AWARENESS OF SUSTAINABILITY ISSUES AMONG SCIENCE EDUCATION AND VOCATIONAL EDUCATION STUDENTS AT THE HASHEMITE UNIVERSITY IN JORDAN: AN EMPIRICAL INVESTIGATION

AHMAD M. QABLAN
SAMER A. KHASAWNEH
AIEMAN A. AL-OMARI

Abstract – *The primary purpose of this study was to assess the level of students' awareness about sustainability issues at the Hashemite University in Jordan. A 30-item instrument, adapted from Dunkerly-Kolb (1998), was used to collect data from a sample of 230 preservice science and vocational teachers during the academic year 2005-2006. Results indicated that preservice science and vocational teachers showed medium level of awareness about sustainability issues. Additionally, results indicated that participants appeared to be independent from their natural surroundings. The study suggested few practical solutions for faculty members and for the university administration to incorporate sustainability principles into university curricula.*

Introduction and theoretical framework

The concerns about the quality of the environment have attracted the attention of the global community. These concerns are considered to be the precursors to develop positive attitudes in people toward the environment. As a result, developing such favourable environmental attitudes has occupied main sections in many international environmental documents (e.g., World Commission on Environment and Development [WCED], 1987). The underlying notion in these documents is that developing caring attitudes about the environment can lead to build good citizens who, in turn, can promote good environmental practices and actions in others.

Many educators argue that preparing scientifically literate citizens should be the ultimate goal of instruction at schools, colleges and universities. They believe that scientific literacy enables people to take right decisions to solve their future socio-economic problems (Colucci-Gray, Giuseppe Barbiero & Gray, 2006), such as shortage in quality food, water, and air. However, many researchers argue that most social and economic issues have a major environmental dimension (Fien, 1993; Cortese, 1999; Hares et al., 2005). They argue that good citizenship requires

a familiarity with the social and economic processes that accompany most environmental issues and some understanding of how the scientific method works (Schneider, 1997; Brickhouse & Kittleson, 2006). Environmental literacy should therefore be a major task for schools and universities in the future (David, 1974; Orr, 1992; Brennan, 1994; Bowers, 1996; Hsu & Roth, 1998; Colucci-Gray, Giuseppe Barbiero & Gray, 2006).

According to Brönmark & Hansson (1998), environmental literacy should include the skills necessary to make educated decisions about environmental problems by being able to integrate information from different disciplines (e.g., solving the population problem requires knowledge from geography, biology, agriculture and other fields). However, although an environmentally literate person is not required to be an expert in technical details, he or she is expected to have a knowledge base of how science and its products (e.g., technology) work in order to evaluate the assessments that surround most environmental policy debates (Schneider, 1997).

Environmental education is recognised as the most promising approach to increase environmental literacy and awareness, and to produce a logical knowledge base on which people can make intelligent decisions to protect the environment (Desinger, 1982). In recent years, much of the discussion of environmental education employs sustainable development as a key guiding notion (Bonnett, 1999), where sustainable development means 'the development that meets the generation's needs of the present without compromising the ability of future generations to meet their needs' (WCED, 1987, p. 43). Indeed the growing consensus about the usefulness of the notion of sustainable development is reflected in a number of influential reports, including *Our Common Future* (WCED, 1987) and *Report of the United Nations Conference on Environment and Development* (United Nations Conference on Environment and Development [UNCED], 1992).

Education intended to prepare sustainably aware citizens is known as Education for Sustainable Development (ESD) (Orr, 1992; UNCED, 1992; Fien, 1993), which differs in turn from environmental education by including issues of international development, cultural diversity, and social and environmental equity.

ESD attempts to prepare future environmental citizens (Fien, 1993; Cortese, 1999, 2001; Sterling, 2001) by focusing on providing students with broad and diverse sources of knowledge. More importantly, the goals of ESD are for students to develop a deep concern about the welfare of the planet, its ecosystems, its cultures and its people. As such, it is therefore important that people understand that they are part of nature and the need to view environmental problems holistically (Colucci-Gray, Giuseppe Barbiero & Gray, 2006).

While the education of the future generation rests in the hands of educators from different disciplines, colleges of education are seen to play a vital role in modelling and practising ESD in their teaching. However, incorporating ESD at schools, both in Jordan and globally, faces many obstacles (Cortese, 1999; McKeown, 2002). Some of these obstacles relate to the educators themselves, while others relate to the need of equipment and preparation.

Addressing these obstacles may greatly contribute to limit the current environmental degradation in the globe. However, limiting that degradation cannot be accomplished without limiting the local and national degradation of the natural resources of every country. With mankind being the major contributing factor to the degradation of earth's natural resources, raising people's awareness of sustainability principles could significantly contribute in overcoming this problem. It was therefore decided that this study sets out to measure the level of awareness that Jordanian students have about sustainability principles. Our choice of Jordan is particularly interesting as it currently faces serious problems in view of its limited and degraded natural resources.

Jordan and its environmental challenges

The geography of Jordan

Jordan is a relatively small country situated at the junction of the Levantine and Arabian areas of the Middle East. Jordan occupies an area of approximately 96,188 square kilometres, including the Dead Sea, making it similar in size to Austria or Portugal. However, Jordan's diverse terrain and landscape belie its actual size, demonstrating a variety usually found only in large countries.

Western Jordan has essentially a Mediterranean climate: a hot, dry summer, a cool, wet winter and two short transitional seasons. However, about 75% of the country can be described as having a desert climate with less than 200 mm of rain annually. Jordan can be divided into three main geographic and climatic areas: the Jordan Valley, the Mountain Heights Plateau, and the eastern desert (or Badia region).

Wildlife and vegetation in Jordan

Throughout history, the land of Jordan has been renowned for its luxurious vegetation and wildlife (Al-Eisawi, 1996). Known in the Bible as the 'land of milk and honey', the area was described by more recent historians and travellers as green and rich in wildlife (Alnewashi, 2003). During the 20th century, however, the health of Jordan's natural habitat declined significantly. Problems – such as

desertification, drought and over-hunting – have damaged the natural landscape and will take many years to rectify (Royal Society for the Conservation of Nature [RSCN], 1994).

Current environmental threats and the Jordanian response

The Jordanian habitat and its wildlife communities have undergone significant changes over the centuries and continue to be threatened by a number of factors (Alnewashi, 2003; Ministry of Environment, 2003). A rapidly expanding population, industrial pollution, wildlife hunting and habitat loss due to development have taken a toll on Jordan's wildlife population. Jordan's absorption of hundreds of thousands of Palestinian refugees, since 1948, has resulted in the over-exploitation of many of its natural resources, and the country's severe shortage of water has led to the draining of underwater aquifers and damage to the Azraq Oasis (Ministry of Environment, 2003).

In recent decades, Jordan has been addressing these and other threats to the environment, beginning the process of reversing environmental decline. A true foundation of environmental protection requires awareness upon the part of the population, and a number of governmental and non-governmental organisations are actively involved in educating the population about environmental issues (Alnewashi, 2003). Jordan's Ministry of Education is also introducing new literature into schools' curriculum to promote awareness of environmental issues among young students (Alnewashi, 2003).

The national strategy presents specific recommendations for Jordan on a sector-by-sector basis, addressing the areas of agriculture, air pollution, coastal and marine life, antiquities and cultural resources, mineral resources, wildlife and habitat preservation, population and settlement patterns, and water resources (Al-Eisawi, 1996; Alnewashi, 2003). The plan places considerable emphasis throughout on the conservation of water and agriculturally productive land, the contamination or loss of which would bring swift and significant consequences to Jordan.

The Royal Society for the Conservation of Nature (RSCN) has been at the forefront of Jordanian efforts for wildlife conservation. Founded in 1966, the RSCN was the first non-governmental organisation of its kind in the Arab world. The society addresses a wide range of environmental concerns, but its primary *raison d'etre* is the preservation of wildlife, both in the Jordanian mainland and in Aqaba's coral reefs and coastline.

The national environmental strategy

For Jordan, environmentalism is neither a luxury nor a trend destined to go out of style in time. The country's scarce resources and fragile ecosystems necessitate

a viable and ongoing programme of action covering all aspects of environmental protection. In order to maintain a viable resource base for economic growth, as well as to preserve the region's natural heritage, Jordan became the first country in the Middle East to adopt a national environmental strategy (Ministry of Municipal, Rural, and Environmental Affairs, 1991). With help from the International Union for the Conservation of Nature, in May 1991 a team of over 180 Jordanian specialists completed a practical and comprehensive working document entitled *National Environment Strategy for Jordan*.

The document is a long-term environmental blueprint for government, non-governmental organisations (NGOs), private sector businesses, communities and individuals. It also contains a wealth of information about Jordan's natural and socio-economic environment. The strategy is predicated on the fundamental principle of sustainable development, which the report defines as

> 'development which increasingly meets human needs, without depleting the matter and energy of the ecosystem upon which development is founded. An economy which develops sustainably would be designed to perform at a level which would allow the underlying ecosystem to function and renew itself ceaselessly.' (Ministry of Municipal, Rural, and Environmental Affairs, 1991, p. x)

The study

Purpose of the study

The primary purpose of this study was to assess the level of awareness about sustainability issues among undergraduate students of the School of Educational Sciences at the Hashemite University in Jordan. The following research objectives were pursued in this study.

- **Objective 1:** To assess the level of awareness about sustainability issues among students at the Hashemite University.
- **Objective 2:** To determine the differences in students' awareness related to sustainability issues based on gender, academic level and academic achievement (GPA), and the class taken (Science vs. Vocational).

Significance of the problem

The preparation of future citizens rests in the hands of educators. The ongoing degradation of national and global environments requires new strategies to impede

that degradation. Educators believe that preparing sustainably aware citizens through sustainability education will contribute significantly to resolving the current environmental degradation (Orr, 1992; Fien, 1993; Cortese, 1999; McKeown, 2002). However, the notion of sustainability education is being underestimated at both national and global levels (Calder & Clugston, 2003). This study addressed the lack of research on sustainability education in the Jordanian context. It intended to assess students' awareness about sustainability issues at the School of Educational Sciences, Hashemite University.

The results of the study are expected to help the Hashemite University administrators, as well as other administrators in other universities in Jordan, to reformulate their educational policies toward addressing sustainability issues in their curricula. Furthermore, it may help them improve their pedagogical strategies to promote sustainability education in their teaching.

Methodology

Population and sample

The population of the study included all the Hashemite University undergraduate students who were enrolled in the 'science education' and 'vocational education' courses offered by the Department of Curriculum and Instruction during the second semester of the academic year 2005-2006. The selection of this purposeful sample of prospective teachers stems from the belief that researchers have about the vital role that teachers play in teaching for sustainability. However, we decided to choose our sample from students from the School of Educational Sciences, and not from other university schools, as their prospective career will be only teaching.

In this study, there were two sections of the science education course with a total number of 120 students and two sections of the vocational education course with a total number of 110 students, resulting in 230 participants. Twenty students were excluded from the actual sample as they had participated in the pilot study. As a result, the actual sample of the study included 110 science education students and 100 vocational education students.

Instrumentation

The instrument used to collect data in this study was a two-part questionnaire named Awareness of Sustainability Issues (ASI) adapted from Dunkerly-Kolb (1998). The first part of the questionnaire collected demographic information

related to students' gender, academic level and academic achievement (GPA), and class type (Science vs. Vocational). The second part of the questionnaire included 30 items related to students' awareness of sustainability issues (see Appendix A). These items were rated on a 5-point Likert scale as follow: 1 – Strongly Disagree; 2 – Disagree; 3 – Neutral; 4 – Agree; and 5 – Strongly Agree.

Validity and reliability of the instrument

The original English version of the ASI was developed after: (i) an extensive review of the literature; (ii) consultation with field centres for environmental education and natural resources; and (iii) participation by a panel of experts including administrators, university faculty members and public officials (Dunkerly-Kolb, 1998). The ASI was shown to have both content and face validity. For indication of reliability, the ASI was studied with 405 students, resulting in an acceptable reliability coefficient of .71 (Nunally & Bernstein, 1994).

Instrument translation process

To ensure equivalence of meaning of the items and constructs between the Arabic and English versions of the ASI, a rigorous translation process was used that included forward and backward translation, subjective evaluations of the translated items and pilot testing. The goal of the translation process was to produce an Arabic version of the ASI with items that were equivalent in meaning to the original English version (Lomi, 1992; Sperber, Devellis & Boehlecke, 1994). Two translators (faculty members), both bilingual in English and Arabic, translated the English version of the ASI into Arabic (forward translation). These translators were asked to retain both the form (language) and the meaning of the items as close as possible to the original, but to give priority to equivalence of meaning. When the Arabic translation was finalised, the ASI was then back-translated (from Arabic to English) by two other faculty members, again both bilingual in English and Arabic.

The back-translated items were then evaluated by five faculty members to ensure that the item meanings were equivalent in both the original English version and the back-translated version. If differences in meaning were found between items, those items were put again through the forward and backward translation process until the faculties were satisfied that there was substantial equivalence of meaning. The finalised Arabic version of the ASI was then pilot tested with a group of 20 students and 10 faculties to collect feedback about instrument content and usage. The feedback from the students did not lead to any substantive changes.

The feedback from the faculties emphasised that the instrument has both face and content validity in the Jordanian context.

It is known that there are several concerns that surround the adoption of a ready-made questionnaire to be used in a different context. While some of these concerns revolve around the content of the items themselves, others revolve around the cultural connotations that items might have. However, the researchers of this study were aware of these major concerns and employed careful strategies to overcome these difficulties. For the issue concerning the content of the original items of the questionnaire, the researchers consulted a panel of experts in environmental sciences to make sure that the content is relevant to Jordanian environment and deals with national environmental issues. With regard to the concern of the cultural meaning that the original items of the questionnaire might have, the panel of experts consulted by the researchers confirmed that the items were culture-free and would not be misunderstood by the respondents.

Instrument standardisation

The instrument was pilot tested with a group of 20 students who were enrolled in the science education and vocational education courses. These students were then excluded from the actual sample of the study. The changes recommended by the validation panel and those identified as needed during the pilot test were incorporated into the instrument. These changes occurred only in the wording of items. The internal consistency of the instrument was determined using the same group of students used in the pilot study. Based on the pilot test, the 30-item instrument yielded a reliability coefficient of .79. With regard to instrument dimensions, the reliability coefficients were as follow: (i) independence from nature (.83); (ii) adherence to nature (.76); (iii) interdependence with other members in nature (.80); and (iv) interest in nature (.79). These figures suggest that the instrument is suitable to measure students' awareness of sustainability issues.

Data analysis

To answer the first objective, descriptive statistics were used to compute the means and standard deviations for the items of the ASI instrument. The SPSS statistical package (version 11.5) was employed to carry out these analyses. The second objective was achieved initially by conducting factor analysis to determine the number of dimensions that exist within the 30 items. Then, the objective was answered using the *t*-test statistic and multivariate analysis of variance

(MANOVA). The *t*-test statistic was used to determine differences in students' awareness related to sustainability issues based on gender, academic level and academic achievement (GPA). In the case where the independent variables in the study had three or more levels (e.g., educational level), the MANOVA statistic was utilised.

Data collection

During the last two weeks of the second semester of the academic year 2005-2006, the researchers handed the instrument to students in the two sections of the science education course and the two sections of the vocational education course. Data were collected in class from 200 students, with a response rate of 95% (200 out of 210). Twenty percent of the respondents were males and 80% were females. Forty-two were freshmen (21%), 52 sophomores (26%), 48 juniors (24%) and 58 seniors (29%). Finally, while 55.5% of the students had an overall grade-point average higher than 3.0, 40% (80) of the students had a GPA lower than 3.0.

The results

- **Objective 1:** To assess the level of awareness about sustainability issues among students at the Hashemite University.

Analysis of the first question data involved the tabulation of 'awareness of sustainability issues' means. The calculation of the total mean score was based on student responses to each item in the selected scale, using the 5-point Likert scale detailed above (see 'instrumentation' section). Given that the 30 items of the ASI questionnaire could each be scored from 1 to 5, the range of scores on the questionnaire items was therefore between 30 and 150. Consequently, the levels of awareness about sustainability issues were interpreted using the following categories: (i) 30-69 = low awareness level; (ii) 70-109 = medium awareness level; and (iii) 110-150 = high awareness level. These categories indicated the level of awareness about sustainability issues among students at the Hashemite University. Students at the Hashemite University were found to have a medium awareness level (M = 98.45, SD = 8.14) with regard to sustainability issues.

- **Objective 2:** To determine the differences in students' awareness related to sustainability issues based on gender, academic level and academic achievement (GPA), and the class taken (Science vs. Vocational).

To answer this question, a factor analysis statistic was utilised to determine the dimensions of the used instrument. The following paragraphs describe this procedure in detail.

Factor analysis

Factor analysis was used to determine how many reliable and interpretable dimensions there are among the 30 items of the ASI questionnaire. Factor analysis was conducted to determine what, if any, underlying structure exists for the measures on the 30 items. Principal dimensions analysis was conducted utilising a varimax rotation.

The initial analysis retained only four dimensions. After rotation, the first dimension accounted for 17%, the second for 10%, the third for 9%, and the fourth for 6% (see Table 1). Table 2 presents the loadings for each dimension. Dimension number 1 – which was labelled 'independence from nature' – included items with both negative and positive loadings. Positive loadings included the variables of 3, 5, 6, 8, 10, 20, 22 and 23. Negative loadings included items 1, 9 and 24. Items with the highest loadings were 8 and 5. Dimension number 2 – which was labelled 'adherence to nature' – included items 12, 13, 14, 15, 16, 17 and 30. The item with the highest loading was 16, while 15 was the only item with a negative loading. Dimension number 3 – which was labelled 'interdependence with other members in nature' – included items 2, 4, 7, 11, 18, 19, 21 and 28. Item 2 carried the highest loading, while items 4, 11 and 19 had negative loadings. Dimension number 4 – which was labelled 'interest in nature' – included items 25, 26, 27 and 29. Two of the four items (i.e., 25 and 27) had negative loadings and the item with the highest loading was 26.

TABLE 1: Total variance explained

Dimension	**Initial Eigenvalues**			**Extraction Sums of Squared Loadings**		
	total	% of variance	cumulative %	total	% of variance	cumulative %
1	4.984	16.615	16.615	4.984	16.615	16.615
2	2.862	9.539	26.154	2.862	9.539	26.154
3	2.610	8.699	34.853	2.610	8.699	34.853
4	1.783	5.944	40.796	1.783	5.944	40.796

TABLE 2: Dimension loadings

Item	Dimension	Loading
Dimension 1: Independence from Nature		
8		.683
5		.650
9		-.623
22		.613
23		.514
24		-.509
10		.484
3		.483
1		-.482
6		.388
20		.364
Dimension 2: Adherence to Nature		
16		.785
14		.669
17		.631
12		.578
13		.560
15		-.493
30		.340
Dimension 3: Interdependence with Other Members in Nature		
11		-.581
2		.502
18		.493
21		.457
19		-.449
4		-.372
7		.323
28		.311
	Dimension 4: Interest in Nature	
25		-.821
27		-.818
26		.812
29		.432

In order to answer the second objective of this study, four-way MANOVA were conducted for the four dimensions of the sustainability awareness mean scores by gender (male & female), academic level (first, second, third & fourth year), average (below 3 & above 3) and the class taken (science & vocational).

TABLE 3: Four-way MANOVA sustainability awareness by gender, academic level, average and class taken

Effect	Wilks' Lambda Value	*F*	Hypothesis *df*	Error *df*	*p*
Gender	.985	.585	4	159	.674
Academic	.958	.575	4	159	.863
GPA	.972	1.154	4	159	.333
Class Taken	.920	3.437	4	159	.010*
Gender X Academic Level	.934	.920	12	420	.526
Gender X GPA	.986	.568	4	159	.686
Gender X Class Taken	.991	.344	4	159	.848
Academic Level X GPA	.925	1.043	12.000	420.966	.408
Academic Level X Class Taken	.954	.634	12.000	420.966	.813
GPA X Class Taken	.992	.308	4.000	159.000	.872
Gender X Academic Level X GPA	.897	1.468	12.000	420.966	.133
Gender X Academic Level X Class Taken	.975	1.039	4.000	159.000	.389
Gender X GPA X Class Taken	.993	.299	4.000	159.000	.878
Academic Level X GPA X Class Taken	.974	.536	8.000	318.000	.829

* indicates significant result

Table 3 presents the four-way MANOVA results. MANOVA results revealed significant differences between the class taken (Wilks' Lambda = .920, $F(4, 159) = 3.437$, $p = .010$) on the four dimensions of the dependent variable of sustainability awareness. Univariate analysis was conducted as a follow-up test.

MANOVA results indicated that gender (Wilks' Lambda = .985, $F(4, 159) = .585$, $p = .674$), academic level (Wilks' Lambda = .958, $F(4, 159) = .575$, $p = .863$) and GPA (Wilks' Lambda = .972, $F(4, 159) = 1.154$, $p = .333$) and the interaction between gender, class taken, academic level and GPA had no significant effect on the students' sustainability awareness.

Table 4 shows the respective mean values and standard deviations of the four dimensions of the ASI questionnaire, and Table 5 presents a summary of the ANOVA results regarding students' class type.

TABLE 4: Means and standard deviations for the four dimensions

Dimension	**Class Taken**	*N*	*M*	*SD*
Independence from Nature	Science	108	35.23	4.76
	Vocational	80	31.90	4.32
	Total	188	33.81	4.85
Adherence to Nature	Science	108	23.11	4.20
	Vocational	80	26.10	3.00
	Total	188	24.38	4.01
Interdependence with Other Members in Nature	Science	108	27.47	3.49
	Vocational	80	28.41	2.98
	Total	188	27.87	3.31
Interest in Nature	Science	108	12.23	2.32
	Vocational	80	12.59	1.69
	Total	188	12.38	2.08
Total		188	98.45	8.14

Discussion and implications

The primary purpose of this study was to assess the level of students' awareness about sustainability issues among preservice science and vocational teachers in the School of Educational Sciences at the Hashemite University in

TABLE 5: ANOVA summary for students' sustainability awareness regarding their class type

Source	**Dependent Variable**	Type III Sum of Squares	*df*	Mean Square	*F*	*p*
Intercept	Independence from Nature	48978.889	1	48978.889	2289.892	.000
	Adherence to Nature	25488.205	1	25488.205	1847.603	.000
	Interdependence with Other Members in Nature	32376.660	1	32376.660	2942.772	.000
	Interest in Nature	6661.584	1	6662.584	1468.213	.000
Class Type	Independence from Nature	161.433	1	161.433	7.547	.086
	Adherence to Nature	30.679	1	30.679	2.224	.138
	Interdependence with Other Members in Nature	24.565	1	24.565	2.233	.137
	Interest in Nature	.406	1	.406	.090	.765
Error	Independence from Nature	3465.046	162	21.389		
	Adherence to Nature	2234.836	162	13.795		
	Interdependence with Other Members in Nature	1782.340	162	11.002		
	Interest in Nature	735.027	162	4.537		
Total	Independence from Nature	219341.813	188			
	Adherence to Nature	114780.000	188			
	Interdependence with Other Members in Nature	148055.563	188			
	Interest in Nature	29636.000	188			

Jordan. Two groups of preservice teachers (science and vocational) participated by responding to a 30-item awareness of sustainability issues questionnaire (ASI).

As indicated in the results section, the mean value of the students' response on the ASI questionnaire was 98.45, signifying a medium level of students' awareness about sustainability issues. However, when performing the factor

analysis statistic on the items of the instrument, four major dimensions emerged. These were: (i) Independence from Nature (mean value 33.81); Adherence to Nature (mean value 24.38); (iii) Interdependence with Other Members in Nature (mean value 27.87); and (iv) Interest in Nature (mean value 12.38). These figures indicate that both science and vocational preservice teachers appeared to be independent from their natural surroundings. This means that their first priority was not considering the environmental consequences of their actions, but their benefits and satisfaction. This non-environmental attitude of students, coupled with their low interest in nature, could be attributed to, and perhaps limited by, the type of education that these teachers received during their preparation. This is in line with the findings of the Calder & Clugston (2003) report on evaluating the progress toward sustainability in higher education. Calder & Clugston (2003) indicate that education for sustainable development has been under funded and under supported, both within and outside of the academic community. They argue that one source of that underestimation is the tensions that have arisen between environmental educators and sustainability educators, which has led in turn to no consensus being found on who or which institutions should guide the higher education on sustainable development movement.

The present finding suggests that, if we are to transform our current education into sustainability education, more attention should be paid to incorporate sustainability concepts into Jordanian higher education. Methods that can be employed by faculty members to incorporate the concepts of sustainability into their teaching include assigned readings, class discussions and class projects. Key benefits of incorporating the concepts of sustainability into teaching include increasing student awareness, collaboration, vision development and social implications. These strategies are also supported by Filho's (1999) earlier research findings that increasing awareness often leads to increased acceptance of sustainability.

However, leaving the mission of incorporating sustainability concepts in higher education only to the faculties' own interests would not help in accomplishing that mission. As university faculty have expanding work responsibilities, special support for faculty and staff is needed in order to successfully integrate the concepts of sustainability in university teaching (Clugston & Calder, 1999). The university, for instance, could involve its faculty and staff members in campus-wide sustainability initiatives (Filho, 1999). These initiatives could help faculty members increase their students' awareness and understanding of concepts of sustainability (University Leaders for a Sustainable Future, 1998). Establishing special sustainability centres (University Leaders for a Sustainable Future, 1998; Filho, 1999) could also facilitate the systematic reinforcement of the value of achieving success in integrating the concepts of sustainability in university teaching.

Another suggestion for Jordanian universities to promote sustainability education within their borders would be to offer faculty development opportunities for sustainability, including workshops and conferences, and to change tenure and promotion requirements in order to reward innovative scholarly focus on sustainable development and contributions to public debate and policy development (University Leaders for a Sustainable Future, 1998).

Furthermore, universities can also promote the articulation of the notion of sustainability by conducting annual campus environmental assessments and by greening their physical operations to make campuses model sustainable communities (Shriberg, 2002). They can also buy green products and use campus purchasing to leverage the development of sustainable local and regional economies (Rothblatt, 1995).

Moreover, universities can foster student engagement by creating a student environmental-sustainability centre on campus and by supporting student activism beyond the campus (Lele, 1991; Kidd, 1992). Again, they can encourage interdisciplinary and integrated thinking through internships and service learning (Clugston & Calder, 1999).

After incorporating sustainability principles in its curricula, the university should seek to increase the level of awareness of the surrounding society about sustainability issues. The literature indicates that it is of paramount importance to increase the level of sustainability awareness throughout society as a whole (Michelsen, 2000). According to Abraham (2005), a sustainable society provides a high quality of life for all of its inhabitants without harming the integrity and productivity of the natural systems and resources upon which all life depends. As such, sustainability should be a goal toward which we could all strive.

Universities are not the only educational institutions in Jordan that have the responsibility to disseminate sustainability principles among students. Jordan's Ministry of Education should play a vital role in incorporating the concepts of sustainability into the schools' curricula. The Ministry of Education can use a number of strategies to accomplish this mission. One such strategy is to use research-based assessment to help teachers analyse their course content for environmental concepts.

Another strategy is to equip the school laboratories with multiple environmental teaching resources (e.g., environmental kits, posters and laboratory sheets) and to encourage teachers to make use of these resources by designing their scientific experiments around special environmental topics that help raise their students' awareness and attitudes toward the environment.

It is important to note that incorporating sustainability concepts into Jordan's curricula requires reliable coordination between the Ministry of Education and

local NGOs (e.g., Royal Society for the Conservation of Nature, Jordan Environment Society and school clubs for the conservation of nature). This would help them to focus their efforts of disseminating sustainability concepts in Jordanian society without waste of time and efforts.

At the end, it is the universities that hold the tools that will allow societies to become sustainable. We thus owe it to the rest of the world to provide them with the mechanisms to achieve this goal. But still, the education of all people is the key to success. For educated people can understand the global impact of their actions and make informed decisions *vis-à-vis* how the world should be for the future generations.

Acknowledgements

The authors would like to thank the Hashemite University, Jordan, for funding the research on which this paper is based.

Ahmad M. Qablan *is assistant professor of science education in the Department of Curricula and Instruction at the Hashemite University, Jordan. He earned his PhD in science education from Florida State University, USA, in 2005. He has over 25 publications on teachers' preparation, education for sustainability and environmental education. Dr Qablan's e-mail address is: ahmadgablan@hotmail.com*

Samer A. Khasawneh *is assistant professor in the Department of Educational Sciences, the Hashemite University, Jordan. His research interests include workforce development, human resource education, and vocational training and guidance. Dr Khasawneh's e-mail address is: samer70802@yahoo.com*

Aieman A. Al-Omari *is assistant professor and chairperson of the Department of Educational Foundations and Administration, the Hashemite University, Jordan. He earned his PhD from Washington State University, USA, in 2005. His research interests include higher education administration, students' affairs administration and leadership. Dr Al-Omari's e-mail address is: aieman66@hotmail.com*

References

Abraham, M. (2005) Sustainability education, *Environmental Progress*, Vol. 24(4), pp. 1-2.

Al-Eisawi, D. (1996) *Vegetation of Jordan*. Cairo, Egypt: Regional Office for Science and Technology for the Arab States, UNESCO-Cairo Office.

Alnewashi, Q. (2003) *Environmental Education in Developing Countries*. Amman: Jordan Environment Society.

Bonnett, M. (1999) Education for sustainable development: a coherent philosophy for environmental education?, *Cambridge Journal of Education*, Vol. 29(3), pp. 313-324.

Bowers, C. A. (1996) The cultural dimensions of ecological literacy, *Journal of Environmental Education*, Vol. 27(2), pp. 5-10.

Brennan, A. (1994) Environmental literacy and educational ideal, *Environmental Values*, Vol. 3(1), pp. 3-16.

Brickhouse, N. W., & Kittleson, J. M. (2006) Visions of curriculum, community and science, *Educational Theory*, Vol. 56(2), pp. 191-204.

Brönmark, C., & Hansson, L. A. (1998) *The Biology of Lakes and Ponds* (Series: Biology of Habitats). New York: Oxford University Press.

Calder, W., & Clugston, R. (2003) *Progress toward Sustainability in Higher Education*. Washington, DC: Environmental Law Institute.

Clugston, R. M., & Calder, W. (1999) Critical dimensions of sustainability in higher education. In W. L. Filho (ed.) *Sustainability and University Life*. Frankfurt: Peter Lang.

Colucci-Gray, L., Giuseppe Barbiero, E., & Gray, D. (2006) From scientific literacy to sustainability literacy: an ecological framework for education, *Science Education*, Vol. 1(26), pp. 1-26.

Cortese, A. (1999) *Education for Sustainability: The University as a Model of Sustainability*. Boston, MA: Second Nature.

Cortese, A. (2001) *Education for a Sustainable Future: The Next Industrial Revolution*. Boston, MA: Second Nature.

David, T. G. (1974) Environmental literacy, *School Review*, Vol. 82(4), pp. 687-705.

Desinger, J. (1982) Environmental education research news, *The Environmentalist*, Vol. 2, pp. 203-206.

Dunkerly-Kolb, S. (1998) *The Construction and Validation of an Instrument to Measure "Community Understanding": Interdependence among Community Members, Awareness of Sustainability Issues, and Experience of Connection with the Environment.* PhD thesis, Georgia State University, USA.

Fien, J. (1993) *Education for the Environment: Critical Curriculum Theorizing and Environmental Education*. Victoria, Australia: Deakin University.

Filho, W. L. (1999**)** Sustainability and university life: some European perspectives. In W. L. Filho (ed.) *Sustainability and University Life*. Frankfurt: Peter Lang.

Hares, M., Eskonheimo, A., Myllyntaus, T., & Luukkanen, O. (2005) Environmental literacy in interpreting endangered sustainability: case studies from Thailand and the Sudan, *Geoforum*, Vol. 37(1), pp. 128-144.

Hsu, J., & Roth, E. (1998) An assessment of environmental literacy and analysis of

predictors of responsible environmental behavior held by secondary teachers in the Hualien area of Taiwan, *Environmental Education Research*, Vol. 4(3), pp. 229-249.
Kidd, C. V. (1992) The evolution of sustainability, *Journal of Agricultural and Environmental Ethics*, Vol. 5(1), pp. 1-26.
Lele, S. M. (1991) Sustainable development: a critical review, *World Development*, Vol. 19(6), pp. 607-621.
Lomi, C. (1992) Evaluation of a Swedish version of the arthritis self-efficacy scale, *Scandinavian Journal of Caring Sciences*, Vol. 6(3), pp. 132-138.
McKeown, R. (2002) *Education for Sustainable Development Toolkit*. Knoxville, TN: University of Tennessee.
Michelsen, G. (2000) Sustainable development as a challenge for universities. In W. L. Filho (ed.) *Communicating Sustainability*. Frankfurt: Peter Lang.
Ministry of Environment (2003) *National Biodiversity Strategy and Action Plan*. Amman, Jordan: Author.
Ministry of Municipal, Rural, and Environmental Affairs (1991) *National Environment Strategy for Jordan: A Resource Book of Information and Guidelines for Action*. Amman, Jordan: Author.
Nunally, J. C., & Bernstein, I. H. (1994) *Psychometric Theory*. New York: McGraw-Hill.
Orr, D. (1992) *Ecological Literacy: Education and the Transition to a Postmodern World*. Albany, NY: State University of New York Press.
Rothblatt, S. (1995) An historical perspective on the university's role in social development. In D. D. Dill & B. Sporn (eds.) *Emerging Patterns of Social Demand and University Reform: Through a Glass Darkly*. Tarrytown, NY: IAU Press.
Royal Society for the Conservation of Nature (RSCN) (1994) *Dana Natural Reserve Baseline Ecological Survey*. Amman, Jordan: Author.
Schneider, S. (1997) Defining and teaching environmental literacy, *TRES*, Vol. 12(11), pp. 1-2.
Shriberg, M. (2002) *Sustainability in US Higher Education: Organizational Factors influencing Campus Environmental Performance and Leadership*. PhD thesis, University of Michigan, USA.
Sperber, A., Devellis, R. F., & Boehlecke, B. (1994) Cross-cultural translation: methodology and validation, *Journal of Cross-Cultural Psychology*, Vol. 25(4), pp. 501-524.
Sterling, S. (2001) *Sustainable Education: Re-visioning Learning and Change*. Bristol, UK: Schumacher Society.
United Nations Conference on Environment and Development (UNCED) (1992) *Report of the United Nations Conference on Environment and Development*. Conference held in Rio de Janeiro, Brazil, 3-14 June 1992. Chapter 36, 'Promoting education, public awareness and training', of this report is available online at: http://sedac.ciesin.org/entri/texts/a21/a21-36-education.html
University Leaders for a Sustainable Future (1998) A strategy to accelerate the shift to sustainability through higher education, *The Declaration*, June Issue, pp. 1-2.
World Commission on Environment and Development (WCED) (1987) *Our Common Future*. Oxford: Oxford University Press.

APPENDIX A

Questionnaire: Students' Awareness about Sustainability Issues

No	Item	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1.	Sciences and technology can solve any future food shortage problems.					
2.	To get along in the world, you need to think about yourself first.					
3.	I would like to always live in the town or city where my family lives.					
4.	The government takes care of poor people in my town or city so I don't need to worry about them myself.					
5.	People can get more done when they work together.					
6.	Sometimes we need to damage our town's natural areas to have the things we want (e.g., bigger houses and nicer neighbourhoods).					
7.	Living things can be taken apart and understood just like machines.					
8.	In order to feed ourselves now, we can't afford to think about our effect on the future generations in my town or city.					
9.	I feel a peacefulness outdoors that I don't feel in any other place.					
10.	As soon as I finish school, I would like to leave this town or city for good.					
11.	Being a part of my community is important to me.					
12.	I would like the natural areas in my town or city to stay the same as they are now.					
13.	The farmland in our area has its limits on how many people it can feed without being destroyed.					
14.	It bothers me when I see buildings in my town or city vandalised.					

No	Item	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
15.	I am afraid of encountering dangerous animals when I walk in the woods.					
16.	Part of the person I feel I am comes from living in this town.					
17.	I could get along without many of the things I own.					
18.	People who stay in the same town all their lives must not have much ambition.					
19.	I see nature as a community of creatures of which I am a part.					
20.	It's easy to get along without ever asking for your neighbours' help.					
21.	Scientists have the ability to understand someday everything about the natural world.					
22.	I feel a special connection to nature that is difficult to explain.					
23.	I would move away from this town or city to advance my career.					
24.	I think most of the concern about environmental problems has been exaggerated.					
25.	Knowing about environmental problems and issues is important to me.					
26.	A community's pollution regulations should not interfere with industrial growth and development.					
27.	I am concerned about the issue of deforestation.					
28.	More controls should be placed on industry and agriculture to protect the quality of the environment, even if it means that the things I purchase will cost more.					
29.	I believe that plants and animals exist to be used by humans.					
30.	I am not concerned about the rate of species extinction in the world.					