Qualitative Analysis of Secondary Students’ and Teachers’ Attitudes Towards a Web-based Environmental Education Program

CONSTANTINE AIVAZIDIS¹, MARIA LAZARIDOU¹, GUSTAV HELLDEN²
1Aristotle University of Thessaloniki – Greece, 2Kristianstad University – Sweden

ABSTRACT This study explored high school students’ and teachers’ perceptions about a web-based environmental educational program titled ‘The River.’ This program aims to the improvement of environmental attitudes and includes different methods and areas of study, from scientific data collection to arts and policy concerning the rivers. In addition, it supports learning through the Internet by traditional and new media, and stresses the importance and necessity of interdisciplinary approach in the teaching / learning process. The qualitative data that were collected from 36 participating students as well as their teachers are presented, and suggestions for improving e-learning courses are discussed.

KEY WORDS: Environmental education, e-learning, qualitative research.

Introduction

There is a basic need for easily accessible information on the presence and biological impact of environmental pollutants (Beamont, Hamilton, Machin, Perks, & Williams, 1999). Water pollution is one of the most common environmental topics covered by schools (Blum, 1979) and, according to a research paper concerning teachers (Simmons, 1998), the river is, from various aspects, one of the most appropriate natural setting for environmental education (EE). Moreover, biological monitoring is a powerful tool for understanding the link between the causes and effects of environmental pollutants, as bio-indication agents can be used to assess the cumulative effects of pollution (Lorenzini & Nali, 2004). Evaluation of water quality is easily accessible to schoolchildren, because of the availability of simple methods for monitoring the biology, physics and chemistry of running water (Spellerberg, Ward, & Smith, 2004). Additionally, the Internet is spread rapidly throughout the educational community and is currently being utilized for a variety of instructional purposes (Perez-Prado & Thirunarayanam, 2002). For these reasons, a web-based water quality monitoring program was developed to increase knowledge and raise awareness of environmental issues, and provide skills of scientific investigation. This program was evaluated with both quantitative (questionnaires) and qualitative methods (interviews and focus groups).

“The River”

“The River” is a web-based EE program for secondary level (teachers and stu-
students). “The River” stresses the importance and necessity of interdisciplinary approach in the teaching/learning process, i.e., the utilization, combination and coordination of appropriate disciplines from the natural sciences, social sciences, applied sciences, technologies, and humanities in an integrated way towards the environment, its problems, protection, conservation and improvement. No single discipline – biology, chemistry or physics, as examples – can encompass the totality of environmental knowledge that constitutes EE. The importance and necessity of interdisciplinarity in the teaching/learning process of environmental education derives from the holistic approach of EE to the environment as a complex entity of natural, built and social components in the life of humanity (Tbilisi Final Recommendations, 1977). Through this program, the students have the opportunity to acquire knowledge of several disciplines relevant to their school subjects, to think from different perspectives (from local to global) and appreciate the complexity of nature. In addition, they may become able to develop scientific and communication skills, which, although suitable for them, are not currently provided through the mainstream system of secondary education. In our opinion, teachers should address the general education of the child by using the environment as a medium for enquiry and discovery that may lead to the enrichment of the learning process. The aim of the project is to raise the understanding and awareness of the rivers as vital elements of our environment and economy, and to enliven the study of natural sciences. It is also hoped that it will give students and teachers the opportunity to use information and communication technology, while learning new things about rivers and having fun as well.

The website consists of several sections. The theory comprises the theoretical section of the site. In this, there are four topics concerning the rivers: a) formation of the river, b) physicochemical parameters of the water, c) the life in rivers, and d) human activities in relation to rivers as well as relative documentation. The last topic contains resource materials, which support the previous topics especially for those who would prefer to be engaged more deeply in the subject, but who do not have access to an appropriate bibliography. Beyond the theoretical knowledge, practical activities are considered important for the process of learning. Twenty-six activities related to the theoretical part can be found in a relevant section in addition to 12 interactive games for online use. Outdoor education was also considered as another important aspect. In order to encourage the students to go out to a river and obtain data, the database section was created. This section allows the student to record scientific and cultural data concerning rivers. The scientific data concern physico-chemical parameters, such as pH, concentration of dissolved oxygen, calcium, nitrate and phosphate concentrations, the temperature of air and water, the current and the discharge, the conductivity and the turbidity, the total suspended solids, and biological data necessary for the appliance of biotic indices. Keys are also provided to help the students identify the macroinvertebrates and plants that gather in a specific site of a river. Collected data by the students are sent electronically for analysis to specialized scientists involved in the program.

The cultural aspect, such as, songs, poems, paintings, literature, or even history and mythology concerning the sites of a river is not neglected in the site. There exists a data base where such information is entered and analyzed. In the assessment section, there is a questionnaire developed for the evaluation of this program.
and a test generator for students’ self-assessment. The intention of the environmental policy section that contains documentation about environmental legislation and policy is intended to help an individual, who is interested, but not an expert in that field, to form a political attitude about the issue of water. Moreover, there also exists documentation about environmental education to help educators to understand, if they do not know, the nature of EE or to build their background about it. The communication is computer-mediated with two additional sections. The ‘Ask Dr. Bug’ section provides a two-way communication channel between the participants and the scientific staff, whereas the forum is a multi-way communication channel among all participants. Finally, additional educational resources are provided through other sections, such as multimedia, links and help.

Methodology

‘The River’ was implemented as an environmental education course in two junior high schools of Thessaloniki, Greece. In total, 164 eighth-grade students, 13-14 years old, participated in the intervention that lasted one school term (10 weeks). After the end of the program, four students from every class voluntarily formed a focus group for the discussion of their educational experience in the course, as indicated in Table 1. Focus groups are moderated meetings of ‘involved’ people discussing their experience of an educational intervention. In focus group interviews, the interviewer has a different role to play, that of the moderator. The terms facilitator, moderator, or group leader are used interchangeably by scholars. The group was treated not as a collection of individuals, but as an entity in itself (Watts & Eubbutt, 1987). In addition to focus groups with students, interviews with the two teachers of these classes were carried out.

Table 1
Focus Groups of the Study

<table>
<thead>
<tr>
<th>School</th>
<th>Class</th>
<th>n</th>
<th>/</th>
<th>Duration</th>
<th>Pages</th>
<th>Words</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>B1</td>
<td>4</td>
<td>2</td>
<td>0:05:47</td>
<td>2</td>
<td>151</td>
</tr>
<tr>
<td>S1</td>
<td>B2</td>
<td>4</td>
<td>2</td>
<td>0:09:47</td>
<td>2</td>
<td>313</td>
</tr>
<tr>
<td>S1</td>
<td>B3</td>
<td>4</td>
<td>2</td>
<td>0:08:23</td>
<td>2</td>
<td>219</td>
</tr>
<tr>
<td>S2</td>
<td>B1-A</td>
<td>4</td>
<td>3</td>
<td>0:28:12</td>
<td>9</td>
<td>2.796</td>
</tr>
<tr>
<td>S2</td>
<td>B1-B</td>
<td>4</td>
<td>0</td>
<td>0:26:39</td>
<td>15</td>
<td>3.994</td>
</tr>
<tr>
<td>S2</td>
<td>B2-A</td>
<td>4</td>
<td>1</td>
<td>0:25:16</td>
<td>13</td>
<td>3.491</td>
</tr>
<tr>
<td>S2</td>
<td>B2-B</td>
<td>4</td>
<td>2</td>
<td>0:32:41</td>
<td>25</td>
<td>5.165</td>
</tr>
<tr>
<td>S2</td>
<td>B3-A</td>
<td>4</td>
<td>1</td>
<td>0:27:40</td>
<td>19</td>
<td>4.148</td>
</tr>
<tr>
<td>S2</td>
<td>B3-B</td>
<td>4</td>
<td>3</td>
<td>0:28:24</td>
<td>17</td>
<td>3.806</td>
</tr>
<tr>
<td></td>
<td></td>
<td>36</td>
<td>16</td>
<td>3:12:49</td>
<td>104</td>
<td>24.083</td>
</tr>
</tbody>
</table>

A semi-structured interview design was used to collect data (Cassell & Symon, 1994; Malhotra, Hall, Shaw, & Crisp, 1996; Yin, 1994). The questions became more focused as the interviews progressed and the researcher gained understanding from students’ experience (Kvale, 1996) that improved understanding (Kram, 1986). Open-ended questions formed the frame of the interview in both kinds of semi-structured and focus-group interviews. Neither the wording of the questions nor their sequence was always identical. Validation was done, with analysis and
careful consideration of the participants responses, throughout the interview process (Kvale, 1996). Questions had to minimise the possibility of the interviewer leading the children towards certain kinds of answers (Swanwick, 1994). All interviews were transcribed and analysed in Greek, to avoid translations and changes in meaning.

The five steps of phenomenological interview analysis suggested by Kvale (1996) were followed: a) the whole interview was read through to get a sense of the whole, b) the natural 'meaning units,' as expressed by the subjects were determined by the researcher, c) the theme that dominated a natural meaning unit was stated as simply as possible, d) the researcher interrogated the meaning units in terms of the specific purpose of the study, and e) the essential, non-redundant themes of the entire interview were tied together into a descriptive statement.

The researcher followed clinical interview strategies (Crabtree & Miller, 1992) to encourage both positive and negative comments, to use particular examples to explain a student’s comments, and to gain a personal, internalised account of student experiences. Self awareness influenced a conscious effort to manage the experienced opportunities brought by the interviews in order to minimise the impact of the limits of that experience on data collection and interpretation processes. The age difference between the researcher and the students was considered prior to the interviews, and a good rapport with the students was sought, in order to obtain honest information (Sekaran, 1992).

Data Analysis

All the interviews were digitally recorded, with the agreement of each participant. Approximately four hours of interviews were recorded. The next step was the transcription, the transformation from an oral to a written mode, which produced 125 pages or 32,270 words of text. All interviews were fully transcribed and then organized and labeled with the ‘qualitative analysis’ program NVivo (Richards, 1999). The initial organisation of the transcribed data using NVivo was of considerable assistance, but the sorting of the labelled data for each teacher or student was completed by the researcher rather than electronically, to enable both familiarisation with the data and to facilitate the interpretation process (Crabtree & Miller, 1992).

The process of generating meaning from the interview data was characterised by action at different levels of detail, beginning with broad groupings, then identifying finer aspects of the data, and sorting them into more specific categories. Statements expressed by students and teachers during the interviews were used as samples of the analysis. The initial stages of analysis included breaking down, comparing, and conceptualizing statements from each interview transcript. This strategy fractures the data, and requires careful examination of the words used by the participants. This process of data analysis resulted in the generation of 534 conceptual statements representing 10 themes of initial comparisons that are presented in Table 2. A matching and collating process enabled groupings of similar comments from teachers or students to be sorted into categories within each major theme (Miles & Huberman, 1984). For example, within the theme of Information and Communication Technology (ICT), the categories of ICT teaching, computer laboratory, ideal situation and future developments emerged as critical to teachers and students. This sorting, matching, and collating of data into similar categories
organized the framework for data analysis and discussion, and enabled a cohesive and integrated flow of information. Data falling outside this broad structure was seen as an opportunity to enhance the study rather than dismissed as irrelevant. Working from the transcripts and guided by the themes allocated early in the process, the categories strengthened and formed the basis for interpretation of phenomena presented by students (Glaser & Strauss, 1967; Miles & Huberman, 1984). Each theme is discussed with illustrative quotations. In the analysis of the interviews, the researcher made use of respondents’ answers from their discourse. The citations used are representative of their views according to the understanding of the researcher; views are not chosen selectively. Whereas possible, respondents’ ideas are treated, so that to depict their range of views and not a fragment of those. In other cases, the main views of their opinions are stated, but only extracts of the most frequent views are presented.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Category</th>
<th>Teachers</th>
<th>Students</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students</td>
<td>PC</td>
<td>3</td>
<td>27</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>e-Learning</td>
<td>4</td>
<td>29</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>Collaboration</td>
<td>5</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Skills</td>
<td>1</td>
<td>16</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Training</td>
<td>2</td>
<td>18</td>
<td>20</td>
</tr>
<tr>
<td>Teachers</td>
<td>PC</td>
<td>4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Role</td>
<td>8</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Teaching</td>
<td>5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Collaboration</td>
<td>4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Skills</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Training</td>
<td>12</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Information and Communication Technology (ICT)</td>
<td>Teaching</td>
<td>22</td>
<td>10</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>Laboratory</td>
<td>20</td>
<td>7</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Ideal</td>
<td>9</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Future</td>
<td>4</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>e-Learning</td>
<td></td>
<td>18</td>
<td>21</td>
<td>39</td>
</tr>
<tr>
<td>PC Role</td>
<td></td>
<td>6</td>
<td>9</td>
<td>15</td>
</tr>
<tr>
<td>Computer Mediated Communication (CMC)</td>
<td>Assessment</td>
<td>10</td>
<td>14</td>
<td>24</td>
</tr>
<tr>
<td>Educational Material</td>
<td>CD</td>
<td>9</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Internet</td>
<td>2</td>
<td>15</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Adequacy</td>
<td>16</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Quality</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>‘The River’</td>
<td>Level</td>
<td>22</td>
<td>35</td>
<td>57</td>
</tr>
<tr>
<td></td>
<td>Laboratory Session</td>
<td>4</td>
<td>39</td>
<td>43</td>
</tr>
<tr>
<td></td>
<td>Project</td>
<td>11</td>
<td>18</td>
<td>29</td>
</tr>
<tr>
<td>Educational Policy</td>
<td></td>
<td>10</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>283</td>
<td>301</td>
<td>584</td>
</tr>
</tbody>
</table>
Findings

The students demonstrated a positive attitude toward ICT and e-learning, but this preference may be attributed to a certain extent to the fact that they regarded them as a game and not as a school subject. The perception of ICT as a game, according to one of the teachers “for young (12-15 years old) students is negative, but for the older ones (16-18 years old), this is positive, because it helps them relax from the pressure of the rest school subjects.” This characteristic of e-learning is worth exploiting, since game-based learning is not just a temporary hype but a fundamental form of learning of the future (Prensky, 2001). A major concern of the students regarding the use of computers was related to possible health implications, although some of them were unsubstantiated, or are regarded as ‘relatively minor or temporary’ (Griffiths, 2002). The literature has shown that playing computer games is comparable to a mild intensity exercise: with normal use, playing may neither improve nor harm physical fitness (Emes, 1997).

The collaborative learning in schools was found to be problematic due to the different level of ICT students’ skills and their immaturity. One of the teachers argued that:

“in e-learning, there is the problem that some students have no idea about computers whereas some others know a lot, and usually those who know a lot are doing everything, in some cases to show off, while the other students feel ashamed, step aside, and this is the end of the story. Namely you lose these students.”

Generally speaking students have low level of ICT skills (Eurydice, 2004) and relevant training is needed. A teacher suggested that students in addition to training “should get written instructions that will guide them when they will be stuck.”

The familiarization of teachers with ICT appeared to be more difficult despite their willingness to take up ICT. Teachers need to have the technical skills necessary for using Computer Mediated Communication (CMC), and training should be available where necessary (Hawkes, 2000). The level of their ICT skills was not sufficient for the implementation of the e-learning programs. As one of them admitted, “the teachers are not able to cope with the demands, only a few are able to use the machines, they are not acquainted with them.” Teacher-level barriers as indicated by the literature are lack of time (Preston et al., 2000), lack of self-confidence in using ICT (Pelgrum, 2001), negative experiences with ICT in the past (Snoeyink & Ertmer, 2001), fear of embarrassment in front of pupils and colleagues (Russell & Bradley, 1997), lack of motivation to change long-standing pedagogical practices (Snoeyink & Ertmer, 2001), and the perception of computers as complicated and difficult to use (Cox et al., 1999). For this reason, there should be cooperation between teachers in order to integrate e-learning in their teaching, but this is quite unlikely in the Greek educational system. They also regarded themselves as irreplaceable due to the personal relationship they have with their students. In e-learning, their role is restricted in the preparation of the material, the supervision and the coordination of students’ activities.

Through the interviews, it became clear that the ICT teaching faced certain difficulties. Apart from those that relate to the Greek educational system in general, others have to do with the distribution and quality of the educational materials, the curriculum and the lack of infrastructure and staff, especially with the subject “Information Technology.” Information Technology is taught only one hour per
week, is never assessed, is affected by the students' skills and, in some cases, it is not considered as a serious subject even by the teachers themselves. For the students / computers ratio, it was claimed that one to one would be the ideal situation, but with younger students and in the case when a student has difficulties in understanding the native language, it would be better if two students share the same computer, that correspond to the bibliography (Wyman, 2004). Three students were regarded as the maximum acceptable number and only when students were attending a teacher's presentation.

Views about e-learning were rather contradictory. Some participants believed that e-learning is never going to take place in schools, because in Greece advances and changes progress very slowly. Some others though went a step further to claim that it should not take place for the reason that it will not be efficient. On the other hand, there were participants who were sure about the deliberateness of e-learning and its distribution within the mainstream education, "when the present generation of teachers will retire." Surprisingly, the students associated e-learning with their future professional development. As a student said, "I put a lot of attention to these lessons, because everything we learn is for our own good, and this is going to be useful in my life ahead, the work that I'll have."

The role of computers in the teaching / learning process according to the participants is useful, because it motivates the students, but there should not be high expectations. As a teacher stated, "computers could, as every technological media, facilitate the work of the teacher, but in no case can replace them." Cox (1997) agree that regular use of ICT across different curriculum subjects can have a beneficial motivational influence on students' learning, and other authors support that online learning engages de-motivated and disaffected students (Duckworth, 2001; Harris & Kington, 2002).

Computer mediated communication (CMC) was another important but sensitive issue. Some students were using extensively the chat programs and were obviously influenced by the recent developments of mobile phone communication. Moody (2000) suggests that students are more likely to participate openly in discussion groups if it is clear that they are not being assessed for their contributions. Hawkes (2000) claims that the focus of discussion needs to be pedagogy rather than technology. The teachers in this study argued that junior high school students are not mature enough to use such tools for educational purposes. "The usage of such programs by younger students should be supervised by their teachers, because in a different occasion, programs will be used for irrelevant reasons." The students stressed the importance of personification of CMC, i.e., that they somehow should know something about the persons they are communicating with.

A lot of importance was ascribed to the assessment, since, according to teachers and students alike, a subject that is not assessed is not taken seriously. The use of computer-generated tests was an idea appealing to teachers, because "it would relieved [them] from a lot of work," but its implementation seems too difficult for most of them. The application of such test developed from an external authority was rejected by the teachers, because they would like to have control over the assessment process, in order to coordinate what they are teaching. The computer-based tests were considered useful by the students, because of their convenience, immediate feedback and repeatability. But, it was obvious that most students misinterpreted formative assessment and considered it rather as summative.
The interviews established the inadequacy of educational material in electronic form in the Greek language, and the mediocre quality of the existing titles. According to teachers, CDs should be developed for the school subjects and distributed along with the school books to every student. But, “these CDs should include every source needed for the corresponding subject, not only text.” The Internet should be used for additional documentation and research. The best possible use of the Internet, according to the participants, is in the context of a project that the students should collaboratively carry out in teams of four or five members. In this way, less assiduous students might be motivated, whereas the interest of the more capable students might be raised as well.

About “the river,” it was argued that it should be focused on a specific grade, or, alternatively, there should be the option for a student to choose a level of difficulty according to her/his skills. In addition, they added that the theoretical part should be taught by a teacher with the optional use of a networked PC and a projector, instead of asking the students to study these lessons by themselves. Or, as a teacher stated, “there should be a short (10' – 15') introduction [by the teacher] in the beginning of each lesson, because a percentage 10 – 20% [of the students] are not going to read what we are asking them for.” The students also suggested that the text could be narrated by a virtual character that they “could look right in the eyes.” The students expressed their preference for the laboratory session, but they had mixed opinions about the use of live or conserved specimens for identification. The students also appreciated the illustration and the highlighted keywords, which allowed them to skim through the text. Finally, it was suggested that educational interventions, as “the river,” should be developed and implemented in the context of specific school subjects.

Last but not least, it was pointed out that computer-based education is an educational policy issue, since it depends on the volition of political leadership to decide, fund and promote such changes. As a political issue it is confronted with particular skepticism: “Every change in schools that demands funding takes place with a slow pace. And I do not believe that there is willingness to happen.” The state has declared its intention to equip every school with computer lab(s), to connect them over a network and progressively to train the teachers in the use of ICT (Odysseia, 2000). This endeavor is under development, but when it will be completed, according to a teacher, “the situation will remain at this stage for many years.”

Conclusion

The findings of this study add to the relatively limited literature of qualitative research about online learning. The findings point out some potential difficulties of using ICT for instructional purposes. Internet-based instruction is growing at a pace faster than any other instructional technology. There is certainly a need for ongoing research to continuously evaluate the effectiveness of the evolving e-learning.

Recommendations

Based on the findings, the following recommendations concerning e-learning could be drawn:

- e-Learning should be integrated into all school subjects.
- In junior high school, ICT subjects should be taught more rigorously, whereas in the higher grades, it could retain its current relax status.

- The development of educational material should be based on careful instructional design and learning theories.

- Computer based educational programs should be scalable, innovative, interactive, and collaborative activities should be integrated in their structure.

- The text of e-courses should exploit the *semiotic* characteristics of hypermedia, be rapidly and easily read by students, and if possible narrated.

- The pictorialization of educational material is necessary, but it should be combined with the development of the students' ability to read images.

- A combination of e-learning with more traditional approaches is desirable.

- Existing educational materials that are converted in digital form should be redesigned in order to utilize the affordances of information technology.

- Instructions about the use of ICT should be given in written form, as well orally.

- Teachers should supervise students' use of computer-mediated communications.

- The differentiation between formative and summative assessment should be clear.

- Computer-based tests should be printable, mainly for verification reasons.

- The students' misconceptions about the consequences of computer use to their health should be dealt with.

- The introduction of e-learning into schools is an education policy issue and should be treated as such.

References


Research Association Annual Conference, University of Sussex at Brighton.


**Website**

http://edu.bio.auth.gr/river