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Community-level environmental projects as learning tools for planners: a case study of graduate planning students

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Despite the potential environmental impact of urban planning, there is little research on Environmental Education (EE) in the context of urban planning curricula. This study follows graduate planning students' learning experience during group projects assigned as part of a planning course at the Technion – Israel Institute of Technology. These participatory projects, characterized as project-based learning and service learning, took place in several communities in Israel. We examined the types of learning impacts the projects engendered by analyzing the reported experiences of the students using parameters from the field of EE. The main goal of this research is to understand the contribution of such practical, hands-on project exercises to the course curriculum for inculcating environmental education themes. Findings indicate that projects helped students acquire and/or improve professional tools. They enhanced motivation to consider environmental concerns in their work and in some cases changed students' personal environmental behavior.

Keywords: environmental education; environmental planning; meaningful learning; project-based learning; service learning; urban and regional planning

Introduction

Environmental education (EE) aims to change behavior for improved environmental outcomes. EE for graduate-level urban planning students can contribute to environmental behavior in two ways. It can influence the behavior of students as individual citizens, as well as influence the future planning projects in which they will be involved. The latter influence can take place at the localized level (a street or a neighborhood), or on a larger scale. On a large scale, such learning may be on a city, district, or even national scale, especially in relatively small, centralized nations such as that within which the case study takes place.[1]

The current study focused on participatory projects, assigned as part of the course 'Introduction to Environmental Planning.' The course is a required graduate-level planning track course in the Faculty of Architecture and Town Planning at the Technion – Israel Institute of Technology located in Haifa, Israel. The projects required students to work on a community-based environmental problem or initiative. The study examines the influence of the projects on students. Specifically, it seeks to understand the contribution of such an exercise to the course curriculum for teaching environmental themes (i.e. reduction of environmental impacts from development;

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land use planning for sustainability; principles of solid waste management and water sensitive urban development, as described in the case study section), with the goal of determining what types of learning took place. Theoretical frameworks of EE and meaningful learning, together with the applied learning strategies of service learning (SL) and project-based learning (PBL), were used to conduct this study.

The first part of this paper describes the relationship between environmental education and participatory projects. Principles of SL, PBL and meaningful learning are described as types of participatory learning. We present these by covering the definitions and criteria of these concepts, the targeted benefits of their usage (e.g. unconscious learning), and possible impediments or challenges to their successful implementation. We then describe the case study and how it fits into the general planning curriculum. Following a description of the methods used for the research, we present results and discuss implications.

EE and environmental planning

Since environmental education emerged in the 1960s, research on the topic has centered on the premise that the provision of information and data was enough to create salient results (Hungerford and Volk 1990; Kollmuss and Agyeman 2002). Recent EE research focuses on how curricula can aid students in making informed decisions in their personal and professional lives and how it can develop student capacity and commitment to act in environmentally beneficial ways (Ernst and Theimer 2011; Martin et al. 2013; Stevenson et al. 2014). In this research, we direct these emphases to curricula for planning studies.

Urban and regional planners address various aspects of the human and natural environment where people live; they have the potential to make large-scale changes with significant community-wide effects (White and Mayo 2004). As a sub-field of urban and regional planning, *environmental planning* applies planning processes to environmental protection and environmental problem solving. It addresses human-environment interactions at numerous levels and scales, including natural hazards, human and environmental health issues, natural resource use and management and sustainable community design (Randolph 2011). Environmental planning coursework is included in most planning program curriculums and usually covers scientific and technical questions, pollution prevention and abatement, and resource protection as it relates to the planning context (White and Mayo 2004).

Over the years, research has shown that the supposedly linear process of influencing behavior through the imparting of knowledge as posited by the traditional EE approach, is not always successful (Hungerford and Volk 1990; Wals et al. 2014). Early on, in keeping with such conclusions, the 1978 Tbilisi Intergovernmental Conference on Environmental Education listed five objectives for EE that transcend the straightforward imparting of knowledge: (a) awareness of environmental problems; (b) sensitivity towards the environment; (c) values and feelings of environmental concern as motivation for active participation in environmental improvement and protection; (d) skills for identifying and solving environmental problems; (e) opportunities for active involvement in resolution of environmental problems (FICE Subcommittee on Environmental Education, 1978). These objectives are the basis for a convergence between EE and environmental planning education because the latter often calls for such sensitivities, awareness and active social participation (White and Mayo 2004; Randolph 2011).

Hungerford and Volk (1990) describe the environmentally responsible citizen according to the Tbilisi declaration as someone who has a basic understanding and awareness of the environment and its allied issues, has feelings of concern for the environment and motivation to participate actively in its improvement and protection. Furthermore, this person should have the skills to identify and solve environmental problems. Such a citizen would be actively involved in working towards the resolution of environmental problems. As such, the educating of such citizens requires four operational objectives: (a) Provision of sufficient information for ecologically sound decision-making; (b) Promotion of awareness of the consequences of collective environmental actions; (c) Imparting of knowledge and the development of skills that enable investigation of environmental issues and evaluation of potential solutions; and (d) Development of skills to a point that enables positive environmental action (Hungerford and Volk 1990). This practical side can be achieved, in part, through the addressing of planning problems.

A practical side to science is noted in relation to EE by Hodson (1994) who sees EE as having three major components: *about* the environment; *in* and *through* the environment; and *for* the environment. The goals of EE should thus be environmental awareness, environmental experience and environmental concern (Hodson 1994). These goals clearly echo those objectives mentioned by The Tbilisi declaration and Hungerford and Volk suggesting a 'hands-on' approach for environmental learning, one that can also serve environmental planning students and teachers (Roakes and Norris-Tirrell 2000; White and Mayo 2004; Randolph 2011).

EE and participatory projects (PBL and SL)

Two hands-on learning strategies or tools that can be used to achieve EE objectives in an environmental planning context are PBL and SL. Both involve participatory real world projects that encourage students to improve their academic, professional and/or knowledge-attaining skill base. Meaningful Learning, which focuses on learning retention, can be used as a framework to assess PBL and SL learning (Ausubel and Paul 2000; Van den Bor et al. 2000).

PBL aims to use projects as a means to enhance independent learning in a real-world context. For the application of this model, we adopt Jones, Rasmussen, and Moffitt's (1997) definition of 'projects' as complex tasks that are based on challenging questions or problems and culminate in realistic products or presentations. Projects help students learn how to work autonomously and develop independent abilities such as problem-solving. They also teach investigative and decision-making skills as well as cooperative learning and reflection (Diehl et al. 1999). This is especially true when PBL is used in a group setting (as in the current study) and as students learn from one another, while enhancing collaboration skills (Bédard et al. 2012). Problem Based Learning, an instructional method in which students learn from the solving of complex problems that lack clear answers (Hmelo-Silver 2004), is a similar concept often used with PBL (in which case termed 'PPBL'). By contrast, Project Based Learning considered in this study involves systematic teaching that engages students in learning knowledge and skills through an extended inquiry process that is structured around complex real-life questions and includes designed tasks and products (English and Kitsantas 2013).

According to Thomas (2000) PBL exercises must: (1) be central (not peripheral) to the curriculum; (2) include a question or problem that 'drives' students to

encounter (and struggle with) the central concepts and principles of the discipline; (3) involve students in a constructive investigation; (4) be significantly student-driven; and (5) be realistic (not purely hypothetical exercises). PBL's targeted benefits are improved academic achievement and perceived school 'climate,' with the latter contributing to 'youth' development and learning, productivity and satisfaction (Thomas 2000). PBL also includes a holistic approach that supports positive norms, values and expectations (NSCC 2014), and it fosters engagement and motivation among learners (Papastergiou 2005). Further benefits discussed in the literature include the combination of a better and deeper understanding of material, enhanced intellectual inquiry, character development, and community building (Udall and Rugen 1996). Also enhanced are 'soft skills' such as multidisciplinary problem-solving skills and the ability to work effectively in teams (Lee et al. 2014).

Some of the challenges for PBL are highlighted in a study that was conducted at the Arizona State University School of Sustainability. Researchers found that while problem and project based learning (PPBL) can be highly effective for higher environmental education (e.g. in university), it loses momentum if not conducted as part of a larger PPBL-based curriculum (Wiek et al. 2014). A suggested remedy would be for environmental education programs to have more cohesion, coordination, commitment and monitoring in developing PPBL training programs. This emphasizes the importance of study in PBL within the context of planning curriculums. Planning schools teach environmental sustainability, yet evidence of deep commitments to such endeavors, such as monitoring and research are in short supply.

SL is another – potentially complementary – form of participatory projects, relevant to environmental education for planning students. It is a form of experiential education, in which students engage in activities that address the needs of communities and receive opportunities designed to promote learning and development (Mintz et al. 2014). Classical education theory posits that the application of knowledge to social problems follows the completion of a person's studies. By contrast, the SL pedagogical method is based on students learning *while* they are engaged in service to the community. If applied effectively, SL may be structured to promote learning about the broader social issues that underlie the need to which the service is responding (Jacoby 1996; Kahne and Westheimer 1996). Two main SL models consist of the philanthropic approach and the civic approach. The first engages students by fostering a commitment to service that stems from a sense of gratitude to the community and from a desire to give back, usually dealing with overt needs of community members. The latter approach perceives a need for deeper analysis of large-scale political and social issues, and views learners as agents of social change (Speck and Hoppe 2004).

As is the case for PBL, reflection and reciprocity are key concepts of SL. Thoughtful reflection on the service rendered is intentionally designed to encourage learning and development. Reciprocity touches on the relationship between the service provider and the person or group being served; both sides are seen as learners and they both contribute to determining what the service task will be and/or how its results are shaped (Jacoby 1996; Kahne and Westheimer 1996; Mintz et al. 2014).

Among the benefits of SL is targeted reflection on the service activity. This results from SL being a formal course-based educational experience that addresses community needs. This combination helps students gain deep understanding of course content, a broad appreciation of the discipline and an enhanced sense of personal values and civic responsibility (Bringle and Hatcher 2009). SL is also

authentic and experience-based, providing motivation for students, as well as an opportunity for higher-order thinking in various environments (Kahne and Westheimer 1996). Moreover, SL is considered a powerful educational and social intervention tool that can, if designed correctly, lead to meaningful learning and skill development in students (McEwen 1996; Speck and Hoppe 2004).

One of the challenges to SL is that learning outcomes may not always be matched well to course objectives; at times, theory taught in the classroom is not sufficiently linked to student projects (Speck and Hoppe 2004; Mintz et al. 2014). One way to address this issue is through the careful articulation of course objectives with projects design accordingly (Mintz et al. 2014). Another problem may arise, particularly in the planning context, when project issues are limited by a local focus. According to Jacoby (1996) larger societal-level considerations are needed. These complementary topics (such as concern for issues of global poverty, international development, social institutions, capacity building, public policy, etc.) could be provided by other courses that make up part of the urban planning curriculum (Randolph 2011; Weimer and Vining 2011). Lastly, in order to achieve a transformative educational experience, SL must include reflection and critical examination as central components (Kahne and Westheimer 1996).

Meaningful learning and EE

There are many facets to meaningful learning, all of which describe the type of effective or 'deep' learning that will not 'go in one ear and out the other,' but will stay with the students and give them skills for the future (Ausubel and Paul 2000; Mayer 2002; Novak 2002; Maryon and Leather 2015). While having several variants and definitions, most authors agree that unlike rote learning (based on memorization and repetition), meaningful learning occurs when learners understand what they have learned and can apply it in the future. Rogers (1983) argued that the approach is less about passing on information to students than it is about teaching students *how to learn*.

Meaningful learning includes the following techniques: encouraging learner participation and self-responsibility; providing an atmosphere of trust nourishing curiosity; achieving results meaningful to and appreciated by the students themselves; encouraging self-initiated discovery; fostering originality and creativity; and aiding students to become life-long learners. By enhancing ability to experience and explore his or her own processes, the instructor raises the learner's awareness for meaningful inquiry (Rogers 1983).

Despite being a somewhat dated concept, meaningful learning has been readily and recently adopted by the Israeli Ministry of Education as the recommended learning mode. Education Minister Shai Piron announced a new reform in 2014 called 'Israel moves up a grade: Moving on to More Meaningful Learning,' which includes, among other steps, the decision to promote the use of PBL (Ben-Sasson 2014; Israeli Ministry of Education 2015). We contend that the concept of meaningful learning is relevant to environmental planning education due to its practical nature, as planners have the ability to promote real-world, large-scale positive environmental change.

Widely-accepted paradigms of EE share characteristics of meaningful learning and meaningful learning has been applied to studies within the EE field (e.g. Johnson and Mappin 2005) and for higher education (e.g. Jayeola-Omoyeni 2013).

For example, Posch (1991) argues that EE should develop qualities in students that allow the latter to critique, construct and act with a high degree of autonomy and self-determination over time. Yet, the concept of meaningful learning has rarely been applied to the study of environmental planning education (White and Mayo 2004) with the closest application being Wals and Jickling's (2002) tying of meaningful learning to 'education for sustainability.'

In the context of long-term and skill-providing EE, Wals and Jickling (2002) propose enhancing student competencies in order to enable students to cope with uncertainty, poorly defined situations and conflicting or diverging norms, values, interests and reality constructions. Meaningful learning integrates new elements, knowledge and insight with the learners' current knowledge base, thus enhancing their ability to successfully solve problems in new situations (Rogers 1983).

Similarly, Van den Bor et al. (2000) suggest that in order to teach about sustainability in higher education curriculums, it is necessary to create opportunities for teachers and students to embark on new ways of teaching and learning. These should pre-suppose problem orientation, experiential learning and lifelong learning, and include moving from consumptive learning to discovery learning. Most important is the idea of transitioning from teacher-centered to learner-centered arrangements, from theory dominated learning to praxis-oriented learning, from sheer knowledge accumulation to problematic issue orientation and from institutional staff-based learning to learning with and from outsiders (Ausubel and Paul 2000; Van den Bor et al. 2000; Novak 2002). Many of these elements can be taught through the use of out-or-classroom ('real-world') participatory projects (Mintz et al. 2014).

The principles of meaningful learning mentioned above correspond with the 'hands on' approach that forms the basic tenets of PBL, as well as those underlying SL. They can therefore be used as a framework for examining student projects for this study. We adopt the framework of meaningful learning to determine how students learned through the use of participatory projects based on its importance to EE. By combining the goals of meaningful learning from the Tbilisi Declaration (1978) and Hungerford and Volk (1990) we developed five 'layers' of learning, as described below.

The case study

The 'Introduction to Environmental Planning' course for graduate planning students that took place in the fall semester of 2013–2014 at the Technion – Israel Institute of Technology serves as a case study. This mandatory, 13 weeks, two-hour a week course teaches theories and practice of environmental planning. It covers a broad range of subjects, each taught in a one-session overview manner. Aside from the assigned projects which are the subject of this analysis, the course requires reading theoretical and professional articles, active participation and passing an exam. Although this course has been taught in the past, this was the first time that the course focused specifically on themes connecting between environment and community, which led to development of the class projects. In conjunction with the goals of meaningful learning, these projects were intended to encourage student responsibility and self-initiated discovery, foster originality and creativity, and give students the tools to become better planners.

The course, required during the first semester of their Technion planning track studies, is designed for students that have not taken environmental studies courses; those that have are exempt from the course. The course starts with lectures on environmentalism and environmental ethics. Subsequent lectures provide a survey of environmental planning-related topics. Topics covered are demography and its environmental impacts; land use planning for sustainability; solid waste management; water resources management; and perspectives on environmental impact assessment. Three subjects are covered in a lecture presented as environmental challenges particular to the Israeli context. Themes infused throughout the course, at times overtly and at others as subtext, included principles of integrated management, environmental justice, sustainable development, the precautionary principle and public participation.

Around mid-semester, students ($n = 27$) were directed to form groups of 3–5 members. Each of the resulting nine groups chose an on-going community-level environmental project according to the group members' inclinations and interests. Project choices required approval of the teacher or the two teaching assistants, who also gave the students guidance and answered any questions they may have had. The students were asked to contribute to the chosen community project in some way, using any known planning skills and the theoretical knowledge they had acquired during the course. Students were required to describe the environmental problem, community actions, and connections between stakeholders and to offer possible solutions. Involvement that could assist or promote the community's environmental interests was encouraged.

Each group gave a presentation on the project to the class and submitted a 20-page report explaining the project and focusing on links between the course material (i.e. theoretical materials taught in class and the academic articles included in the syllabus) and the chosen project (Table 1). Presentations made to the class provided some opportunity for discussion of how the project unfolded, but this occurred once the projects were more or less complete. Students were expected to communicate directly with community stakeholders, tour and photograph the project location, and in some way serve the community. In their presentation and reports[2] students were instructed to describe their participation in the project.

The nine projects varied in type, scale and manner of participation, although all of them included meetings with stakeholders, looking up plans and maps, and writing a set of final recommendations. Some projects took place in urban settings and others in rural ones, some in Jewish communities and some in Arab or mixed Arab-Jewish ones. For the most part, students chose active preexisting projects, each related to a different environmental problem (i.e. waste management, air pollution, ecotourism planning, etc.). For example, a group that chose the neglected Medatech Garden as its focus, researched its history and procured the original and current plans and photographs of the Garden, toured the garden and arranged for a public participation event with activities intended to connect residents to the garden. During the event, residents were asked to post (on a bulletin board) what they wanted the garden to provide.

As mentioned, Introduction to Environmental Planning is a core course of the curriculum. It is designed to give students that have not had environmental coursework (defined as *not* having taken *more than* one course on general environmental subjects, such as environmental quality concerns, earth science, natural resources, environmental institutions, etc.), an understanding of how planning is applied to

Table 1. Description of participatory community projects.

#	Title	Planning-related topic	Community services/products
1	Public participation in the Madatech Garden, Haifa	Green (public) spaces, community gardens, public participation	Public participation event at the garden to raise awareness among community members (to improve the state of the garden, neglected at the time)
2	Community battle against the electrification of the train line, Haifa	Transportation, sustainable energy, visibility, public participation, coastal planning, environmental justice	Pole of residents' views regarding the electrification in Bat-Galim neighborhood, Haifa
3	Recreational vehicle traffic, Tzipori Creek (near Ras Ali Bedouin settlement)	Open spaces, eco-tourism, traffic planning, noise pollution, air pollution, regulatory void	Contacting council persons and promoting the creation of a forum or roundtable of adjacent city councils on the matter
4	Waste management and planning in Qiryat Yam	Waste management planning, recycling, environmental education	Lesson plans for elementary schools on waste and recycling
5	Community-based environmental tourism in Gisr a Zarka	Eco-tourism, coastal planning, environmental justice	Recommendation paper for eco-tourism in Gisr a Zarka
6	The Israel Trail as an anchor to socio-economic change	Eco-tourism, eco-trails, environmental justice	Recommendations paper for integrating the cross-country trail (passing through the village) with current and potential local businesses
7	Recycling in Kibbutz Lehavot Haviva	Waste planning and management, recycling	Monitoring (successful) recycling efforts of the recycling pilot program in the Kibbutz
8	Environmental and community influences of a new housing project in Givat Zemer, Haifa	Open spaces, residential planning	A recommendations paper, including criticism and suggestions regarding the current struggle of nearby residents
9	Kfar Maserik pollution – community activism	Environmental justice, pollution, environmental activism	Gathering data regarding pollution levels and sending them to the polluting companies. Establishing a Facebook™ page for the community opposition to the pollution of the area

environmental problems. Since the goal of this research is to understand the contribution of participatory projects for inculcation of EE within urban and regional planning curriculums, analysis of students' perspectives on their participation in class projects was deemed appropriate for the task at hand.

Methods

We applied the five-layers of meaningful learning (described above) to assess the types of learning that took place and the effect of the participatory projects on the students' learning experience, using a two-stage mixed-methods approach. We incorporated closed-ended ranking (quantitative) surveys (hereafter 'surveys') followed by one-on-one in-depth (qualitative) interviews. The surveys were filled out by the students during the last session of the course, whereas the interviews (of 10–20 min) took place more than a month after the course ended.

Answers to the short six-question survey ranked the students' perceptions of how the projects' influenced their understanding of the class material (Table 2). In the survey, filled out anonymously, the students indicated their general perceptions of the projects' contribution to the community and to the understanding and awareness of ecological-social (eco-social) issues. Students also ranked the projects' expected influence on their future work as planners.

Eighteen students filled out the survey, and eight students participated in the interviews. For both the surveys and the interviews, participation was volunteer-based and not all students participated. In-depth interviews were designed to provide a deeper look into educational experiences shared by the students[3] and to obtain greater understanding of their learning experience. Also, the fact that only 18 of 27 students submitted their questionnaire made interviews necessary. We treated interview answers as texts and analyzed them using thematic analysis; we asked participants to recount their experiences and opinions regarding their participation in the project and its benefits (or lack thereof). As guidance, similar questions to those of the questionnaire were asked, and the interviewees were requested to elaborate (if the answer was 'yes') or to explain the reasons for their answer (if it was 'no').

Thematic analysis is widely used in qualitative textual analysis and especially in interview analysis to identify and report patterns and themes as relevant to the

Table 2. Questions[a] asked in the survey.

No.	Overall objective	Wording[b]
1	Understanding of general course materials	Did your involvement in the participatory project contribute to your understanding of the material studied during the course?
2	Contribution to the community	Did you feel you contributed to the community of the environment with your participation in any way?
3	Interest in future projects	Would you like to participate in environmental community projects in the future?
4	Awareness of 'real life' project characteristics	Did your experiences in the participatory project cause you to be more aware of the manner in which environmental community subjects are expressed in real life?
5	Environmental considerations for the future	Did your active participation contribute to your willingness to integrate *environmental* considerations in your future work and studies as planners?
6	Community-related considerations for future	Did your active participation contribute to your willingness to integrate *community-related* considerations in your future work and studies as planners?

[a]Possible answers on a scale of one to five were: 1 = Not at all; 2 = To a small extent; 3 = To a medium extent; 4 = To a large extent; 5 = To a very large extent.
[b]Translated from Hebrew.

research question (Braun and Clarke 2006; Fereday and Muir 2006). It involves several steps once the data is collected, including the collection of quotes, generating short descriptions, organizing the information and searching for (recurring) themes thus identifying the meaning of the codes (Aronson 1994; Braun and Clarke 2006). Approaches employed to analyze codes can be theory-driven, inductive, bottom-up or be the result of prior-research driven codes (Boyatzis 1998).

For our study, the codes, and subsequently the themes and patterns, were derived bottom-up by the researchers' analysis of the data. We based interpretations on an examination process, searching for reoccurring themes of and types of learning gained from the projects or activated by them. Questions were designed according to the five EE objectives. These are derived from of the Tbilisi Declaration (1978) and also to Hungerford and Volk's (1990) four levels of EE goals, which together comprise the following list of five EE learning categories:

(1) Internalizing theoretical material
(2) Learning or enhancing future working tools
(3) Raising awareness to eco-social considerations
(4) Increasing student motivation to include environmental considerations
(5) Changing environmental behavior

These categories were also used to frame the discussion of the findings, including the reported types and sub-types of learning that had taken place following students' participation in the projects.

Findings

Data from the 6-question surveys (see Table 3) provided initial preliminary insight into the students' perceived learning process and as such, informed the subsequent in-depth interviews. We first present a short summary and analysis of the survey responses and then describe and interpret finding from the in-depth interviews.

Survey

Survey responses showed that on average students felt that their participation in the project contributed to understanding of the material taught in class, although only 'to a medium extent.' Students' also indicated that they felt their contribution to the community was limited (the lowest of all 6 parameters). This was disappointing particularly because the projects were defined as participatory and because the question used the wording 'in any way.' One of our conclusions, based on informal student

Table 3. Data collected from surveys (see question phrasing above).

No.	1	2	3	4	5	6
	Contribution to understanding	Contribution to the community	Interest in Future Projects	Awareness	Environmental considerations fur future	Community-related considerations
Avg	3.235	2.588	2.824	3.765	3.176	3.118
SD	1.33	1.16	1.18	1.13	0.50	0.94

comments, was that this was due to the short amount of time (only one semester) allotted for the project and this was in addition to other work for the course. When considering the short amount of time spent on the projects, a score of 2.5488/5 could be interpreted as a relatively high sense of contribution.

Survey data indicates that students were moderately interested in participating in similar projects in the future. Some students may have been more interested in community and environmental issues to begin with and therefore the project did not change their position.

The highest score was received for the question about whether the students felt that the project helped them become more aware of the manner in which environmental subjects are addressed in 'real life' and therefore, the most observable contribution of the projects to students' learning. The answer indicates that despite its limits, this type of participatory project was substantial enough to give students the sense that they had learned about the way things actually *are* rather than only how they are supposed to be.

Most students had the same or similar answer to both of the last two questions pertaining to whether the project enhanced their willingness to integrate both *environmental* and *community* considerations in their future work and studies. Students indicated obtaining a heightened awareness of the importance of environmental issues, especially in terms of their prospective professional field. They also felt, on average, that their participation in the projects contributed to willingness to include community-related considerations in their future work to a medium (or slightly above medium) extent. These two questions relate to the EE elements of acquiring information, enhancing sensitivity and promoting future action. We focused on these two points in the in-depth interviews.

To conclude, from the surveys we learned that while the students' sense of contribution to the project was rather low (2.588), their perception of the level in which they became more aware of how environmental community subjects are expressed in the field was on average higher (3.765) than any other perceived influence about which they were questioned. Also of note is the focus on the students' perceptions of how the projects influenced them even though results can be understood only as indicators of the students' learning process rather than indicators of causality between their participation in the project and results of that participation. Quantitative data collected from the surveys was limited due to the number of responses and the lack of a control group. These limitations led to the bulk of our findings being arrived at through the in-depth interviews.

Interviews

The interviews yielded several insights, particularly in regard to the connection between the projects and the class material. They also indicated improved skills, increased awareness of eco-social considerations, professional orientation and behavioral changes.

Connection to class material

Generally, with the exception of one student from among the eight who participated in the in-depth interviews, all of them felt that they had learned a lot from the lectures and they reported that they remembered the relevant material well. However,

when relating class material to the projects, most students began the interview by saying that they felt that the participatory project by itself did not help understand the material. One student (Interviewee 1; hereafter 'Int.' 1), when asked generally what she felt she had learned from the participatory project, initially answered: 'Frankly? Not a lot.' Interestingly, her teammate had the opposite response and elaborated about all the things she had learned. In fact, Int. 1 also gave very different statements as the interview progressed. Others said that the project only helped them learn something about a very specific subject in the field of environmental planning. Still others stated that the project was a focused and 'deeper' learning experience that caused them to remember and to want to use what they had learned in the future.

Some comments were:

> My project was narrow and touched only on lesson three [on waste management] and [name of guest lecturer]'s lecture and two more assigned articles. [Int. 5]
>
> Some of what we learned is only relevant to Tzipori Creek. Not everything can be principles and theories [learned in the course] that are expressed [in the field]. [Int. 4]
>
> I think that a connection was lacking between the theoretical material studied in class and the project. [Int. 6]

As the interviews continued, it seemed that most students felt they had in fact improved their understanding of class material and that they had internalized it following the project, albeit without being fully aware of this. For instance, Int. 1, who had initially answered 'not a lot' when first asked what she learned from the project, went on to say the following about working with representatives of a local sustainability committee:

> What really makes a difference is meeting these people who have this thing in their blood, and they have some effect on your consciousness, which is beyond the learning process. The connection to those who are dedicated 'crazies' is something very significant for the internalization process. [Int. 1]

Other perceptions regarding the extent to which the theoretical material taught in class was 'internalized' due to the participatory project experience were mixed. Some interviewees felt that the project helped them understand the importance and impact of real-life community environmental planning issues presented as theoretical materials in the class lectures, even to the point where the projects could replace the lectures (e.g. Int. 5). Other students felt that their project helped them understand a very specific or narrow part of community-environmental planning. Some students felt that they had not learned much in regard to environmental planning but had learned about community planning. The following quotes demonstrate these different perspectives, respectively:

> The project made me go over the material, get in and work more thoroughly on the syllabus and not necessarily only things for the test and think what I can do. It's like it activates more things […]. [Int. 8]
>
> In general, I think [the project] really exposed me to the whole environmental subject. Of course I was aware of it but it's not the same as when you go into details … I got into the world of waste and recycling, and so I delved into that and discovered how important it is …. [Int. 3]
>
> Let's just say that it's much less scary now, I mean this subject [environmental planning] is already much clearer and much less intimidating. [Int. 5]

Two interviewees (Int. 2 and 8) felt that the project was connected very loosely or did not connect to what was taught in the classroom, despite receiving other types of knowledge from the project, especially in terms of working with communities. These students were not from the same group and their team mates, who were also interviewed, did not express the same sentiment. Therefore, we can conclude that the perception of connectivity between the project and academic materials taught in class does not necessarily depend on the objective nature of the project or the team.

Skill development

All the interviewed students said that they had developed or improved upon some skills that they believe are relevant to their future work due to their participation in the project. They mentioned the following tools:

(1) Mapping a problem and its stakeholders
(2) Assessing how projects look to the residents and to the local government
(3) Addressing real-life complexity and obstacles to planning
(4) Getting information from people
(5) Implementing integrative planning
(6) Assessing human behavior regarding environmental issues (which solutions might work and which would not)
(7) Reading and understanding plans, maps and laws
(8) Synthesizing different types of information, including theoretical

Interestingly, each student felt that he or she exercised different skills than other students and even other team mates (though with some overlap), suggesting that the specific team or project were not a determining factor in tool development. Some excerpts are:

> This mapping of stakeholders and the mapping of a problem in time and space – although it's the first time I have done this it is definitely a contribution of the project. [Int. 4]

> I think I gained an understanding of what projects look like in the field for the residents and the local government. We saw how they saw things and we understood what the different hurdles are, and what the intriguing points are. [Int. 2]

> I discovered all the 'green' websites and all the government and public [servants] that deal with the subject. […] I learned how to get information, how to talk to the people we met with … You learn what to ask, what is relevant and what is less relevant. [Int. 3]

> As far as tools go, it's through mapping stakeholders and plans […] that you finally understand that it's about people, whether it's public participation or understanding their needs for practical reasons, since you want your plan to be realized in the end … It's very clear from our project […]. [Int. 4]

> [I learned] how to work with the people. [I got] some experience with talking to stakeholder groups and gathering information from them and also their needs and wants, and then thought how I can finally construct something that can help them implement. [Int. 8]

Awareness of eco-social considerations

All interviewees felt that the project raised their awareness of eco-social consideration (environmental or community issues) such as shared open spaces or sustainability.

> As far as […] sustainability is concerned, it's something that really penetrated me powerfully. It's not just the environmental issue, it's thinking about the next generations. I mean, these things … I didn't think about them before. [Int. 1]

> It [the project] contributed, of course it did …. because the more you are aware of it [environmental issues] the more you understand the consequences of every little thing. [Int. 3]

> [The project] helped me come full circle, to see things in a much more global and broad level. And it did close a circle. […] It started with the world, went on with this [recycling] … and ended with my little girl. [Int. 5]

Int. 5 above explains how she became aware of the fact that recycling has ramifications on both a personal and a global level. She also relates to how personal actions (i.e. recycling with her daughter) influence both the world and potentially, on an individual level, her daughter.

Professional orientation

When asked about their interest in continuing to work on environmental problems as planners and infusing environmental perspectives in their work all but Int. 2 responded positively. Some students said that the project reinforced their interest in environmental planning work.

> I will definitely [include community and environmental considerations in my work] because I feel it is a critical part of planning, I mean I already came from that place. […] it was strong from the beginning but I think the project gave it another pat on the back. [Int. 6]

> [Following the project,] I would be happy to work in an environmental planning firm if I had the chance. I would like to do something that has a positive effect. [Int. 3]

> [After participating in this project,] I sometimes go into the council's website to see bids [job postings] … a green or environmental orientation definitely interests me. You know, what I have [as background] is nothing, just this introductory course …. [Int. 5]

Some said that although it is important to have environmental planners, they themselves did not specifically want to be environmental planners. The inclination to pursue environmental planning projects was not found to be related to a specific project or team, as members of the same teams gave different answers to this question. All interviewees indicated their intention to include environmental concerns in their planning.

> I have a better understanding of why we need an [environmental] survey and I can read that survey better. So as far as understanding consultants, getting the idea about what that consultant is babbling on about, that it's not just babbling but that there's something behind it. I think that this is very important. But I'm not looking for a career change. [Int. 5]

> Today when I look at a project I look at it in that [environmental] view too, it goes in there and I understand the need for that. [Int. 1]

> Let's say that when I went to study for my degree I knew I had some directions that interested me and environment wasn't one of them. […] And [the project] made me see that there are points that do interest me in this area of expertise, […] things in urban planning and regional planning that I can see being expressed here [about the environment] that before [the project] I didn't see. [Int. 7]

All interviewees said that they now understand the need to include community considerations in planning and that they plan to do so in the future. Some described changes in their level of interest that may lead to additional community-level environmental related work.

> The subject of community gardens was new to me and the project gave me the urge to do something. Now we have this initiative, […] it's to start cultivating our garden in the building, and it just connected for me. [Int. 6]

Behavioral changes

Others indicated overall changes in daily behavior. In addition to influences on a professional level, students reported on changes in their personal behavior, indicating having undergone a process of internalization. Behaviors changed in the area of diet (becoming vegan), recycling, looking for environmental or community planning employment, participating in community gardening and activism.

> I suddenly made recycling bins in my house and bought a hybrid car, I stopped eating meat and milk – […] [because] their entire direction harms the environment. There's something that penetrates when you go into the 'guts' of a project, you get infected by other people's work, by other people's enthusiasm. [Int. 1]

> I, for instance, don't come from an environmental background at all, and suddenly I met all those 'green' groups [because of the project] and I really felt like seeing what they do. I joined Megama Yeruka [a student environmental group], and it opened another channel for me that I never dealt with. […] I'm interested, I follow them. [Int. 8]

Otherwise, the interview results suggest that most students felt that the project helped them understand materials taught in the class or included in the required course readings. Also, the project participation was perceived by the students as beneficial to the community, which strengthened their willingness to work on environmental and community projects in the future. Another important, meaningful learning-related point concerns the changes in behavior immediately following students' project participation.

Students' awareness of the extent of learning seems to have increased during the interview process. This conflicted to some extent with the data received from the surveys, which suggested a more moderately perceived understanding of the material. Several interviews began with the participants claiming that they had learned very little from the project and then continued with information that contradicted that claim, suggesting 'unconscious' learning. Interviews also revealed that the students felt they needed to spend more time on the project and that a more frequent discussion of group projects in class would have aided them in internalizing the knowledge and tools learned.

Discussion

We discuss here the students' learning experience through the prism of meaningful learning while focusing not only on the EE goals achieved by the students, but also

on more specific goals particularly relevant for urban planning. First we address whether these participatory projects can be considered PBL and SL exercises according to the literature, thus analyzing (albeit to a limited extent) the nature of the projects. Then we discuss the types of learning that were achieved according to the aforementioned five EE categories.

The projects fulfilled Thomas's (2000) standards for PBL because they were indeed a central part the course curriculum and they included a driving question or problem phrased by the students which lead them to work with the central concepts and principles of environmental planning. Further, the projects involved students in a constructive investigation both as a group and as individuals, were by and large student-driven and had their own independent existence (Thomas 2000). The projects met criteria suggested by Jones, Rasmussen, and Moffitt (1997) and Diehl et al. (1999) including the exercise of tasks through autonomous work, the application of diverse skills, problem-solving, option investigation, and decision-making.

As expected for SL exercises, the projects enabled students to engage in activities that addressed community needs and contained structured opportunities intentionally designed to promote learning and development (Mintz et al. 2014). Through their projects, students pursued both philanthropic and civic approaches as categorized by Speck and Hoppe (2004), although some did more of one than the other. Both students and community were learners, therefore infusing 'reciprocity' as described by Jacoby (1996).

Students' reports and interviews indicate that they had learned about the community members' situation and received information from them, while also sharing insights, planning knowledge and recommendations with the community members. Finally, the students' recounting of the tools they felt they acquired suggest that the projects enhanced student competencies for coping with uncertainty, vagueness, divergence and conflicting values, all SL criteria suggested by Wals and Jickling (2002). Projects also promoted the understanding of broader social and environmental issues which are suggested objectives for SL (Jacoby 1996; McEwen 1996), through for example, the exposure to conflicts between local and regional or national priorities (e.g. as evidenced by the limited resources provided by central government for local infrastructure).

In regards to the bulk of the analysis – the achievement of meaningful learning – analysis we proceeded with caution. Meaningful learning occurs on a continuum between rote learning and deep (meaningful) learning. There is usually not a simple 'Yes/No' answer to the question: 'Did meaningful learning occur?' This is because the location on the continuum depends, among other factors, on the nature of the knowledge possessed by the learner beforehand, and the level of effort to integrate between new and old knowledge. It can also be hard to identify a direct contribution of specific teaching techniques to meaningful learning (Novak 2002). We had to keep this in mind when considering whether theoretical material had been internalized.

We identified a pattern related to the differences between (a) the survey results and the responses to initial interview questions, and (b) the students' comments in the in-depth interviews as each one progressed. Students initially answered that they did not feel they had learned a lot regarding environmental issues, or that they had only learned about one particular subject at the focus of their project. However, during the interviews students actually made their own connections between their project and other environment-related issues, suggesting a subdued level of learning

awareness. Studies of unconscious learning have demonstrated that it is an integral part of the learning process, and that unconscious mental representations enable rapid mental integration of information, which then, in turn, supplies information for conscious processing (Evans 2008; Kuldas et al. 2013). Information and learning that have to do with social and behavioral changes have been found to be particularly linked to unconscious processing or learning (Wilson and Dunn 2004; Bargh 2006; Evans 2008).

Half the interviewees ($n = 4$) made a dichotomist distinction in their interviews between community and environment and said that the project taught them more about community planning than environmental planning. Yet the reports had references and links between the work they did on the project and environmental planning issues, including references to similar cases around the world that stressed environmental concerns and topics. Most reports also had plans and maps of the areas in question, and included an analysis of these spatial products. This together with interview responses suggests that the students had produced products that showed a high level of understanding and awareness of the environmental planning issues relevant to the case study they had chosen.

All the interviewees said that they had developed or improved *future working tools* that they perceived as relevant to environmental planning owing to participation in the project. Several students mentioned application of the same skills as students working on other projects. The skills and tools that the students felt they had learned were not included or measured in the surveys, and therefore, aside from the reports, interviews were the only source of information regarding this part of the (perceived) learning process. Interview answers demonstrate that the participatory projects contained several challenges or, alternatively, learning opportunities; they required the use of several academic and professional tools (mentioned in the findings section), some general and some specific to the planning field.

As for the measurement of perceived *awareness to eco-social considerations*, participants reported that their environmental awareness had increased due to the projects. They indicated that this was either due to the need to understand and analyze class materials on a deeper level, or – as most said – because they saw how environmental matters influence the community. Further, they reported relating to and empathizing with the community members and activists that they got to know during their work on the project.

In regards to *motivation to address environmental considerations*, there was discrepancy between survey and interview results. In the surveys, students indicated a similar amount of interest in community-based issues as they did to interest in environmentally-based ones (3.118/5–3.235/5). In the interviews, all but one student said that the project led them to want to be involved in environmental planning in the future and all agreed that this experience caused them to want to address environmental aspects of planning projects. This response links to unconscious learning which has been found to be particularly conducive to influencing behavior and motivation (Bargh 2006; Evans 2008; Kuldas 2013). Logically, the open-ended interviews would be better able to identify such ‘deeper’ types of learning than the surveys.

All the interviewees reported that close contact with the community members involved in a plan, a conflict or a struggle created the most motivation for incorporating community-based considerations in planning. Interviews showed that students who reported that they identified with the cause, also felt that they had learned more

about the subject they explored and showed a better understanding of the planning issues at hand. Although our research did not include an analysis of the reports themselves systematically, they suggest that students became involved with the community effort and even identified with it. One indication of this was that students used the word 'we' instead of 'they' when describing their involvement with stakeholders, thus indicating identification with the latter. However, identification stopped short of encouraging (most) students to become involved *exclusively* in environmental planning issues. Some interviews demonstrated that student motivation grew in regard to their interest in community planning issues over environmental planning issues and concerns. However, this could be due to some of the interviewees' desire to make a clear differentiation between community (social) and environment ('eco') considerations, even when the two coincide.

Finally, interviews suggest that projects contributed to the ultimate EE goal *change of personal and professional environmental behavior* (Hungerford and Volk 1990; Kollmuss and Agyeman 2002). Half of the interviewees reported an active change in their own personal environmental behavior due to their participation in the project. This is despite the fact that the course was mandatory, lasted only one semester, and students only worked on the project for part of that semester. However, three of the four interviewees who did not report any change in their behavior said that following their project experience they now planned to include environmental considerations in their current or future work as planners. Such changes seem to echo the internalization and meaningful learning experienced by the others.

Conclusions

Participatory projects that involve planning students in community environmental initiatives have clear advantages highlighted by this research. Overall the projects contributed significantly to several types of meaningful learning, as judged using the five-layer framework for analysis presented herein. Class projects raised planning students' awareness regarding environmental considerations in urban and regional planning, and helped them be more sensitive to community needs. Meaningful learning experiences supported by the participatory projects included obtaining information from stakeholders, officials and other sources; evaluating community projects and actions; implementing environment- and community-based considerations, and more.

To extract useful insights about students' learning, the use of short multiple-choice surveys is limited; such surveys did not encourage the students to think deeply about their learning experience, while open-ended, in-depth interviews did. Analysis of interview responses revealed that the specific project or team was an important factor when it came to the perception of the level of relevance of the project to the class materials but had little effect on other desired outcomes such as awareness of environmental considerations, motivation to consider environmental issues in future work, and the changing of environmental behaviors. As study examined a very small number of project teams, it would be helpful to further explore the importance of specific projects (their topics, location, population etc.), as well as group membership (i.e. influence of interaction with other group members), with respect to achievement of EE goals.

Additional research could be conducted on a larger scope, using a control group of students that participated in the same course but did not take on a project and/or

with paired one-to-one before and after analysis. We also propose that the environmental background of participating students be known, via a two-phase questionnaire, in which students are asked about their environmental behavior and positions before and after their participation in the project. Finally, similar educational efforts should aim to make students more conscious of their learning (e.g. through in-class reflection) so that they will seek out similar opportunities for it.

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Notes

1. The area of Israel is approximately 21,000 km^2.
2. The full reports were published online as a collection (in the original Hebrew), and are available at: http://portman.net.technion.ac.il/files/2014/03/%D7%90%D7%A1%D7%95%D7%A4%D7%94_13.05.2014.pdf.However, because their length is approximately 20 pages each, it was not possible to include them here as appendices.
3. Interviews have been found to be highly useful in assessing EE learning experiences (Rickinson 2001; Seidman 2013).

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