, N. (1999). Environmental knowledge, attitudes, and behavior in Dutch secondary education. *The Journal of Environmental Education*, 30(2), 4–14. <https://doi.org/10.1080/00958969909601864>
- 12) Makki, M. H., Abd-El-Khalick, F., & BouJaoude, S. (2003). Lebanese secondary school students' environmental knowledge and attitudes. *Environmental Education Research*, 9(1), 2133.
- 13) Maloney, M. P., Ward, M. P., & Braucht, G. N. (1975). A revised scale for the measurement of ecological attitudes and knowledge. *American psychologist*, 30(7), 787.

The Status of Moroccan High School Students' Environmental Knowledge

- 14) Michelsen, G.; Fischer, D. Sustainability and education. In *Sustainable Development Policy: A European Perspective*; Hauff, M.V., Kuhnke, C., Eds.; Routledge: London, UK, 2017.
- 15) Morris, C. (2016). Environmental knowledges and expertise. *International Encyclopedia of Geography: People, the Earth, Environment and Technology: People, the Earth, Environment and Technology*, 1-8.
<https://doi.org/10.1002/9781118786352.wbieg0446>
- 16) Otto, S., & Pensini, P. (2017). Nature-based environmental education of children: Environmental knowledge and connectedness to nature, together, are related to ecological behavior. *Global Environmental Change*, 47, 88-94.
<https://doi.org/10.1016/j.gloenvcha.2017.09.009>.
- 17) Otto, S.; Pensini, P. Nature-based environmental education of children: Environmental knowledge and connectedness to nature, together, are related to ecological behavior. *Glob. Environ. Chang.* 2017, 47, 88–94.
- 18) Richmond, J. M., & Morgan, R. F. (1977). *A national survey of the environmental knowledge and attitudes of fifth year pupils in England*.
- 19) Riouch, A., & Benamar, S. (2018). Evaluation and proposals for improving the situation of environmental education in Morocco. *American Journal of Educational Research*, 6(6), 621-631.
- 20) Tilbury, D. (1994). *Environmental education: Developing a model for initial teacher education* [Doctoral dissertation, University of Cambridge]. <https://www.repository.cam.ac.uk/handle/1810/251565>
- 21) Tilbury, D. (1995). Environmental education for sustainability: Defining the new focus of environmental education in the 1990s. *Environmental Education Research*, 1(2), 195-212. <https://doi.org/10.1080/1350462950010206>
- 22) UNESCO & IUCN. (1970). *Final report: International working meeting on environmental education in the school curriculum*. <https://portals.iucn.org/library/node/10447>
- 23) UNESCO & United Nations Environment Program. (1978). *Intergovernmental Conference on Environmental Education, Tbilisi (USSR) 14-26 October 1977: Final report*. UNESCO.
- 24) UNESCO-UNEP. (1978). *Final Report: Intergovernmental Conference on Environmental Education Organized by UNESCO in Cooperation with UNEP*. (UNESCO-UNEP Environmental Education).
<https://unesdoc.unesco.org/ark:/48223/pf0000032763>
- 25) Van Liere, K. D., & Dunlap, R. E. (1981). Environmental concern: Does it make a difference how it's measured? *Environment and Behavior*, 13(6), 651-676. <https://doi.org/10.1177/0013916581136001>
- 26) Vicente-Molina, M. A., Fernández-Sáinz, A., & Izagirre-Olaizola, J. (2013). Environmental knowledge and other variables affecting pro-environmental behaviour: comparison of university students from emerging and advanced countries. *Journal of Cleaner Production*, 61, 130-138.



There is an Open Access article, distributed under the term of the Creative Commons Attribution – Non Commercial 4.0 International (CC BY-NC 4.0) (<https://creativecommons.org/licenses/by-nc/4.0/>), which permits remixing, adapting and building upon the work for non-commercial use, provided the original work is properly cited.