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Measuring grade 10 students' knowledge, skills and attitudes of sustainable development

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Abstract

In Lebanon, since 1990, successive Governments have stressed the priority of education and the development of its potentials to enable it to contribute to sustainable human development. However, these approaches were never evaluated by standardised measures that might monitor evidence of changes in the knowledge, attitudes and behaviours among students concerning sustainable development (SD). This study has two main objectives: (a) to establish a baseline on the knowledge, attitudes and behaviours of Lebanese tenth grade students towards SD, b) to assess the impact of type of school, gender, presence of environmental club in school and being a member in the environmental club in school on the levels of knowledge, attitudes and skills of SD. The study was conducted in 20 schools in administrative Beirut region (12 private and eight public). The sample consisted of 437 students who completed a developed questionnaire that included items involving all SD pillars: social, environmental and economic. Results showed that students' SD knowledge, attitudes and skills were relatively high where the average mean of students' answers on items concerning social pillar was greater than that of the environmental pillar which in turn was greater than that of the economic pillar. Environmental club membership manifestly promoted SD knowledge, skills and attitudes. Gender influence was conspicuous in the results of SD attitudes and skills where female students excelled over male students. The Lebanese government should affirm its commitment by: adopting policies and strategies on SD to put more focus on the role of Education for sustainable development, ensuring efficient integration of SD into the curriculum, establishing SD clubs and encouraging students' enrolment into it.

Keywords: Sustainability, education for sustainable development, knowledge, attitude, skills, environmental club.

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Abbreviation List

CERD	Center of Educational Research and Development
CSD	Commission on Sustainable Development
EFA	Education for All
ESCWA	Economic and Social Commission for Western Asia
ESD	Education for Sustainable Development
MDG	Millennium Development Goal
NES	National Educational Strategy
NGOs	Non-Governmental Organizations
SD	Sustainable Development
SDG	Sustainable Development Goal
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
WEF	World Economic Forum

1. Introduction

Sustainable development (SD) is the most frequent term heard in the world today due to the inconveniences faced by earth inhabitants from different dimensions: environmental, social and economic. Lebanon is confronting a broad range of serious environmental and natural resource problems. The country faces a looming water shortage, its roads are polluted with deadly levels of micro-particles, and its waterways and coastlines are littered with garbage and full of toxic pollutants. The government is still trying to figure out what to do with Beirut and Mount Lebanon's waste that has been piling up on the streets. Lebanon's progress towards the achievement of the Millennium Development Goals (MDGs) followed by SD goals has been challenged by a complicated political situation and spillovers of the Syrian crisis, especially the massive influx of refugees (United Nations Development Programme Lebanon, 2014). Today, all Lebanese stakeholders including policy makers and educators are concerned about finding ways to solve national problems for a sustainable future.

After the adoption of the United Nation General Assembly for resolution 57/254 and the designation of UNESCO to lead the UN Decade for Education for Sustainable Development (UNDESD) from 2005 to 2014, followed by the adoption of the post 2015 SD goals from 2015 to 2030, education has become the most significant opportunity for learning the values, behaviours and life styles required for sustainable future and for positive societal transformation. One of the overarching goals of ESD is to reorient curricula reforming education as a vehicle of knowledge, values and actions to build a sustainable world. Education at all levels can shape the world of tomorrow, equipping individuals and societies with the skills, perspectives, knowledge and values to live and work in a sustainable manner. ESD is a vision of education that seeks to balance human and economic well-being with cultural traditions and respect for the earth's natural resources. ESD applies transdisciplinary educational methods and approaches to develop an ethic for lifelong learning; fosters respect for human needs that are compatible with sustainable use of natural resources and the needs of the planet; and nurtures a sense of global solidarity (UNESCO, 2013). However; a key challenge is to assess whether changes in behaviour are, in fact, taking place as a result of SD integration into the learning process.

In Lebanon, since 1990, successive Governments have stressed the priority of education and the development of its potentials to enable it to contribute to sustainable human development (Lebanese Association for Educational Studies, 2006). That was evident through the awakening plan in 1996, the education for SD workshops and training done by the Ministry of Education in 2008, the National Educational Strategy done in 2010, and lately the 'Lebanese Youth as Messengers for Sustainability' project, led by Makhzoumi Foundation and consortium partners including also Minister of State for Administrative Reform , Center of Education for Research and Development (CERD) and other national and international NGOs. However, these approaches were never evaluated by standardised measures that might monitor evidence of changes in the knowledge, attitudes and behaviours among students concerning SD.

As well, the Lebanese National Commission for UNESCO is acting, since 1948, as an advisory role, to advise the various national ministerial departments, as well as the national agencies, institutions and organisations on all matters relating to UNESCO and their respective programmes including ESD. Since 1995, a network of schools coordinated by the National Commission of UNESCO implements education for SD and provides UNESCO with periodic reports about the achieved projects, however; till now, no measurement of students' knowledge, skills and attitudes about SD has been done to reveal the impact of schools' implementations on students.

Research done in other countries (Michalos et al., 2012) revealed that 21% of grade 10 Students' SD behaviour is accounted to their SD knowledge and attitude. No research is currently available in Lebanon that measures the SD Knowledge, skills and attitudes of Lebanese students. Instead, a research was conducted (Makki, Abd-El-Khalick & BouJaude, 2003) to assess Lebanese secondary school students' environmental knowledge and attitudes, and explore the relationship between participants' knowledge and attitudes, biographical and academic variables and commitment to environmental friendly behaviour. It showed that participants had favourable attitudes towards the environment but lacked in their environmental knowledge. Environmental knowledge was significantly related to parental education level, and to participants' environmental attitude, beliefs, affect and behavioural commitments.

Here comes the aim of this paper which is to present standardised measures of students' knowledge, attitudes and behaviours concerning SD as those concepts are understood in the United Nations Educational, Scientific and Cultural Organization (UNESCO Education Sector, 2006), the lead agency for the UNDESD.

The research is structured with two main objectives:

a) to establish a baseline on the knowledge, attitudes and behaviours of Lebanese tenth grade students towards SD
b) to assess the impact of type of school, gender, presence of environmental club in school and being a member in the environmental club in school on the levels of knowledge, attitudes and skills of sustainable development.

The research questions that will be answered by this study are:

1. What are the Lebanese grade 10 students' SD knowledge, attitudes and skills?
2. Are the Lebanese grade 10 students' SD knowledge, attitudes and skills affected by school type, gender, presence of club in school and being a club member?
3. What are the Lebanese grade 10 students' opinions and perceptions of the Lebanese SD situation?
4. What is the Lebanese grade 10 students' main source of SD knowledge?

1.1. Definition of sustainable development

SD, as defined by the Brundtland Commission in 1987, is 'meeting the needs of current generations without compromising the ability of future generations to meet their needs'. SD, being wider than a

focus on environmental concerns, has three main pillars: (1) environmental, (2) economic and (3) social. It involves harnessing the efforts of those working in a number of diverse policy areas that range from natural resource management and climate change to issues such as social inclusion, protection of human rights, promotion of inter-culturalism, development of sustainable transport, as well as efforts to ensure social justice and equality.

The history of the sustainable development started in 1968 by the international non-governmental organization 'Club of Rome' that was devoted to the study of the 'world problematique', the term it coined to describe political, social, cultural, environmental and technological problems from a global, multidisciplinary and long-term perspective. By publishing the report 'the Limits of Growth' in 1972, the Club of Rome had brought the ecological limits to economic and demographic growth to the door of the world opinion. In the same year, the United Nations Conference on Human Environment took place in Stockholm and led to the development of the United Nation Environmental Programme. In 1984, the UN Assembly assigned the Brundtland Commission to form the World Commission on Environment and Development, today recognised for having promoted the values and principles of SD, and they led to the release, in 1987, of the report 'Our Common Future'. In 1992, the United Nation Conference on Environment and Development, also called Earth Summit, occurred in Rio De Janeiro in Brazil. It resulted in defining the key principles and establishing a programme of actions called agenda 21 on which several SD initiatives today are based. By Rio declaration, signatory countries, including Lebanon, agreed that protection of the environment, social and economic development is fundamental to implementing SD. This declaration set Sustainable Development priorities at the international level. Since that time a number of important international conferences on SD have been held, including the 1997 Earth Summit+5 in New York and the 2002 World Summit on Sustainable Development in Johannesburg. These meetings were primarily reviews of progress; and reported that a number of positive results had been achieved, but implementation efforts largely had been unsuccessful at the national and international level. At the Millennium Summit in September 2000, the largest gathering of world leaders in history adopted the UN Millennium Declaration, committing their nations to a new global partnership to reduce extreme poverty and setting out a series of time-bound targets, with a deadline of 2015 that have become known as the Millennium Development Goals. As the MDG deadline approached about one billion people still live on less than $1.25 a day—the World Bank measure on poverty—and more than 800 million people do not have enough food to eat. Women were fighting hard for their rights, and millions of women died in childbirth. In the United Nations Conference on Sustainable Development—or Rio+20—that took place in Rio de Janeiro, Brazil on 20–22 June 2012, Member States decided to launch a process to develop a set of Sustainable Development objectives. In September 2015, the General Assembly has adopted the 17 Sustainable Development Goals with 169 targets, which will build upon the MDGs and converge with the post 2015 development agenda.

1.2. Definition of education for sustainable development

The relationship between education and SD was first recognised on an international level at the 1972 Stockholm Conference on the Human Environment. Agenda 21, the outcome of Rio De Janeiro Conference in 1992, acknowledges that education is essential for making progress towards SD: 'Education, including formal education, public awareness and training, should be recognised as a process by which human beings and societies can reach their fullest potential' (Shaw & Oikawa, 2014).

The overall aim of ESD is to empower citizens to act for positive environmental and social change, implying a participatory and action-oriented approach. ESD integrates concepts and analytical tools from a variety of disciplines to help people better understand the world in which they live (Shaw & Oikawa, 2014). Pursuing SD through education requires educators and learners to reflect critically on their own communities; identify non-viable elements in their lives and explore tensions among conflicting values and goals. ESD brings a new motivation to learning as pupils become empowered to

develop and evaluate alternative visions of a sustainable future and to work to collectively fulfil these visions (Shaw & Oikawa, 2014).

Based on countries' commitment at the 2012 United Nations Conference on Sustainable Development (Rio+20) to strengthen ESD beyond the end of its Decade (2005–2014), UNESCO, in consultation with Member States and relevant stakeholders, developed the Global Action Programme (GAP) on ESD. The GAP was endorsed by UNESCO's 37th General Conference (November 2013) as the follow-up to the UNDESD. It is also brought to the attention of the UN General Assembly in 2014 for consideration and appropriate action. The overall goal of the draft GAP is 'to generate and scale-up action in all levels and areas of education and learning in order to accelerate progress towards SD'. This goal is further declined into two objectives: (a) to reorient education and learning, so that everyone has the opportunity to acquire the knowledge, skills, values and attitudes that empower them to contribute to SD; and (b) to strengthen education and learning in all agendas, programmes and activities that promote SD (UNESCO, 2013),

During the UNESCO World Conference on ESD held in Aichi Nagoya, Japan, from 10 to 12 November 2014, a Declaration was adopted that calls for urgent action to further strengthen and scale up ESD, in order to enable current generations to meet their needs while allowing future generations to meet their own, with a balanced and integrated approach regarding the economic, social and environmental dimensions of SD. In this conference, the UN Secretary-General Ban Ki-moon called for sustainability to be 'built into everything we do' and suggested that education was 'the starting point' for a successful and sustainable future.

Representatives of Higher Education Institutions adopted the Aichi-Nagoya Declaration on ESD unanimously expressing their renewed commitment to implement and pursue promises made in previous declarations including International Association of universities.

A whole-school approach to ESD calls for SD to be integrated throughout the formal sector curriculum in a holistic manner, rather than being taught on a stand-alone basis. This philosophy supports the notion that ESD is Education for SD rather than education about SD (Hargreaves, 2008). In practice, this approach means that a school will incorporate teaching and learning for SD not only through aspects of the curriculum but also through sustainable school operations such as integrated governance, stakeholder and community involvement, long-term planning and sustainability monitoring and evaluation. Whole-school approaches also advocate for active and participatory learning, a hallmark of ESD, and call for the entire school, including students, educators and administrators, to be actively engaged in working towards a sustainable school with ESD fully integrated into the curriculum as the driving factor (Hargreaves, 2008**)**. Moreover, this approach requires an effective evaluation and measurement tools to study the effectiveness of ESD integration at all levels.

The 2015 World Education Forum (WEF) adopted the Incheon Declaration, committing to undertake steps towards promoting education opportunities for all by 2030, addressing five themes: the right to education; equity in education; inclusive education; quality education and lifelong learning. The Incheon Declaration expresses agreement on 'essential elements' of the Education 2030 Framework for Action, building on the UN-led Education for All framework and goals (Ashalaw, Lemma & Karippai, 2013).

1.3. Education for sustainable development in Lebanon

In fact, 17 years of civil unrest in the country resulted in an education sector in need of rehabilitation of its infrastructure, a complete reform of its curricula, a reorganisation of its management system, skills development and training for all its personnel. The launch of the Education Awakening Plan in 1996 confirmed the commitment of the Lebanese Government to reform the education system (MEHE, 2010). In 1997, Environmental education was introduced into the Lebanese curriculum through integrating its components into selected topics within subjects, however, this new curriculum was

developed without solid research regarding Lebanese Students' environmental knowledge, skills and attitudes (Makki, Abd-El-Khalick & BouJaude, 2003)

The latest initiatives of the Lebanese Ministry of Education was the formulation of a National Education Strategy (NES) 2010–2015 which provides a comprehensive analysis of issues, detailed recommendations and a proposed action plan to achieve the respective development objectives (MEHE, 2010). The vision of NES reinforces building up a knowledgeable free society based on human rights, and peace where every individual is empowered by the prerequisite knowledge and skills to reform all inconveniences in Lebanese environment, economy and society (MEHE, 2010).

In 2008, Education Minister Bahia Hariri stressed the importance of developing the educational sector in Lebanon during the inauguration of the regional workshop ESD organised by UNESCO. Representatives from 12 Arab countries participated in the 4-day workshop, including education experts from Jordan, Bahrain, Tunisia, Saudi Arabia, Sudan, Syria, Oman, Palestine, Egypt, Libya, Morocco and Lebanon, in addition to officials from regional and international organisations. The countries participating in this UNESCO-led initiative developed four concrete objectives: improving access to quality based education; reorienting existing education programmes; developing public understanding and awareness; and providing training for teachers. Following the workshop, the participants trained instructors in their home-countries, who subsequently trained the teachers to teach the concept of SD to their students in the classroom. However; Representatives from CERD agreed that the difficulty was the evaluation and finding indicators such as how the children learn and progress in their views on SD—both in their perspective and their societies and later, how they apply their knowledge, knowing that, Lebanon is one of the most progressive countries on the subject. Many concepts of SD already exist in the national curriculum, whereas in other Arab countries it is not as common.

The first 'National Environmental Educational Policy' for Lebanon was launched during an official event in the Ministry of Education on October 17, 2012. The evaluation of the Lebanese Education Curriculum showed that the environment is integrated within all the subject matters but not in a consistent way where it was found that in some grades, important environmental concepts are missing (MEHE, 2010). Accordingly, the Environmental Education Curriculum for the first Cycle and the Available Resource Handbook were developed (CERD & AFDC, 2010). Although SD was mentioned in the objectives the focus was only on the environmental pillar.

The researchers of this study were involved in a project entitled 'Lebanese Youth as Messengers for Sustainability' that fosters a culture of sustainability among the Lebanese children and young, their families and the local communities, in order to enhance a SD in the country and sustainable relationships in the Mediterranean region. The project was implemented over 2 years (2014–2015), and included workshops for teachers, the preparation of an educational toolkit on ESD, seminars for stakeholders, environmental days for families in addition to a contest on the preparation of sketches on sustainable consumption and production targeting students of the intermediate level in public and private schools. However, the number of training workshops done was limited and not all schools received the toolkits.

As well, The UNESCO Associated Schools Project Network (ASPnet)—Lebanon, which was set up as early as 1994, is a network of schools designed to strengthen the commitment of children and young people to actively strive to promote peace as well as national and international understanding and respect for human rights and democracy. The activities of ASPnet—Lebanon have been so far channelled into UNESCO's four major areas of concern and cluster around the following: (1) world concerns and the role of the United Nations System, (2) education for SD, (3) peace and Human rights and (4) intercultural learning (Lebanese National Commission for UNESCO, 2014).

ASPnet Lebanon comprises 50 schools, both public and private, of different educational levels (primary, intermediate, secondary and technical) and comes from different geographical districts.

As for the Lebanese curriculum, it includes some of the topics that involve SD in sciences, geography, civics, sociology, economy and languages. The curriculum evaluation is currently held by a systemic work in the framework of two theses at the Lebanese University—Faculty of Education (Karameh & Ghazaleh).

2. Methodology

This study is a quantitative research whose population included grade 10 students from 20 Lebanese schools from administrative Beirut. Students of grade 10 were selected assuming that they have passed through various extracurricular activities in their elementary and middle classes and that they learned about SD in their curriculum.

2.1. Sample

From the administrative Beirut region, 20 schools were chosen among schools enlisted within Center of Educational Research and Development (CERD) website. Initially, the selection was made considering all schools in the administrative Beirut region that had more than 100 students in their secondary classes to ensure the existence of at least 20 students in grade 10. According to CERD list, only four public schools were enlisted under the schools' category with community service programme or presence of environmental club. For this reason, four public schools with community service programme or presence of environmental club and four public schools without community service programme were selected. As for private schools, among those who agreed to conduct the research, six schools with environmental club and six schools without environmental club were selected.

The total number of students in the sample was 437 students 275 students were from private schools and 162 students were from public schools. Among the private schools' students, 128 students belong to schools having environmental clubs and 147 students belong to schools without environmental clubs. While among the public schools' students, 81 of them belong to schools having environmental clubs and 81 students belong to schools without environmental clubs. Among the 209 students belonging to schools with environmental clubs, 68 students were members of the environmental club. The students of the sample included 208 males and 229 females. Table 1 shows the description of the sample demographics.

Table 1. The Distribution of the chosen sample

Demogra-phics	Private schools	Public schools	Schools with club	Schools without club	Club members	Non-club members	Male	Female
Number of students	275	162	209	228	68	141	208	229

2.2. Tools

A questionnaire (Annex 1) was developed by adapting questions from that designed by International Institute for Sustainable Development (IISD) in 2011; these questions were used by IISD researchers in several studies and validated progressively by them. The adopted questions were selected to suit the Lebanese context, some questions were omitted and others were added to study the perception of Lebanese students on SD in Lebanon.

The questionnaire included 40 questions, 10 of which measured knowledge (1, 2, 4, 6, 12, 22, 23, 24, 26 and 27), 10 of which measured skills (30, 31, 32, 33, 34, 35, 36, 37, 38 and 40), 12 of which measured

attitudes (3, 7, 8, 10, 11, 13, 15, 16, 18, 21, 28 and 29) and the last eight questions measured students' awareness about the Lebanese sustainability situation (5, 9, 14, 17, 19, 20, 25 and 39). Respondents were asked to indicate their level of agreement or disagreement with each sentence on a Likert-type scale running from—strongly agree (=5), to—agree (=4), through—neutral (=3) to—disagree (=2), till—strongly disagree (=1). Strongly agree and agree responses indicated that the respondent's knowledge, skills, attitudes and contextual awareness were consistent with themes regarded as necessary and/or favourable for SD which was not the case of some reversed questions (7, 8, 13, 31, 33 and 35). Off-scale responses—I don't understand (=6) were important because they indicated that students did not know how to respond or did not understand the sentence.

The questions covered all the pillars of SD: environment, economy and society. However, the number of questions involved in social and environmental pillars is four to five times more than that of questions involved in the economic pillar and this is for the convenience of the questionnaire to grade 10 students who, for the first time in their academic years, study about economic production and consumption. The numbers of questions involving the social pillar are 2, 3, 5, 6, 10, 17, 18, 19, 20, 22, 23, 26, 28, 30, 33, 34, 37, 38, 39 and 40, while those concerning the environmental pillar are 4, 7, 8, 9, 12, 13, 14, 15, 16, 21, 27, 31, 32, 35 and 36. As for the questions involving economic pillar, they are 1, 11, 24, 25 and 29.

Piloting of the questionnaire was done in May 2015, in one private school in the mount of Lebanon where 40 students from two grade 10 classes responded to the suggested questions without any inconvenience and confusion. The questionnaire's language is Arabic to avoid any language barriers; the duration to complete the questionnaire was about 10–15 minutes. As well, the questionnaire included a set of demographic questions concerning gender, name of the school, if the respondent is a member of the environmental club or not, and the resources from which the respondent acquired his/her knowledge about SD.

2.3. Data gathering and analysis

Data gathering was authorised by the Ministry of Education and Higher Education. However, schools' approval to distribute these questionnaires was not easy for many reasons. Some of the reasons were as follows: (1) during the last trimester, schools argued that they had no time to waste to complete their year curriculum, (2) schools explained that they accepted, so many visits from organisations and research teams and that they didn't have any extra time and (3) it was difficult to reach all the directors of the public schools because they were all at the convention that the Ministry of Education held during that week.

Questionnaires were distributed to students without interference from the teacher or the researcher who explicitly assured students that the questionnaire was not a quiz, and supervised the administration and completion of the questionnaire. Participants completed the questionnaire individually and were not permitted to consult their science textbooks or other references. However, they were allowed to ask questions of the researcher regarding the questionnaire items.

Three indexes, namely, the Index of Knowledge of SD (K), Index of Favourable Attitudes towards SD (A) and Index of Favourable Behaviours towards SD were constructed (S). SPSS analysis was made by crossing the indexes by gender, type of school, presence or absence of environmental club and member or not in the environmental club. ANOVA tests, Chi square tests, correlation test and crosstab were employed to analyse the obtained data.

3. Results

By considering the mean scores of students' SD knowledge, skills and attitudes, the mean of knowledge and attitudes is relatively high (greater than 4) while skills are relatively low (less than 4). However; all means could be considered averagely good.

Table 2. Students' SD knowledge, skills and attitudes means

	Mean	*N*
Knowledge	4.0700	437
Skills	3.5911	435
Attitudes	4.1912	437

3.1. Students' level of knowledge

Based on Table 3, the lowest mean knowledge questions scored were those related to the need of: (1) using renewable energy, (2) fair distribution of goods and services to all people around the world and (3) waste reduction. On the other hand, the highest mean knowledge question scored was that: (1) environment protection and (2) culture of peace where people settle conflicts by discussion is a necessity for SD and that (3) respect for cultural diversity is a must for a given country.

Table 3. Means of knowledge

Question	Pillar	Don't understand (%)	Mean	*N*
27	Environment	9.61	3.69	395
24	Economy	10.76	3.80	390
12	Environment	7.55	3.87	404
26	Society	5.49	4.10	413
22	Society	5.49	4.16	413
2	Society	5.95	4.18	411
1	Economy	6.64	4.19	408
23	Society	4.12	4.21	419
6	Society	4.58	4.22	417
4	Environment	4.12	4.46	419

Referring to Table 4, a significant difference was detected among the means of knowledge scored by students who are members in the environmental club in school, who are not members in the environmental club in school and who don't have an environmental club in their school. The mean of knowledge scored by students who are members in their school environmental club is the highest (M = 4.1824) while the lowest mean of knowledge scored by students who don't have an environmental club in their school (M = 4.0143).

Table 4. Knowledge mean scores of the three categories

	N	Mean
Club member	68	4.1824
Not a club member in a school having club	141	4.1060
No club in school	228	4.0143
Total	437	
ANOVA test		p = 0.025

By considering the students in schools having club, there was no significant difference between students who were members and who were not members in their knowledge scores (Table 5).

Table 5. Knowledge means of club members and non-club members

Students of schools having club	*N*	Mean
Club member	68	4.1824
Not a club member	141	4.1060
Total	209	4.1309
ANOVA test		$p = 0.225$

By comparing between the students of mean knowledge score between 4 and 5 (highest score) in schools having clubs, a non-significant difference was obtained between students who were enrolled in the club and those who weren't (Table 6).

Table 6. The percentage of students with scores (4–5) in schools having clubs

	Percentage of students with scores (4–5)	
Club members	77.9%	
Not a club member in a school with club	66.7%	
Chi-square test		$\alpha = 0.064$

By comparing students who had club in their school and those who hadn't, there was a significant difference in their knowledge scores where students in schools having clubs scored better (Table 7).

Table 7. The knowledge means among schools with and without club

	N	Mean
Presence of club in school	209	4.1309
Absence of club in school	228	4.0143
Total	437	4.0700
ANOVA test		$P = 0.012$

By comparing the students of mean knowledge score between 4 and 5 (highest score), a significant difference was obtained where students having club in their school responded better (Table 8).

Table 8. The percentage of students with scores (4–5) in schools with and without clubs

	Percentage of students with scores (4–5)
Schools with club	70.3
Schools with no club	59.5
Chi-square test	$\alpha = 0.011$

By crossing the index of knowledge by the type of school (public or private), there was no significant difference in the mean of knowledge scored by students as shown in Table 9.

Table 9. The knowledge means among public and private schools

	N	Mean
Public school	162	4.0533
Private school	275	4.0799
Total	437	4.0700
ANOVA test		$p = 0.582$

However, by comparing between the students of mean knowledge score between 4 and 5 (highest score), a significant difference was obtained where private school students responded with highest knowledge score more than public school students based on Table 10.

Table 10. The percentage of students with scores (4–5) in public and private schools

	Percentage of students with scores (4–5)
Public Schools	57.4
Private Schools	69.0
Chi-square test	0.01

While through crossing the index of knowledge by gender, no significant difference in the mean of knowledge scored by male and female students (Table 11).

Table 11. The knowledge means of male and female students

	N	Mean
Female	229	4.0867
Total	437	4.0700
ANOVA test		$p = 0.454$

Even considering students with high scores (4–5) there was no significant difference between males and females (Table 12).

Table 12. The percentage of males and females students with scores (4–5)

	Percentage of students with scores (4–5)
Males	62.5
Females	66.7
Chi square	$\alpha = 0.209$

By considering the pillar involved for every question, the mean scores of social questions ($M = 4.174$) is greater than that of environmental questions ($M = 4.00$), which is greater than that of the economic questions ($M = 3.995$) (Table 13)

Table 13. Average knowledge mean score for each pillar

Pillar	Number of questions involved	Average mean
Environment	4, 12, 27	4.00
Society	2, 6, 22, 23, 26	4.174
Economy	1, 24	3.995

3.2. Students' attitudes

Based on the findings (Table 14), the least attitudes scored by student were: (1) we need stricter laws and regulations to protect the environment, (2) SD will not be possible until wealthier nations stop exploiting workers in poorer nations and (3) as long as resources are available, using more than we need now threatens the health and welfare of the future generation. While the most attitudes scored by students were: (1) we need to find ways to reduce poverty, (2) the use of clean energy consuming vehicles should be encouraged by governments and (3) people who pollute our land, air or water should pay for damage done to communities and the environment.

Table 14. Means of attitude

Question	Pillar	Didn't understand (%)	Mean	*N*
8	Environment	1.37	3.75	431
11	Economy	8.92	3.77	398
7	Environment	3.66	3.79	421
15	Environment	2.29	3.96	427
3	Society	3.89	4.05	420
13	Environment	2.97	4.09	424

18	Society	5.72	4.26	412
29	Economy	1.83	4.31	429
28	Society	1.37	4.52	431
21	Environment	1.14	4.52	432
16	Environment	1.83	4.55	429
10	Society	1.14	4.72	432

Based on Table 15, the mean attitude scored by students who are club members was *M* = 4.2438 which was slightly greater than that scored by students who didn't have clubs in their school. While the least attitude score was for the students who were not members of the club in their schools (*M* = 4.1006). As shown, there is a significant difference in attitude scores among the students in the three categories.

Table 15. The mean attitude scores of students of three categories

Between groups	*N*	Mean	ANOVA test
Club member	68	4.2438	*p* = 0.020
Not a club member	141	4.1006	
No club in school	228	4.2316	
Total	437	4.1912	

By considering the students in schools having club, there was a significant difference in the attitude scores of students who were members and who were not members, where the students enrolled in club scored better (Table 16).

Table 16. The mean scores of club and non-club members

	N	Mean
Club member	68	4.2438
Not a club member	141	4.1006
Total	209	4.1472
ANOVA test		0.031

By considering the high score students (4–5) in schools having club, there was a slight significant difference in the attitude scores of students who were members and who were not members, where club members scored better attitudes (Table 17).

Table 17. Percentage of club and non-club members who scored (4–5)

	Percentage of students with scores (4–5)
Not a club members	62.5
Club member	66.7
Chi square	0.052

There was no significant difference in the attitude scores between students in schools having clubs and those in schools that didn't have clubs (Attitude 18).

Table 18. Mean score of students in schools with and without club

	N	Mean
Club in school	209	4.1472
No club in school	228	4.2316
Total	437	4.1912
ANOVA test		0.06

By considering high score students (4–5), there was no significant difference between students in schools having clubs and those in schools having no clubs (Table 19).

Table 19. Percentage of students who scored (4–5) in schools with and without club

	Percentage of students with scores (4–5)
School without club	69.9
School with club	75.9
Chi square	0.095

There is a significant difference in attitude scores among students from private school and those from public schools, where students of private schools scored better attitudes (Table 20).

Table 20. The mean scores of students in public and private school

	N	Mean
Public school	162	4.1321
Private school	275	4.2260
Total	437	4.1912
ANOVA test		$p = 0.043$

As for students who scored in attitude between 4 and 5, there was no significant difference in students in private and public schools (Table 21).

Table 21. Percentage of students with scores (4–5) in public and private schools

	Percentage of students with scores (4–5)
Public school	72.2
Private school	73.5
Chi-square test	0.431

There was a significant difference between the attitude scores of male students and those of female students, where female students scored better than male students (Table 22).

Table 22. Mean scores of males and females students

	N	Mean
Male	208	4.1164
Female	229	4.2591
Total	437	4.1912
ANOVA test		$p = 0.001$

The study showed that there was a significant difference between male and female students attitude while considering high score students (4–5) where female students had higher scores than male students (Table 23).

Table 23. Percentage of male and female students who scored (4–5)

	Percentage of students with scores (4–5)
Males	65.9
Females	79.5
Chi-square test	$\alpha = 0.001$

By considering the pillars of attitude questions, the students scored better in social questions than in environmental questions, and they scored least in economic questions as shown in Table 11.

Table 24. Average mean scores for every pillar

Pillar	Question numbers	Average mean
Environment	8, 7, 15, 13, 21, 16	4.11
Economy	11, 29	4.04
Society	3, 18, 28, 10	4.3875

3.3. Students' skills

The highest skill scored by students were: (1) treating everyone respectfully while using the computer or phone for social networking or gaming, (2) usually examining problems from many points of views and (3) treating all people respectfully regardless of their racial background. Whereas the lowest skill scored by the students were: (1) volunteering to work with local charities or environmental groups, (2) picking up litter from the ground and (3) never wasting water in personal use (Table 25).

Table 25. Means of skills

Question	Pillars	Didn't understand (%)	Mean	*N*
38	Society	2.75	3.11	425
36	Environment	2.75	3.28	425
30	Environment	2.75	3.32	425
32	Environment	3.66	3.40	421
31	Environment	2.97	3.49	424
35	Environment	4.12	3.50	419
37	Society	2.97	3.55	424
33	Society	4.81	3.93	416
40	Society	4.58	4.09	417
34	Society	2.75	4.37	425

A significant difference in the skill scores was evident among students where the students who were club members scored best (*M* = 3.8110), while those who were not club members in their school (*M* = 3.4952) scored better than those in school with no club as shown in Table 26.

Table 26. Mean scores of students of three categories

	N	Mean
Club member	68	3.8110
Not a club member is a school having club	141	3.4952
No club in school	228	3.5858
ANOVA test	437	$p = 0.001$

As well, the study showed that there was no significant difference between students' skill scores who had club in their schools and who didn't have club in their schools (Table 27)

Table 27. The mean scores of students in schools with and without club

	N	Mean
Presence of club in school	209	3.5970
Absence of club in school	228	3.5858
Total	437	3.5911
ANOVA test		0.838

There was no significant difference between high score skill students (4–5) who had clubs in their schools and those who didn't, where students from schools having clubs scored more high skill scores (Table 28).

Table 28. The percentage of students with answers (4–5) from schools with and without club

	Percentage of students with scores (4–5)
Schools with club	26.9
Schools with no club	28.2
Chi square	$\alpha = 0.425$

By considering the students in schools having club, there was a significant difference in their skill scores between students who were members and who were not members, where students enrolled in club scored better (Table 29).

Table 29. Mean scores of students who are club and non-club members

Students of schools having club	*N*	Mean
Club member	68	3.8110
Not a club member	141	3.4952
Total	209	3.5970
ANOVA test		$p = 0.000$

There was a significant difference between high skill scored students (4–5) who were club members and who were not club members in schools containing clubs, where club members had more high skill scores than non-club members (Table 30).

Table 30. Percentage of club and non-club members who scored (4–5)

	Percentage of students with scores (4–5)
Club members	35.8
Non-club members	22.7
Chi-square test	$\alpha = 0.035$

There was no significant difference in students' skills scores between private school students and those of public school students (Table 31).

Table 31. The mean scores of students from public and private schools

	N	Mean
Public school	162	3.6229
Private school	275	3.5724
Total	437	3.5911
ANOVA test		$p = 0.372$

There was a non-significant difference between high skill scored students (4–5) who were in private and official schools (Table 32).

Table 32. Percentage of public and private school students with scores (4–5)

	Percentage of students with scores (4–5)
Public schools	27.3
Private schools	27.7
Chi-square test	$\alpha = 0.509$

As for Gender, the study showed that the female students' skills score were significantly higher than male students' skill scores (Table 33).

Table 33. The mean scores of male and female students

	N	Mean
Male	208	3.5028
Female	229	3.6706
Total	437	3.5911
ANOVA test		$p = 0.002$

The female high skill scored students were significantly greater than male high skill scored students (Skill Table 34).

Table 34. The percentage of male and female students with score (4–5)

	Percentage of students with scores (4–5)
Males	22.3
Females	32.3
Chi square	$\alpha = 0.013$

As for the pillars covered by the skill questions, they were social questions whose scores were greater than the environmental questions. The economic questions were not found in the skill question list (Table 35)

Table 35. The mean for every pillar question

Pillar	Question number	Average Mean
Society	38, 37, 33, 40, 34	3.728
Environment	36, 32, 31, 35, 30	3.417

3.4. Lebanese student opinion about the situation of SD in Lebanon

Table 36. Means of Lebanese context

Question number	Question	Don't understand (%)	Mean	*N*
9	Lebanese people respect laws and regulations to protect the environment	1.14	1.82	432
5	Lebanese people in their lifestyles take into considerations the needs of the future generations	2.75	2.31	425
17	Lebanon addresses SD as a national priority	9.84	2.37	394
39	My school has some common projects with associations or local authorities	3.89	3.40	420
14	Climate change exists in Lebanon	2.29	3.59	427
25	The disparity among Lebanese people concerning goods and services is affecting the development of the country	8.70	3.74	399
20	I am allowed to participate and express myself in community	2.52	3.88	426
19	I am allowed to participate and express myself in school	1.60	4.12	430

Based on Table 36, the questions with highest scores were 19, 20 and 25. Students' highest scores questions showed their belief that they are allowed to participate and express themselves in school and in their community and that the disparity among Lebanese people goods and services is affecting the development of the country. Although the score of question 25 is considered high; however, the percentage of 'I don't understand' answers for this question is very high. This could be attributed to the student's insufficient knowledge to answer this question.

The questions with least scores were 9, 5 and 17. Students' least scores questions showed their belief that Lebanese people don't respect laws and regulations to protect the environment, Lebanese people in their lifestyles don't take into considerations the needs of the future generations, and that Lebanon doesn't address SD as a national priority. As well, among the students' answers for number 17, 9.84% of the answers of this question was 'I don't understand know' and again this could be indicating that students didn't have enough knowledge to answer this question. Average score questions revealed students' beliefs that climate change exists in Lebanon and that their schools have common projects with associations and local authorities.

3.5. Main SD source of knowledge

By studying the source of students' knowledge about sustainable development, the results showed that the most students' main source was the curriculum as 57% of students replied, while 12.4% of students stated social media as their main source of SD knowledge, 10.5 % of students stated school's activities as the main source of SD knowledge, 9.8% of students stated parents as their main source of SD knowledge, 6.2% of students stated environmental club as their main source of SD knowledge, 2.1% of students stated non-governmental organizations NGOs as their main source of SD knowledge, 1.6% of students referred their main source of knowledge to their friends and the least students' main source of knowledge was media as only 0.5% of students replied.

Table 37. Main source of knowledge on SD as declared by all students (*n* = 435)

Main source of SD knowledge	Percentage of students referring it
Curriculum	57
Social media	12.4
School's activities	10.5
Parents	9.8
Environmental club and/or community service	6.2
NGOs	2.1
Friends	1.6
Media	0.5

By considering students in schools with environmental clubs, same results were obtained concerning the most students' main source of SD knowledge which is the curriculum but with small percentage reduction and the least students' main source of SD knowledge which is media. Parents were more mentioned in this group than the whole group of students

Table 38. Main source of knowledge for students of schools that have clubs (*N* = 209)

Main source of SD knowledge	Percentage of students
Curriculum	53.1
Social media	13.4
Parents	11
School activities	10.5
Environmental club	7.7
NGOs	2.4
Friends	1
Media	1

By comparing the main sources of SD knowledge between students in public and private schools, still the curriculum remained the main source of SD knowledge for most students, however, a significant difference was observed in percentage of students assigning curriculum, social media, parents and media as their main source of SD knowledge were greater in private schools than those in public schools, whereas the percentage of students assigning school activities, environmental club, friends and NGOs as their main source of SD knowledge were greater in public schools than those in private schools.

Table 39. Main source of knowledge for students of public and private schools (*n* = 435)

Main source of SD knowledge	Percentage of students in private schools	Percentage of students in public schools
Curriculum	63.6	45.7
Social media	10.9	5.5
Parents	10.9	8
School activities	9.1	13.0
Environmental club	2.5	4.6
NGOs	1.5	3.1
Friends	0.7	3.1
Media	0.7	0.0
Pearson Chi square		α = 0.000

By studying the effect of (1) presence of environmental club, (2) being a member in the environmental club and (3) gender, no significant difference in students' main source of SD knowledge. Same scheme of students' main source of SD knowledge was shown by comparing high and low score students in SD knowledge and attitude, however; by comparing the answers between high and low SD skill scores, there was a significant difference in students' main source of SD knowledge where more percentage of high SD skill score students assigned parents as the main source of their SD knowledge than those of low SD skill score students.

Table 40. The main source of SD knowledge of high and low SD skill score students

Main source of SD knowledge	High SD skill score students	Low SD skill score students
Curriculum	55.8	57.8
Social media	5.8	14.9
Parents	18.3	6.7
School activities	9.2	10.5
Environmental club	6.7	6
NGOs	1.7	2.2
Friends	0.8	1.9
Media	1.7	0.0
Pearson Chi square		Significance 0.001

4. Discussion and interpretation

Based on the results concerning the SD knowledge, skills and attitudes Mean scores of grade 10 students in administrative Beirut region, relatively high scores achieved in knowledge and attitudes and average scores achieved in skills (Table 2), and this could be referred to different Lebanese effort and interventions deployed last years on SD specially those led by UNESCO, also because SD concept exists in Grade 10 on civic education.

4.1. Student's SD knowledge

The highest students' knowledge scores were revealed in the necessity of environmental protection, peace and respect of cultural diversity (Table 3). This implies that students have a significant awareness about the environmental and social challenges concerning pollution and social sectarian conflicts but they are not sure that these concepts are relevant to SD since the results concerning the relevancy of SD to global citizenship, maintaining good health and having human rights were lower in score.

The knowledge results of students were lowest concerning the need for renewable energy with high percentage of 'I don't understand answers' indicating that students are still not aware of the term renewable energy and its significance in replacing the use of non-renewable combustible fuel, although

the concept of renewable energy is included in the physics Lebanese curriculum of grade 8. That's why, reinforcement of this concept is recommended by integrating it in the physics curriculum of grade 10 within the Electricity unit.

The second lowest score result was related to the fair distribution of goods and services which involves the economic pillar of SD. This indicates that although students study economy in grade 10 but they still don't understand the properties of a sustainable economy which must be integrated into their curriculum as well.

The third lowest score result was about waste reduction which is a prerequisite knowledge to students who will be the changing factors to the Contextual Lebanese waste management Crisis.

Obviously, the environmental and social SD pillar knowledge results were higher than that of the economic pillar due to the community service and environmental activities or even separate extracurricular activities that are limited to environmental and social awareness and rarely involving economic issues like system thinking and entrepreneurship. This is proven as well by the highest knowledge scores of environmental club members who are more engaged in the above mentioned activities among all other students (Table 6).

Moreover, the presence of environmental club in school has a positive impact on increasing students' SD knowledge as revealed in the results (Table 7), however, there was no indicative difference between the knowledge of club members and non-club members (Table 5). This symbolises that the activities performed through the environmental club are well reached to all school students at the level of SD knowledge.

Private school students responded with highest knowledge score more than public school students based on Table 10, although, there was not a significant difference in the knowledge score means between private and public school students (Table 9). This could be inferred to the fact that some private schools are using, in middle school, different textbooks in their curriculum which include more SD content.

4.2. Students' attitudes

Students' results in this study (Table 14) showed high attitude scores with the first best score for the importance of finding ways to reduce poverty, the topic that is studied and found in the geography Lebanese curriculum of grade 10. The second and third best scores were environmental focusing on the necessity for the government to encourage the use of clean energy in vehicles and to set punishment regulations for those polluting the community and environment. This indicates students' rejection and refusal towards the current context which is evidently realised by them when considering the students' results in the Lebanese situation on SD questions, where most students agreed that Lebanese people don't respect the laws and regulations to protect the environment.

The least score attitude was that Lebanese people don't need stricter laws and regulations to protect the environment. At first, it seems that there is a contradiction between one of the highest score attitudes which is the need to punish people polluting the environment and the least score attitude which is the adequacy of Lebanese environmental laws and regulations, however, this indicates a more critical students' view towards the Lebanese situation where despite the presence of strict environmental laws and regulations, Lebanese people don't respect these laws and regulations, that's why, there must be a more consistent punishment system to protect the community and environment. This view is really affecting students' beliefs in their ability to change the current situation and consequently negatively affecting their leadership skills, motivation and integrity.

The second least score attitude is economic concerning the possibility of achieving SD even if wealthier nations continue exploiting workers from poorer nations. This item, as well, showed the highest percentage of 'I don't understand' answers indicating that there is a gap in students' perception

about sustainable economic pillar. The third least score attitude was environmental revealing the students' irresponsibility in the use of resources as long as these resources are available without considering the health and welfare of the future generations. This shows the ineffectiveness of curriculum and environmental school activities in modifying students' attitudes about the wise use of resources.

The results of this study (Table 22) showed that there are differences between mean scores describing boys' and girls' attitudes towards SD. The mean scores describing girls' attitudes towards SD were higher than those of boys, The results support the survey report of Jarvinen (1995) that Finnish young people aged 15–17 have environmentally dichotomous attitudes, girls having more positive attitudes towards environmental responsibility than boys. When compared to the survey report of Haikonen and Kiljunen (2003), which examined the environmental attitudes of Finnish adult men and women, possibly parents of the surveyed teenagers, the result was the same (Leitto, Juti, Lavonenj & Meislo, 2004) . This trend has been found also in Sweden, Germany, USA and Japan (Eisner, Eisner & Yoshida, 2003). In that study, males demonstrated better environmental knowledge, whereas females showed higher motivation for ecological thinking and behaviour. Another research showed that girls are more human right favourable to human rights than girls (Mekhael, 2015)

Environmental club members showed better SD attitudes than non-environmental club members (Table 16) although the presence of the club in school revealed no influence on students' SD attitudes (Table 18). However, this was contradicted in an Ethiopian study in 2013 that found that the Environmental attitudes of environmental club member and non-club member students were not significantly different (Ashalaw, Lemma & Karippai, 2013).

The study showed (Table 20) as well private school students have better SD attitudes than public school students. One possible explanation of this difference could be that, private students may have more exposure to environmental issues as compared to public schools through environmental projects, fieldtrips and the use of more interactive tools due to the availability of resources.

4.3. Skill results

The skills that were highly scored by students have social nature (Table 25). They include treating people online respectfully without considering their racial background which reflects students' awareness of human rights that are included in the civic curriculum of grade 10. Another skill that was highly scored was examining problems from different points of views. This 'open-mindedness is one of a number of ideal invoked in attempts to characterise the nature of scientific inquiry' (Hare, 1995, p. 76).

Students scored less for volunteering in democratic activities related to students' life in school which is a skill of active citizenship. Active citizenship is a combination of knowledge, attitudes, skills and actions that contributes to building and maintaining a democratic society (Nosko & Szeger, 2013). Researchers found that participation in school extracurricular activities, involving democratic citizenship like leader nomination and election, in high school was associated with higher rates of volunteering in democratic activities related to students' life in school (James, Ian & Carole, 2008). This indicates that the extracurricular activities involving democratic citizenship in the chosen schools in this study were not enough to increase the frequency of this citizenship skill.

Environmentally, students' results were low for not considering the consumption and life styles that are damaging to the environment including waste management, wasting water and recycling. Obviously, the environmental activities and integration approaches were insufficient to implement sustainable consumption and production concept as observed in the knowledge item (fair distribution of goods and services) and in attitude item (students' irresponsibility in the use of resources as long as these resources are available without considering the health and welfare of the future generations). Sustainable consumption and production is about the use of services and related products, which respond to the basic needs and bring a better quality of life while minimising the use of natural

resources and toxic materials as well as the emission of waste pollutants over the life cycle of the service of the product, so as not to jeopardise the needs of further generations (Norwegian Ministry of the Environment, 1994). This concept must be integrated into the curriculum since education for SD is a value-driven educational process oriented towards the development of people's skills, aiming at people's responsibility and proactive engagement in building a sustainable society (Weber, 2004)

Research related to environmental education has consistently indicated that many students and young adults attribute a large amount of their knowledge of environmental concepts, problems and issues to out-of-school (non-formal) educational settings and experiences. Data also indicate that students and young adults attribute much of their attitudes and values to similar experiences. When a school provides strong environmental education experiences or programmes, the impact of out-of-school experiences decrease, yet remain very significant (Iozzi, 1981; Iozzi & Shepard, 1988). Reviewers of research (Iozzi, 1981; Hungerford et al., 1985) report that many of out-of-school (non-formal) educational activities dealt with relatively minor environmental problems (picking up litter, etc.) and that activities ought to focus on more serious problems (water pollution, hazardous wastes, population problems). These types of activities are recommended to increase environmental skills like picking up litter and volunteering to work on local charities or environmental groups that have shown low scores in the current study.

The presence of Club in schools didn't affect the students' SD skills (Table 30), however; environmental club members showed better SD skills than non-environmental club (Table 29). It can be deduced that membership in environmental club increases students' SD knowledge, attitudes and skills and that is due to their active engagement with environmental and social activities.

Female students' revealed better SD skills than males (Table 33) and this is due to their greater environmental attitudes and values that were evident in the result (Table 22).

4.4. Lebanese situation results

Based on the results of the Lebanese Context (Table 36), most students agreed that they are allowed to participate and express themselves in school and community. This is very important for student leadership which is a significant approach in education for SD. Student leadership encompasses many of the ideas and intentions that are often described as student participation, student agency or student voice. The term student leadership refers to education principles and practices that give young people the opportunities and support to find their voices, to participate in decision-making, and to understand their rights and responsibilities as active citizens. When students are given the skills and opportunity to lead within their schools, they are empowered to have a real impact on their learning and school environment and are prepared to participate meaningfully in their community (Black et al., 2014).

Relatively high score item was the effect of disparity in goods and services among Lebanese people on development. This implies students' awareness of the need to reduce inequality among Lebanese people which is goal number 10 of the SD goals. Although students studied the concept of climate change in geography curriculum, they still didn't express much perception about its presence in Lebanon, for this reason, greater emphasis must be applied on this topic integrating the Lebanese context in climate change.

School partnership with organisations and local authorities through projects seems to be rare as demonstrated by students' answers. This partnership should be encouraged for more active and effective SD learning experience for all stakeholders especially students. Never forget to mention the resources that could be facilitated for SD school projects through these partnerships.

Students expressed their ignorance to the fact that the Lebanese government had adopted the concept of SD although they study about SD in the sociology curriculum. This ignorance could be removed by focusing on the Lebanese Situation about SD through the teaching learning process.

Not considering the needs of future generations and not respecting the laws and regulations that protect the environment are two characteristics of Lebanese people as admitted by most students. This doesn't only reflect a critical view about the Lebanese Situation but also a self-awareness skill as students showed in their skills and attitudes this irresponsible consideration to future generations.

4.5. Main SD source results

The main source of all students' SD knowledge appeared to be the curriculum (Table 37) and this was expected since SD is taught in sociology subject in grade 10. In schools where environmental clubs were present; parents were mentioned more frequently as the main source of SD knowledge (Table 38). Research findings reveal that environmental knowledge was significantly related to parental education level (Makki, Abd-El-Khalick & Boujaude, 2003). As well, parents are significantly mentioned in higher frequency as main SD source of knowledge among students who scored high in SD skills (Table 40).

5. Conclusion

By measuring the SD knowledge, attitudes and skills for grade 10 Lebanese students from Beirut region, the results were relatively high. Students have a significant knowledge about the environmental and social challenges concerning pollution and social sectarian conflicts but they are not sure that these concepts are relevant to SD. A fundamental SD gap was perceived regarding the concepts of renewable energy and sustainable production and consumption. That's why, reinforcement of these concepts is recommended by integrating it in the curriculum of grade 10. Noticeably, the environmental and social pillar knowledge, attitudes and skills results were higher than that of the economic pillar due to the community service and environmental activities or even separate extracurricular activities that are limited to environmental and social awareness and rarely involving economic issues like system thinking and entrepreneurship that must be endorsed. The results show the ineffectiveness of curriculum and environmental school activities in modifying students' attitudes and skills about the wise use of resources, accordingly, it is suggested to reinforce the values of using resources wisely though curriculum and extracurricular activities. The skill of volunteering in environmental campaigns and the democratic activities in school life was underprivileged. Enhancement of these citizenship activities favouring students' participation: Council, election and campaign council in school is mandatory.

Environmental club membership manifestly promoted SD knowledge, skills and attitudes. Gender influence was conspicuous in the results of SD attitudes and skills where female students excelled over male students.

With reference to students' perception and opinion to the Lebanese situation in SD, it is highly recommended to relate the Lebanese situation concerning SD and climate change to curricular subjects. Students didn't show confidence on the role of state by adopting SD as a priority and the Lebanese government should affirm their commitment by adopting policies and strategies on SD and to put focus on the role of ESD.

School Partnerships with NGOs and local associations should be encouraged for more active and effective SD learning experience for all stakeholders especially students. Never forget to mention the resources that could be facilitated for SD school projects through these partnerships.

As for the main source of SD knowledge proclaimed by students, curriculum maintained the highest rank; accordingly, reorienting curriculum to integrate education for SD is required for enhanced implementation of SD knowledge, skills and attitudes and for improved coping with Current Lebanese situation and needs.

5.1. Limitations

A limitation at the level of sample representativeness was that there were 12 private schools and eight public schools instead of being correspondent to the proportionality of public and private schools in Beirut region, this is due to the presence of only four public schools that have environmental clubs (that are one of the objectives of our study) based on the list of schools displayed on Center of Educational Research and Development which was not updated, where some schools were listed with no environmental clubs had environmental clubs in school and the opposite. The limitations of this research also include the fact that most of the chosen private schools were members in the UNESCO Association School Project Network where education for SD is integrated though projects and activities and sometimes thorough curriculum, this appeared in the high SD knowledge, skills and attitudes of students in this study that might be less concerning students in other private schools which again affect the sample representativeness. The language of the questionnaires is Arabic which was somehow difficult to some students who are more fluent in English or French language leading to the administrator's intervention. This intervention was an implementation threat that might affect the internal validity of the study.

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Annex 1

Dear Students;
This questionnaire and the information inside will be used only for research purpose. Your anonymous will be respected so you are not obliged to put your name
Mark by **X** the best answer

Sex	Male……			Female ……			
I am a member in the environmental club	Yes …….			No ……			
My knowledge about Sustainable Development (SD) is from:	School Curriculum …….	School Extracurricular activities …….	Environmental club …….	Social media/internet …….	Non-governmental Organizations (NGOs) ……	Parents …….	Friends …….

Question	Strongly disagree	Disagree	Agree	Strongly agree
1. Economic development is necessary for SD				
2. Improving people's opportunities for long and healthy lives contributes to SD				
3. The present generation should make sure that the next generation can live in communities that are at least as healthy as those that exist today				
4. Protecting the environment is necessary for SD				
5. Lebanese people in their lifestyles take into consideration the needs of the future generation				
6. A culture of peace where people settle conflicts by discussion is necessary for SD				
7. As long as resources are available, using more than we need now does not threaten the health and welfare of future generations				
8. We don't need stricter laws and regulations to protect the environment				
9. Lebanese people respect the laws and regulations to protect the environment				
10. It is important to find ways to reduce poverty				

11. SD will not be possible until wealthier nations stop exploiting workers in poorer nations				
12. SD requires individuals to reduce all kinds of waste				
13. Understanding and addressing the problems of climate change is not important				
14. Climate change exists in Lebanon				
15. Climate change is a serious problem that would badly influence the environment				
16. Use of clean energy consuming vehicles should be encouraged by governments				
17. Lebanon addresses SD as a national priority				
18. Citizens should be well-informed and actively participate in democratic processes				
19. I am allowed to participate and express myself *n* school and community				
20. People who pollute our land, air or water should pay for damage done to communities and the environment				
21. Good citizenship is necessary for SD				
22. Respect for cultural diversity is a must for a given country				
23. SD results in fair distribution of goods and services to all people around the world				
24. The disparity among Lebanese people concerning goods and services is affecting the development of the country				
25. SD requires respect for human rights				
26. SD requires shifting to the use of renewable resources as much as possible				
27. Males and females should have equal access to all kinds of education, employment and health services				

28. Males and females should have equal opportunities to participate in political life and economy				
29. I never waste water in my personal use				
30. Even when I have the option, I do not always recycle in my school or house				
31. I have changed my personal lifestyle to reduce waste				
32. We are allowed to use environmental resources as much as we want if the purpose is to create and maintain jobs				
33. I treat people respectfully, except those who have racial backgrounds different from my own				
34. When I use the computer or phone for social networking or gaming I always treat everyone as respectfully as I would in person				
35. I do not think about how I might be damaging the natural environment in my consumption and lifestyle				
36. I pick up litter when I see it in a park or a natural area				
37. I participate in democratic activities related to student life at my school				
38. I volunteer to work with local charities or environmental groups				
39. My school has some common projects with associations or local authorities				
40. I usually examine problems from many points of view				