Students Teach Pupils Environmental Issues and Renewable Energy

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Abstract. Technological advances and accessibility to information on the internet have opened a new channel of pupils that are being taught by students throughout the country. Students, full of motivation and a will to learn and teach, have understood that this way is good for them – enabling them to profit from a side job and take advantage of the knowledge they have accumulated in their degree. Holon Institute of Technology ("HIT") developed a new program at the Faculty of Electrical Engineering. The Renewable Energy program gives the students technical and practical aspects of energy use (technology and methodology of the study) and energy efficiency. The program also deals with minimizing the environmental impacts of energy use, as well as with energy economy and environmental policy. The entrance of students to the field of teaching pupils while still in their studies brings many advantages, such as: fresh knowledge, motivation to teach, and innovative, out of the ordinary methods that arouse interest in the pupils and intrigue them.

1. Introduction

Technological advances and accessibility to information on the internet have opened a new channel of pupils that are being taught by students throughout the country. Students, full of motivation and a will to learn and teach, have understood that this way is good for them – enabling them to profit from a side job and take advantage of the knowledge they have accumulated in their degree.

The students are divided into two groups – students that teach classes of pupils and give lectures within their studies and students that teach private lessons to groups of pupils and individual pupils.

On first sight, it seems as though it would be better for a pupil who has difficulties to take private lessons with a qualified, veteran teacher that would surely be able to teach him well. However, this is not true. Professional teachers, especially veteran ones, normally use fixed teaching methods. Pupils that have had difficulties in school will continue to experience difficulties also in private lessons, if the teaching methods are similar. In contrast, students bring new, fresh teaching methods, which assist the pupils more.

In addition, students are closer in age to pupils, therefore they may be more able to connect to them and understand them. As part of a social involvement project in which we participate in "Revivim" school in Holon, the students required to teach pupils about the fields of Environmental and Renewable Energy academic advisor Dr. Hen Friman.

We have decided to research teaching by students against teaching by teachers, and to examine it by means of the pupils’ attention in class and their achievements in virtual quizzes we have conducted. We felt that we had succeeded to intrigue and arouse interest in the pupils by using different, unique teaching methods. The pupils, for their part, responded with excitement and participated throughout all
of the activity hours. In addition, significant improvement was seen in the knowledge they have accumulated from the initial quiz to the final quiz.

In conclusion, the entrance of students to the field of teaching while still in their studies brings many advantages, such as: fresh knowledge, motivation to teach, and innovative, out of the ordinary methods that arouse interest in the pupils and intrigue them. On the other hand, teachers have greater experience, a connection to the Ministry of Education and the required material, and teaching experience.

2. HIT – Holon Institute of Technology

HIT – Holon Institute of Technology was established in 1969 and became an independent public academic institution of higher education in 1999, certified by the Council of Higher Education of Israel. HIT focuses on the teaching of sciences, engineering, computer science and technology, management of technology and design. It also emphasizes multi-disciplinary theoretical and practical research of innovative technologies from a professional scientific, economic and cultural perspective. HIT trains highly qualified students in the realms of science, engineering, management and design, and plays an important role in their integration upon graduation into key positions within the industry. HIT aspires to quality and excellence in teaching and innovative research, and strives to introduce novel and unique cutting-edge teaching and research technologies. HIT also prides itself on its advanced academic achievements, application of innovative techniques and interdisciplinary professionalism that lead to creative teaching and new technologies. HIT aims to utilize the intellectual and professional potential of each and every student, so that they can fully integrate into the fast-paced technological world of today. Providing superior technological and scientific education enables HIT graduates to enter key leadership positions in both the private and public sectors.

2.1. Faculty of Engineering

The last decades have been dominated by the rapid changes introduced by the technology revolution, which has a tremendous influence on our daily lives. Today we are facing a myriad of new challenges. Technology-based industry has matured in many ways and the required skills for future engineers are much more complex in a world where "machines/computers" execute many of the engineering tasks. Most of all, we are facing a new generation of sophisticated students, who were born into the digitized/multimedia world. The mission of the study program is to encourage and initiate academic development, through the development of new study programs and methods, while being responsive to the rapidly changing trends in the field. The proper education of the undergraduate students must also be a function of market needs and predictions of how technology will develop in the foreseeable future.

In order to ensure that our graduates are well qualified to meet the future needs of the market, meticulous attention must be paid to maintain a high standard in the fundamental courses and impart practical tools and skills. It is also important to introduce a wide variety of new subjects. The aims and goals of the Engineering faculty are to provide the students with a rich and comprehensive study program, and keep the study program updated to meet the ever-changing requirements for engineers of the future, enrich the student’s theoretical knowledge as well as teach practical and design skills and knowledge; adapt its teaching methodologies and techniques, focusing on understanding as a goal; enable students to achieve skills such as self-learning and to acquire expertise via practice by understanding constantly update the teaching methods and the study program maintain relationships with the various relevant industry sectors introduce the students to state-of-the-art equipment and facilities, for conducting experiments that reinforce their understanding of the theoretical and practical issues studied in the courses promote research in the various fields; and explore cooperation with other institutes in Israel and abroad. Engineering is a practicing profession, a profession devoted to harnessing and modifying the three fundamental resources that humankind has for the creation of all technology: energy, materials, and information. The overall goal of engineering education is to prepare students to practice engineering and, in particular, to deal with the forces and materials of nature. Thus, from the earliest days of engineering education, instructional laboratories have been an essential part of undergraduate studies. Indeed, prior to the emphasis on engineering science, it could be said that
most engineering education took place in the laboratory. The emphasis on laboratories has varied over the years. While much attention has been paid to curriculum and teaching methods [1], [2]. The essential role of laboratories can be correlated with the fact that engineering is, in general, problem solving and analytical thinking. Well-designed laboratories during undergraduate engineering degrees can improve these skills for graduate engineers [3].

2.2. Social Involvement Unit
One of the many goals of the Social Involvement Unit, which is a part of Dean of Students Office, is to promote social involvement of students and staff in the community. It also promotes weak applicants and students at the institute by offering mentoring, tutoring, emotional support, guidance to learning, and adjustments in school. Over the years, the unit has worked in many education and welfare arenas to promote immigrants, youth, and more. The Social Involvement Unit serves as a professional centre to encourage and promote the social impact of students and staff and to leverage knowledge, expertise, and human capital for the benefit of the community through social involvement projects and course actions involving meaningful activities.

2.2.1. Action learning course.
The action learning course is an academic course which combines academic learning with social activities. These courses deal with processes and social challenges, reveal different ideologies, and develop critical thinking and pragmatic ideas. Students receive course credits and a grade for being part of such course. Participating students enrol in courses that involve action and activities to engage in the experiential learning process, thereby creating a dialogue and cross-fertilization between being taught in the classroom and experiencing the reality in the real world [4]. A learning experience includes meeting with social organizations, institutions, and state authorities and carrying out practical work with diverse populations. Through experience, students strengthen their academic skills, formulate ethical attitudes toward reality, develop professional and civilian perspectives, and realize how they can influence their surrounding in the present and hereafter.

3. Students Teach Pupils
Today, most schools in Israel and around the world are measured by achievements in national and international exams. Because the amount of theoretical material is large, and due to relatively short study time, it is almost impossible to deal with issues that are beyond the curriculum set by the Ministry of Education because of the teachers' lack of time and because of their erasure, most of the lessons in the school are monotonously boring and destructive in terms of curiosity and imagination [5]. The introduction of principles of environmental thought and energy efficiency in the early stages of childhood is very important, including the development of a sense of wonder, recognition of the beauty and mystery of the natural world [6]. The positions are formed at the very early stage of life [7]. The effective acquisition of environmental thought and energy efficiency in young children should be done in an integrated form of frontal learning that provides basic concepts along with experiential experience which [8], [9] This gives the pupils the motivation to learn, even for the weaker pupils, which allows the pupils to learn on several levels: 1. Hearing, 2. Touching, 3. Vision. These three levels give the pupils the application and understanding of the material, which at the end of the process the material learned is stored in a long-term memory for future use in the pupils daily life. Scientific and Technological Education in primary schools requires renewal and modernization [10]. There is some evidence that pupils claim that science and technology education is disconnected from reality and boring [11], [12]. Good teaching is context-dependent, and therefore what the outstanding teacher can do in his teaching may be different in different institutions with different populations of learners and different teaching objectives. Today, two definitions of good teaching are accepted when one argues that the ultimate goal of teaching is effective pupils learning [13], and the second argues that good teaching promotes high quality learning [14]. According to current teaching objectives, good teaching requires achieving multidimensional goals in addition to learning a particular material and developing related knowledge. For these purposes there is a cognitive dimension (developing
problem-solving abilities and independent learning skills, such as effective time management and coping with difficulties) and an effective / emotional dimension (development and change of attitudes, motivation and motivation for learning). The goal was that as a result of the teaching, in addition to the development of understanding of the learning material, there is also learning and development of a variety of skills and development and attitudes towards green thinking and energy efficiency.

3.1. The Methodology
The course sought to provide students with knowledge on a variety of environmental issues and experiential teaching skills for pupils. Multidisciplinary, environmental thinking, and simple ways to increase energy efficiency for young school pupils. Figure 1 shows the process steps. In order to evaluate the contribution and success of the course, a number of tools were used. We collected data on the perceptions of those involved, which we asked about the material being studied, the general experience in the classroom. The data collection tools were lesson observations. Interviews with pupils

In these lessons, these interviews were conducted in a number of minutes, followed by lessons with about 5 pupils of each class, in order to understand the pupils experience and their positions. In addition, interviews were held with the class educators. In order to obtain numerical values that would indicate the success of the process, computerized surveys were conducted at the beginning of the activity, “entrance examiner”, without prior knowledge, and a computerized survey at the end of the activity. These surveys asked five questions about the subjects learned in the session. At the end of the course, a comprehensive evaluation survey was conducted for all the systems to examine the impact and effectiveness of community intervention in the community [13]. A combination of visual teaching methods, including media in a school-run session, requires special effort and early preparation from pupils. Teaching through visual means and media requires the students who pass the lesson to reduce some of their control over the learning process. Pupils of the New Generation usually have more expertise, sophistication, and knowledge than the teachers in visual and media practice. This is actually the key to channeling their energy into learning [11], [12].

![Figure 1. Students Teach Pupils methodology](image)

4. Results
The course is a practical course. built of two parts: a frontal part and a practical part. 22 students from the faculties of Computer Science, Technology Management and Electrical Engineering at the Holon Institute of Technology chose to take part in the course, providing students with extensive environmental knowledge such as introduction to ecology, electricity generation, air pollution. The second stage of the practical course, the students were required to divide into work groups, to choose a specific subject in the field of knowledge, and to present to the pupils of the "Revivim" Elementary School in Holon, 90 minutes of exposure to one of the environmental issues Each group planned, integrated visual teaching methods, media and acquired and constructed models and experimental
systems that were used as instructional aids for the demonstration and experiential learning of scientific principles. In order to examine the effectiveness of the training, random interviews with pupils were conducted, interviews with pupils and educators were conducted at the beginning and end of each session "Trivia", virtual quizzes, and knowledge. At the end of the course, after all the first and second classes (230 pupils) at "Revirim" School were exposed to the various workshops of the pupils, environmental higher.

4.1. The Frontal part
During the first six sessions, the students learned about the ability to produce existing electricity in Israel, which does not grow at the pace required by the increase in consumption. The State of Israel suffers from a shortage of electricity, The Ministry of Energy and Water is working to develop and integrate renewable energies into Israel's energy sector, as a result of the government's decisions to reduce energy consumption, subject, in order to promote security Energy independence and the strengthening of aspects of the environment. In Israel and around the world awareness is raised of the importance of encouraging the transition to renewable energy - energy derived from the use of solar radiation, wind, biomass and other non-perishable sources that are not fossil fuels that pollute the environment. The management of the national water sector, while dealing with a resource in short supply, presents a complex challenge that requires optimal response. The State of Israel is located in a region that suffers from water shortage, yet the state has achieved impressive achievements in the field of desalination, regular water supply of the highest quality in the world, the world's highest-level wastewater is low water. The course explained how this turning is made and what is required to be done in order to preserve the situation. The course dealt with another problem that exists in Israel is solid waste, the Ministry of Environmental Protection works to reduce the amount of waste generated and reduce the waste transferred for landfilling. One way to do this is through recycling, recycling is the process of removing materials from the waste stream and using them as raw materials, or creating new products, most of the recycling in Israel is done at sorting and separation plants. The students learned what effective teaching is and how to write lesson plans.

![Figure 2. Convert kinetic energy (by blowing air) into electrical energy](image1)

![Figure 3. created a "Grass Head" that performs photosynthesis](image2)

![Figure 4. Speed of infiltration of water in different soil](image3)

![Figure 5. Robots that avoided by Renewable Energy - sunlight](image4)

4.2. The practical part
In the practical part of the course, students were divided into work groups, 2-3 students per group. Each group wrote an experiential lesson plan that designed, purchased and built models that were
integrated into a teaching system that exemplifies one of the scientific principles learned in the course. The students presented a teaching system to the first and second graders at the "Revimim" Elementary School, each week a different class. The group that dealt with energy efficiency, explained the concept, presented simple ways of making a preference for roasting laundry on a rope instead of turning on a clothes dryer, closing the light on the exit of the room, preferring sunlight to electrical lighting and activating a "Monopoly" game that included questions and activities related to saving electricity. The group that dealt with the water sector - in explaining the aquifer, which demonstrated the processes of water seepage in which the pupils created a model that describes the water cycle in nature. The energy conversion group presented the concept of energy "rolling" and held a competition between the pupils who were required to convert kinetic energy (by blowing air) into electrical energy - lighting the bulb (Figure 2). The group, which dealt with air pollution and the environment, explained to young pupils how the water value of water is and how the burning process affects this value. The children also created a "Grass Head" that performs photosynthesis (Figure 3). The group that dealt with soil in the environmental system taught how to characterize the soil and examined the speed of infiltration of different lands and the quiz: Which land is most suitable for agriculture? (Figure 4) The group that dealt with renewable energies presented the types of energy (wind, water, and sunlight) and the pupils experimented with vehicles and robots that avoided sunlight (Figure 5).

4.3. Effectiveness of teaching

In order to contribution to the learning process of pupils in "Revimim" elementary school. Each entry questionnaire and exit questionnaire consisted of five questions. When we examined the correct response rate in the entrance tests versus the correct answer in the exit tests, as shown in Figure 6, questionnaires entry 11-41% of pupils (depending on the question) Choose the correct answer. About 78-94% of the pupils chose the correct answer after studying in experiential material, experience and probably internalized the material.

Additional evidence of internalization of pupils' material and confidence in the new material they received was obtained when examining the time of response to questions of entrance exams and exit tests. As shown in Figure 7, the pupils were asked about 76 seconds on average to answer the various questions. On the other hand, in the summary questionnaires, the response time was reduced by an average of 31 seconds. Since the pupils were more confident in their answers and the material had a "fresh" in mind.

When pupils were asked about their overall enjoyment of the course, all the sessions they performed (Figure 8) showed that 68% of the pupils enjoyed a great deal of activity during the course, 23% to a large extent, 8% 1% enjoyed very little.
Data collection for the concepts involved, we asked them about the subject matter, the general experience in the classroom. Interview with pupils and classroom teachers: "I did not know that the wind could be turned on", "Now I understand why my mother keeps telling me to close the light in the room ..." said first grader pupil. The staff of the "Revimim" School also in interviews that "the meeting of the young pupils with the students from HIT gave the pupils a different experience than what they are accustomed to on a daily basis", "The pupils were able to bring resources and formations we can't display routine, diversity has contributed greatly to the learning process of the pupils". When students were asked about the extent of the personal contribution of the course, Maor Kakosh, a second-year electrical engineering graduate studies said that the institute, are mainly engaged in natural sciences: physics and mathematics. In this course, he received new tools dealing with the worlds of ecology and ecology. For Maor, this is the closing of a circle to return to "Revimim" School, where he studied in his youth. Amit Levy, a second-year computer science student, said he enrolled in studies to develop his personal career, but as part of the "Green Ambassadors" course, he taught first and second graders and was exposed to community issues. Dinal Srbi, second-year student in Management of Technology said that as part of a course "green ambassadors" She has the right to engage in teaching, whatever she thought she could get during the title. This experience was very experienced and meaningful for her and in her opinion may help her in the continuation of the professional path. An analysis of the results of the feedback shows that the students greatly benefited from the meetings with the students, learned a lot. The students noted that the pupils had a great commitment to the whole process. In addition, the institute noted that students are given the theoretical knowledge and the course was able to put it into practice and contribute to the community.

In March 2017, 230 pupils from the "Revimim" School gathered at an impressive ceremony held at HIT Holon Institute of Technology, where pupils received the green ambassador's certificate - a child with high environmental awareness (Figure 9). The HIT students get Certificates of appreciation and appreciation for their great contribution to the success of the course (Figure 10) During the ceremony, Jocelyn Koren, principal of "Revimim" School, said that "Revimim" is a "green" school. The meetings with the students were meaningful experience sessions and aroused a lot of curiosity among the pupils".
5. Conclusions
The Renewable Energy program gives the students technical and practical aspects of energy use and energy efficiency. The entrance of students to the field of teaching pupils while still in their studies brings many advantages. Based on the results, at the beginning of the lesson, pupils hesitated and took a long time before picking an answer. This hesitation can be explained by the fact that the pupils did not have extensive knowledge about the subject. On the other hand, on the exit test, there was a significant improvement as pupils quickly selected the correct answer, demonstrating their improved knowledge of environmental issues and Renewable Energy.

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