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Digital Literacy Integration in Educational Practice: Creating a Learning Community, Through a Geographic Project in Mytilene Senior High School, Greece

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Abstract

This study focused on the analysis of Grade-12 (Senior) students' sociocultural constructivist interactions using Web 2.0 applications during a geographical research process. In the study methodology context, a transdisciplinary case study (TdCS) with ethnographic and research action data was designed, implemented and analyzed in real teaching conditions for this study. The goal of the research process was students to integrate into authentic activities that that relate to their experiences and create a learning community, developing cognitive geographic knowledge. The study reveals a need to: a) design and implement transdisciplinary actions to create more learning incentives, exchange ideas and collaborate, for the geographical science issues study, b) shape new ways of interacting and

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operating social structures in the context of geographical research process, c) promote the skills that students need in real life, as participatory interaction, interpersonal communication, spatial thinking and high cognitive functions (cooperation, crisis, feedback and empathy, among others), and d) use Web applications in learning practice, shaping new methods of processing, sharing and exploiting information and produced products from the students' study.

Keywords

Digital Literacy; Educational Practice; Geographical Research; Sociocultural Constructivist Pedagogy

In the developing and rapidly changing society, people need to develop a range of competences that are necessary for the 21st century, such as cooperation and communication, solidarity, encouraging dialogue and argumentation, digital literacy, respect for diversity, as well as self-motivation and critical and creative thinking. With technological developments, the entire world may be accessible through our fingers. In mid 2015, there were over 3 billion people online around the world (ITU, 2015) and this affected the way they participated and acted in their personal time, at work, in education and in society in general. Thus, in a society that is global rather than limited to a particular state but is global, technologically literate people develop and prosper at all levels (Shah, 2015; Kavanagh and O'Rourke, 2016).

In recent years, knowledge and information are rapidly shared through advanced digital tools and a digitally literate person may: (a) understand the nature, role, design and control of technological systems and (b) use the capabilities of digital tools to search, collect, assess, edit and share information. In addition, the term includes the social practices, strategies and skills, such as the development of communication and collaboration, giving digital literacy a social nature. Based on the above, digital literacy can be defined as the skills that a person needs for life, education and work in a digital society (JISC, 2014; Kavanagh and O'Rourke, 2016). According to the official results from Eurostat in 2015, 95% of families in European countries (with two adults and dependent children) had Internet access at home (in Greece the percentage is slightly decreased at 91%) (Eurostat, 2016a). Furthermore, 89% of Europeans who belonged to the age group 16-29 used the Internet and only 2% of this age group had never used the Internet (in Greece the percentages are 87% and 2% accordingly) (Eurostat, 2016b; 2016c). However, that same year, the percentages of Internet use by Europeans of the same age group for educational activities are far from these rates. Specifically, 35% of young Europeans used the Internet for educational purposes (in Greece the rate drops reaching 15%) (Eurostat, 2016d; Kavanagh and O'Rourke, 2016). The above results concerned us and for this reason we investigated the efforts made to integrate digital literacy in educational policy and practice at both the European and national level. Specifically, an important text with suggestions on education is The Muscat Agreement in Oman in 2014 entitled "2nd Global Education Meeting for All", (UNESCO, 2014b), which re-confirms that education is a necessary prerequisite for peace, democracy, sustainable development, economic growth, decent work, gender equality and respect for cultural and linguistic diversity, creating opportunities for fair, sustainable and inclusive societies. Therefore, education is placed at the center of international development, as a fundamental human right, promoting free and compulsory basic education, the provision of quality education (safe and healthy environment) at all levels from early childhood to higher education and holistic lifelong learning approach, using innovative methods and information and communication technologies. Another key

discussion document is the Framework for Action by UNESCO in Incheon, South Korea, in 2015, as a continuation of Dakar and the movement of Education for All (Galguera, 2015; Benavot, 2015), where the role of education was redefined and the new axes to ensure a single educational program from 2015 to 2030 were set. Focusing on digital literacy, on the thematic debate on "Innovating *through technology*: shaping the future of *education"* (United Nations, 2015, p.23), the way in which governments can use the significant abilities of digital skills in learning and the promotion of innovation and improvement of efficiency were examined. During the examination, the significant role of digital technologies to improve equality and quality of learning was marked. The knowledge, skills, principles and behaviors that citizens/students should have, in order to make informed decisions and have an active role at local and international level to face and resolve international challenges, as well as their democratic propagation through digital technologies can be obtained through International Education for Democratic Citizens.

Initiatives for Educational Reform

Recent initiatives for educational reform (Conclusions of the Council, 2013) "note" the importance of developing key competences for responding young people to social, economic and technological changes and developments, such as: critical thinking, creativity, "learning to learn", communication, co-operation, democratic consciousness, and respect for diversity, innovation, cultural sensitivity, adaptability, flexibility, initiative, responsibility and problem solving. Based on the above reorientation of the qualitative characteristics of youth education, the latter acquires a multidisciplinary character in a school that is required to ensure high quality education for all, in accordance with the principle of equal opportunities and diversified pedagogy, to promote the exploitation Modern learning theories, to furthering the sustainability and technologies and to use innovative and flexible tools that encourage cooperative and experiential learning (Luckin, et al., 2009; Campbell et al., 2010; Conclusions of the Council, 2013; Henson, 2015; Pazey, et al., 2015).

According to the above, Greece has designed its educational policy for each educational structure. Its policy integrates the structure of education in relation to international data and modern learning theories, although these curricula of Greek education allow even the introversion of the Greek school, the discouraging the development initiatives of the teacher, as well as the reducing disparities in educational outcomes (Birbili, 2011). A notable effort was the pilot application of the new school curriculum since 2011 (New Compulsory Education Curriculum, 2011), which marked the response to the new educational needs and challenges of the 21st century, placed the student at the center of changes, aimed for the overall improvement of the educational level of students, as well as the quality of the education provided. Particularly, the Operational Program named “Education and Lifelong Learning”, which is co-financed by the European Social Fund, implemented the strategy of the Ministry of Education, Lifelong Learning and Religious Affairs and started to implement the vision for the New School – the School of the 21st century. The project called “New School” is open to the society, ideas, knowledge and the future, digital, innovative, green and all-day. It is a school with the student at the center without social, economic, educational, religious or cultural discriminations, with the participation of the teacher in class, promoting

actions that improve the quality of courses, placing the student at the center of changes and preparing them for the challenges of the 21st century. The entire action was developed as part of the implementation of the action called "NEW SCHOOL" (School of the 21st Century) and its results were the creation of new curricula, which were pilot applied in 188 school units across the country (21 kindergartens, 99 primary schools, 68 high schools) since the school year 2011-2012 and Guidelines for Teachers (Operational Programme "Education and Lifelong Learning, 2011; Birbili, 2011; Panagiotidou, 2012; Klonari and Mandrikas, 2014).

The interest of this study focuses on the New Geography Curriculum (NGC), which first introduces concepts, such as spatial perception and spatial abilities to develop geographical thought, through activities and educational material (mainly digital) which was appropriately selected to achieve the expected outcomes, such as interaction of the place with human activities, the use of digital tools, as well as the adoption of a variety of methodological practices during teaching (such as exploratory-type activities, working in groups and experiential approach including field study) and a multidisciplinary approach of Geography. Such an approach is geographic research, one of the basic geographic processes in educational practice. Students, working in projects, have the opportunity to: a) ask geographic questions, develop critical thinking, act constructively and creatively; b) collect, record and present information on geographical distribution; c) organize geographic information, identify sources exploring prejudices and views, d) analyze and evaluate geographic data, present findings, extract and document conclusions, e) search for creative ways of using and applying geographical capabilities to give new interpretations of issues and issues developed between the sites; f) use problem-solving and decision making to develop analytical skills and creative thinking to answer geographic questions at the beginning of the investigative process. The necessary information is collected from a variety of sources, including field work, the Internet, digital media, official sources, interviews, newspapers and magazines. (Lee and Bernaz, 2009; Lambrinos, 2009; Anthamatten, 2010; New Geography Curriculum, 2011; Mandrikas and Klonari, 2013; Klonari et al., 2014; Klonari, 2015; Biddulph, Lambert, and Balderstone, 2015; Rutherford, 2015).

In addition, in the NGC, the research and collaborative process in geographical education is directly related to Web 2.0 applications, practices and practical implications. The rapid development of geospatial technologies, including GIS, GPS, the international imaging tools and the Web-based 2D and 3D representations of the Earth's landscape, further reinforced the on-line provision, accessibility and diffusion of geographical skills and knowledge. The above mentioned technologies allow visualization, mapping, organization and analysis of multiple-level geo-referenced data that promote understanding of the environment and the reception of informed decisions for the future. In addition, the ability to use, analyze and interpret images and maps acquires a social character with the help of the social -Web 2.0 tools (Klonari et al., 2014; Baker et al., 2015; Solari, Demirci and Van der Schee, 2015).

Socio-Cultural Constructivism: A Modern Pedagogical Approach to the Learning Process

Woo and Reeves (2007) state that the use of digital skills in the teaching process mainly promotes the development of new forms of interaction among students/users. In particular, the above authors point out that interaction is a key component in any learning process. The exact meaning of meaningful interaction is closely related to learning theories that govern the development of constructivist learning environments. Also, according to Kanuka and Anderson (2007, p.62), the "*constructivist learning theories are becoming widely accepted in all fields of education, including the application of technology to teaching and learning*". Constructivism is a theory that has multiple roots in the philosophical and psychological aspects of this century, namely in the works of Piaget, Bruner and Goodman (Perkins, 1991). In recent years, however, constructivism has received increased attention from researchers from different disciplines, including design education (Fosnot, 2013; Steiner, 2014; Mann & MacLeod, 2015; Gurses, Dogar & Gunes, 2015). For almost fifty (50) years, constructive theory has made an important contribution to education, shaping the way we think about the active role of the student, the educator, or the researcher. Constructivism is a theory that equates learning by creating meaning from preexisting experiences and thoughts (Taylor, 2014). Even though constructivism is considered to be a branch of Gnosticism, it stands out from traditional cognitive theories. Knowledge building requires the use of real problems, self-organization, monitoring, correction and creation of objects to promote pre-existing and collective knowledge as a by-product of the process (Steiner, 2014). In recent literature, we come across various approaches to the above-mentioned concept, such as trivial / personal constructivism, radical constructivism, critical constructivism, social constructivism, cultural constructivism and a combination of the two last sociocultural constructivism (such as, Taylor, 2014; Efran et al., 2014; Steiner, 2014; Taber, 2015; Mann & MacLeod, 2015; Barak 2016; Yambi 2016). Focusing on the latest approach,, Stauffacher et al. (2006, p.258) noted that knowledge is made and acquired through experiential activities in a political, cultural and social environment, which is the theory of sociocultural constructivism (Vygotsky, 1978; Scott, Cole and Engel, 1992; Von Glasersfeld, 1995; Lucas, Gunawardena and Moreira, 2014; Exarchou and Klonari, 2014).The sociocultural constructivist process includes the construction of knowledge through social and cultural interaction both among students and between them and their social environment. The approach is thus focused on authentic activities that relate to the students' experiences or can emerge and become parts of their experiential and learning place or can be represented by their real situations through simulations. The epistemology of sociocultural constructivism has emerged as a prominent approach of teaching in secondary and higher education. In general, in sociocultural constructivism, the process of building knowledge is guided by the social interaction and occurs in a social environment. In particular, the theoretical bases of sociocultural constructivism are mainly inspired by Vygotsky's work (1993; 1997). According to this work, learning should be seen not only as a process of active and collaborative knowledge-building but also as a process of integration into the culture and learning practices of a wider society. The thought is analyzed not only at the level of perceptual processes that occur in the individual, but also as a process of mutual adaptation to the learning concepts of the wider society, which have been identified and consolidated culturally. Vygotsky's studies are based on an understanding of the social content of cognitive development

and, in particular, the role of language in the development of cognitive structures. Students learn the cognitive and communication tools of their own culture. Therefore, it needs to consider not only the interaction of the students with the external physical world, but also the immediate social world and the intervention nature (Gupta, 2013; Mayes & de Freitas, 2013; Barth & Michelsen, 2013).

The above didactic approach is an important part of teaching practice worldwide. Students build new knowledge through individual and social processes (Olusegun, 2006; Aydin, 2011; Quain, 2014; Hassen, 2015). It is worth mentioning examples of scientists whose consider this approach important in the fields of science, such as Geography: Olusegun, (2006) and Aydin (2011), note that geography has a significant scope in our lives and that knowledge needs to be transferred to students through flexible learner-centered and active learning strategies such as: brain-based learning, problem-based learning, cooperative learning, problem-solving, multi-intelligence, event-based learning, creating a school open to society and consequently to real life.

Methodology

Based on the above proposed pedagogical practices of the NCG, specific questions identified regarding the young people participation in geographical research and collaborative actions using Web 2.0 applications, in the frame of socio-cultural constructivist view of learning. Thus the present work focused on the analysis of Grade-12 students' sociocultural constructivist interactions during a geographical research process and considered the following research questions: a. Does the social interaction that forms among students develop in the context of their research, geographical action using an educational online environment, according to the socio-cultural constructivist pedagogy?; and b. Does the sociocultural constructivist interaction of students in an educational online environment affect their cognitive development and their geographical approach to the research issue? The answers to these questions are given by the empirical part of the study, in which a transdisciplinary case study (TdCS) of a students' social Web learning community was designed, implemented and analyzed in real teaching conditions. Specifically, a TdCS was selected, with ethnographic data and research action data in the frame of the general education course "Research Project" of the first grade of General Senior High School. Additionally, to ensure the reliability and validity of pumping data sources, multiple research tools with qualitative and quantitative features were used. This was done through the process of methodological triangulation both in the production process and in the interpretation of the research data (Olsen, 2003; Olsen, 2004; Scholz et al., 2006; Stauffacher et al., 2006; Stauffacher, 2010; Cohen, Manion & Morrison, 2012).

This study is used the analysis of the students' action products (learning community exchanges, through bookmarks, tags, annotations, interactive sticky notes, digital highlights, images and documents) in a students' social Web learning community as the main research tool, questionnaire and observation students/ participants' behavior. The latter is analyzed in the study of participation and overall behavior of the students who participate in the project, through inactive participation (merely as an observer) of the researcher themselves in this course. In addition, questionnaire is used at the initial phase of the research process to record demographic and social data of the students/ participants. To better understand and analyze the outcomes of the students/participants

in a social Web 2.0 learning community, we performed a quantitive content analysis (QCA) and a social network analysis (SNA) of community exchanges (Kerbrat-Orecchioni, 1992; De Laat, 2002; Cerratto and Rodriguez, 2002; Scott, 2012; Prell, 2012; Exarchou and Klonari, 2012; 2013; Exarchou, Klonari and Lambrinos, 2015).

Study Identity

The case study was conducted in accordance with the curricula within the time frame from October 2013 until May 2014, three (3) hours weekly, at the Informatics Laboratory of the school within the framework of the course "Research Project". Sixteen (16) Grade-12 students of a public General School in Mytilene, one computer science professor and one research participated. Researcher had the role of observer searching for students' interactions via Web 2.0 applications and the teacher offered assistance in required technical issues.The students were divided into groups of five-six (5-6) persons in the geographic research project called "Europe in our lives" with the use of Web tools. The goal of the research process is to create a learning community on "Europe in our lives" to develop high-level skills, such as critical and intercultural perspective of everyday life as a step towards an active European citizenship, the development of relations, generalizations configuration, use maps, comparison and exploration via Web 2.0 applications. The Web 2.0 tools were used during the research process were Diigo (Digest of Internet Information, Groups and Other Stuff - www.diigo.com), a social bookmarking tool and Google Earth, one of the geospatial technologies and allows the visualization, mapping, organization and analysis of multi-level geographic data reports. With regard to the first tool, Diigo, users have the ability to share, comment, research, manage, and organize bookmarks. The value of the organization comes from the fact that users create their own dictionary giving meanings that may not explicitly described therein. Result of social bookmarking is that the one, users organize their data in an easy way and on the other socialized learning the choices of other people who have common interests with them (Diigo, 2013; Castek et al., 2014). Also, the second tool, Google Earth, belongs to geospatial technologies, which focus on the development of spatial thinking skills and are a beneficial sub-product of geographically literate users. Google Earth is an application that allows web-based transition to any part of the Earth via satellite imagery, as well as geographical information systems (GIS) data (GoogleEarth, 2013; Bodzin, Anastasio and Kulo, 2014; Demirci, 2015; Blank et al., 2016).

Data on Questionnaire Responses

A small sample of sixteen (16) Grade-12 students of a public General School in Mytilene, (Lesvos, Greece) (N=16; 10 females and 6 males; aged 15 – 16) participated in an eight-month (three time internal of 66 days) "Europe in our lives" project, creating a learning community. The students of the sample also varied in their socioeconomic and cognitive background. Most students had a previous experience in geographical and environmental actions, while 25% had used social computing for educational and research purposes (Table 1).

Table 1
Description and Categories of Independent Variables

Variables	Categories and Percentage of participants (%)	Description
Course performance		
Theoretical direction	1, excellent (n=18,75); 2, good (n=68,75); 3, sufficient (n=12,5)	Indicates the students' performance in courses theoretical direction, Technological direction and Sciences Codification: 1, excellent (>18); 2, good (<17); 3, sufficient (<13)
Technological direction	1, excellent (n=0); 2, good (n=43,75); 3, sufficient (n=56,25)	
Sciences	1, excellent (n=37,5); 2, good (n=37,5); 3, sufficient (n=25)	
Previous experience		
Geographical & environmental actions	1, yes (n=56,25); 0, no (n=43,75)	Indicates whether students had geographical and environmental experience before Codification: 1, yes; 0, no
Use of social web tools	1, yes (n=25); 0, no (n=75)	Indicates whether students used social web tools before Codification: 1, yes; 0, no
Socioeconomic characteristics		
Sex	1, female (n=62,5); 0, male (n=37,5)	Sex of students Codification: 1, female; 0, male
Social status of families		
Parental education level	1, excellent (n=56,25); 2, good (n=31,25); 3, sufficient (n=12,5)	Education level of parents Codification:1, excellent (Higher Tertiary education level; MSc level; PhD level); 2, good (Secondary education level: academically oriented high school or vocational training); 3, sufficient (Secondary education level: Middle or Junior High School)
Financial stability	1, yes (n=43,75); 0, no (n=56,25) Note: The positive responses number was the same for both questions. Accordingly, the same also applies for the negative responses	Students' responses to maintain or not their parents work, their activities/ hobbies in recent years. Codification:1, yes; 0, no

Findings

Quantitative Content Analysis

As mentioned in a previous section for a better understanding and analysis of students' research activities, a quantitative content analysis (QCA) was carried out using as an analysis unit, the exchanges of the students' learning community. For the analysis, the coding system or Interaction Analysis Model (IAM) was applied. Subsequently, based on the research goals, the above-mentioned model improved with other indicators (skills) that are in line with geographical research stages of NGC for the

"New School" (New Geography Studies Programs for the New School "School of the 21st Century", 2011) and are a guide to the implementation of a geographic research project. Enhanced IAM has five phases of development in the process of constructing knowledge along with geographic approaches/skills and allows the identification of different learning exchange elements through phases corresponding to the evolutionary process of constructing thinking: I) sharing/ comparing knowledge; II) dissonance, negotiation/ co-construction; III) negotiation/ co-construction; IV) testing tentative constructions; V) statement/ application of newly-constructed knowledge, and a) asking geographic and environmental questions; b) acquiring geographic and environmental information; c) organizing geographic and environmental information; d) analyzing geographic and environmental data; e) answering geographic and environmental questions (Brown & LeVasseur, 1981; Lockyer and Patterson, 2008; Lang, 2010; Heffron & Downs, 2012; Edelson, Shavelson & Wertheim, 2013; Exarchou &Klonari, 2015).

The students' exchanges number was 268 at the end of May. Each active student has had more than thirty three (33) exchanges and more connections with others, thus creating a dynamic research learning community. Based on the above, we find that the construction of knowledge in the present learning process is mainly based on sharing and comparing information (38%) and on the demand of geographical information with regards to geographic skills (43,4%). Thus, the implementation of the above learning process inspires the students to gradually move to all phases of cognitive development aiming to further explore knowledge and develop more geographical skills (Figures 1 and 2).

Figure 1. Exchanges distribution per time interval and Gunawardena, Lowe and Anderson (1997) phases.

Note: The duration of each time interval of 66 days; 1o: First time interval; 2o: Second time interval; 3o: Third time interval.

	I	II	III	IV	V
1o	74	68	0	0	0
2o	28	27	13	2	0
3o	0	0	39	9	8

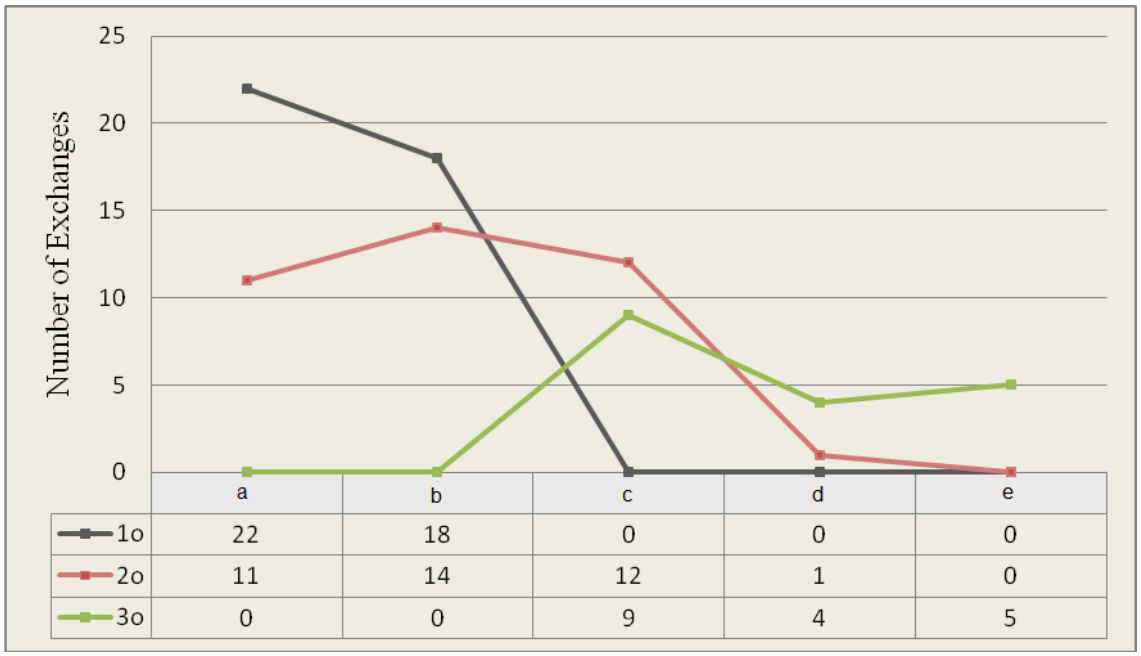

Figure 2. Exchanges distribution per time interval and geographic skills.
Note: The duration of each time interval of 66 days; 1o: First time interval; 2o: Second time interval; 3o: Third time interval.

Then, an exchange thread is presented, which shows the gradual transition to all phases of cognitive development, with the aim of further exploring knowledge and developing more geographical skills. The thread started with the statement of opinion and reference to examples of a member of the research team to record data with a European character at school (Table 2).

Table 2
Sample of learning exchange (indicative source)

I think we should start recording data with European character at school, such as posters of various events, photos of landscapes from various European countries etc.**[St19, Group A , PhI_b**]
I think we should be more specific to our topic and initially write a few words about it to help the other teams as well.**[St21, Group A, PhI_c**]
The European identity, the European culture and the European citizenship are our basic concepts and each team needs to define them. According to the glossary (from the PAM-INA program), identity is a term used to describe the sense of individuality or team/collective identifications of a person. Identity refers to the way in which people see themselves and how other people see them. An important aspect of their identity is when individuals exercise personal choices when specifying their identity and their collective identities. National identity: when someone believes that belongs and is therefore identified with a particular nation. European identity: when someone is identified and feels European. **[St21, Group A, PhI_b_c**]
For us, it is a less complicated issue and there is no specific definition of European culture. This makes sense because European culture has many dimensions. The cultural character of Europe has encouraged cultural exchanges with the help of European actions for a common cultural heritage of Europe. The purpose of the European Union is double: to maintain and support diversity and to help in order to make it accessible to everyone. I mention some examples of actions performed at schools: Erasmus and Comenius. **[St24, Group B , PhI_c,**]

For us the topic is complicated and makes it hard for us, we need more time. To answer the question whether we should connect the European identity to the European culture and citizenship: Difficult.**[St29, Group C , PhI_d**]
Based on the information we have, we are talking about a common European place, where everything is connected because here each person has the European identity, as well as European culture (with all those things they offer and are offered by the European countries). For citizenship, we do need time to make something relevant. **[St28, Group C , PhI_b**]
Of course, we can have a cultural sharing without borders, always respecting diversity of each nation. With all these actions, we have nothing less than profit!! The glossary will help you with active citizenship. I also suggest you the following website: http://www.pi.ac.cy/pi/index.php?option=com_contentandview=articleandid=955andItemid=408andlang=el **[St24, Group A , PhI_c**]
I totally agree St24; a typical example is the cultural elements of culture in Greece that can be found everywhere and are used in our daily life: music, movies, food, sports, home, even at school, as St19 wrote. **[St21, Group A , PhI_d**]
We made a research regarding the term citizenship and we found the following: This term is the legal bond between a person and a state which makes the person able to exercise all their rights, which derive from relevant policies (persons who are sentenced are excluded). Active citizenship is the ability of an individual to have active contribution to the society, such as the participation in public life, official democratic structures, debates, organizations etc. It is divided into civil, social and political one. **[St29, Group C , PhI_c**]
Therefore, to answer our main question, yes, there is an interaction between the three main concepts: European identity, cultural and citizenship, because if you are not an active European citizen, you cannot participate in actions and you do not feel a European citizen. **[St21, Group A , PhIII_e**]
In addition, European equality is based on the principles of the French Revolution i.e. liberty, equality and fraternity. Thus, in the European context which is characterized by these principles, the free flow of ideas and populations is promoted and that is the reason why you should be an active citizen and participate in actions of the European family, such as the Erasmus program. **[St24, Group A , PhIV_e**]
Note: Student: St; Students'group: Group; IAM Phases: Ph; Geographic Skills: b;c;d;e.

The content of students "exchanges" of phase I mainly regarded definitions, opinions and examples regarding the three main concepts of the research process, such as the European identity, culture and active citizenship. These interactions were mainly focused on opinions regarding the connection of the three concepts, which included expressions of social exchanges among students. For example, the thread "exchanges" of Table 2 shows their interest for a common European place and gives examples/actions of cultural sharing that take place in Greece and in other European countries. However, the first team found several difficulties in researching the concept of active European citizenship and needed more time and help compared with the other teams (Phase I). Then, some students agreed that if you are not an active European citizen (active citizenship), you cannot participate in actions (culture) and you do not feel a European citizen (identity). Based on the above, some students organized and presented data with photos, maps and graphs regarding the actions proposed in the common European area and particularly in the field of education, such as Comenius and Erasmus. The thread closed with students agreeing that there is an interaction between

the three main concepts of research and that the single European framework promotes actions that support the free flow of ideas and populations (Phases III and IV).

Social Network Analysis

The analysis of social networks was used to analyze the social structure of the Web 2.0 learning community during the students' geographical research project. At first, we calculated the degree of centrality of the students' social status and then and then we proceeded in the analysis of density to describe the students' interactions in the learning community. The centrality degree is divided into indegree and outdegree and indicates the central or non-central role of students in a community. Based on De Laat (2002), indegree central measures only the relationships that a "member-node" has with the other members of the group and is therefore not based on individual reports. Thus, in this analysis, the indegree measures provided information on the number of students/ members who use the shared bookmarks, documents, labels or notes and comments from a particular student/ member. The above outdegree analysis provided information about the number of shared bookmarks, labels, annotations, interactive notes, digital snapshots, images and documents that a student/ member had shared with other members.

As shown in Table 3, there were differences in the input and output degrees of centrality among students. The output degrees of centrality (outdegrees) were ranged between 1 and 14 (Mean = 7,312, Standard Deviation = 3,652) and the input degrees of (indegrees) were ranged between 2 and 13 exchanges (Mean = 7,312, Standard Deviation = 3,618). Three members ST19, St21 and ST28 had a high output degree of centrality (14, 14 and 12 exchanges, respectively), and two members, St31 and St32 had a low degree (2 and 1 exchanges, respectively). A high output degree of centrality shows that the student creates connections and activates the other members of the network, regardless of the team. Five members, ST19, St20, ST21, ST24 and ST28 had a high input degree of centrality (13, 11, 12, 10 and 13 exchanges, respectively), and seven members St17, ST18, S25, ST23, ST30, ST31 and ST32 had a low degree (2, 3, 3, 5, 4, 5 and 4 exchanges, respectively). A high input degree of centrality of students shows prestige or interest towards the said students (or their exchanges). Thus, students with a high degree of centrality (indegree and outdegree, summed) have more connections with other students, creating a dynamic research team and enforcing the research process through a learning network (Table 3).

Table 3
Members' participation in the network

Members	**Total exchanges**	**Outdegree** M=7,312 SD=3,652	**Indegree** M=7,312 SD=3,618
St17	4	4	2
St18	5	4	3
St19	58	14	13
St20	12	6	11
St21	59	14	12
St22	14	6	8

St23	17	9	5
St24	12	9	10
St25	10	8	3
St26	11	8	7
St27	10	7	9
St28	34	12	13
St29	6	6	8
St30	8	7	4
St31	4	2	5
St32	4	1	4
Total	268	117	117

Note: Student: St; Mean: M; Standard Deviation: SD; For conducting the analysis and visualization of the social network was used the Cyram NetMiner 4.0 program (NetMiner 2015).

In general, we could say that all students interact with each other and most of them had close bonds. However to have an indication of the overall connection of students/members of the network, we examined the density of interaction between them, which was 0,488, i.e. 48.8% of students/members of the networks cooperated during the research project, which was encouraging and positive (Figures 3 and 4).

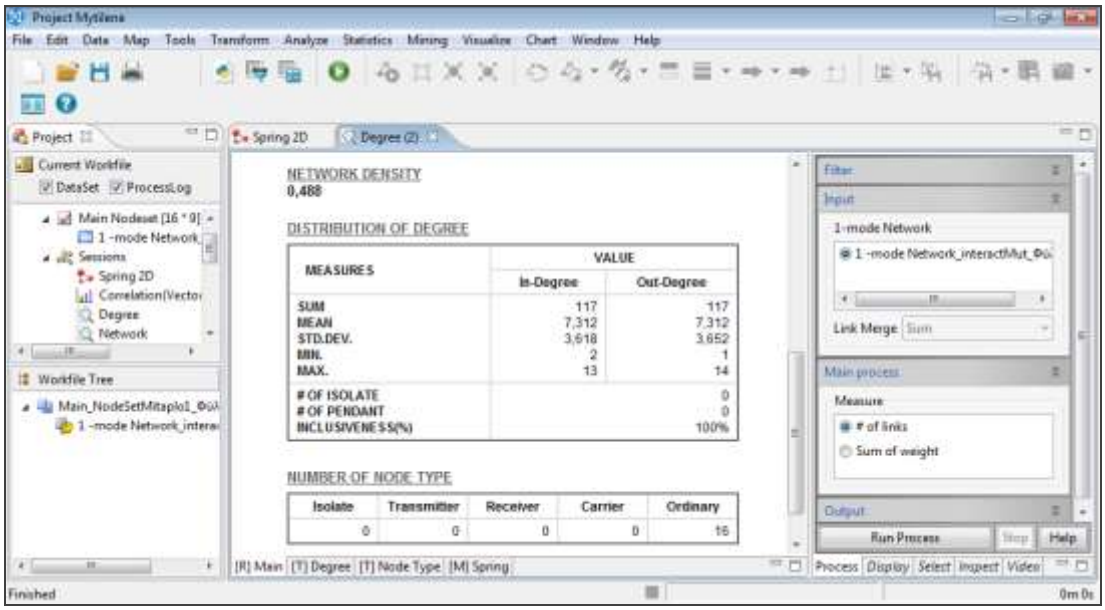

Figure 3. Screenshot from the Cyram NetMiner 4.0 program: Interaction density

Note: For conducting the analysis and visualization of the social network was used the Cyram NetMiner 4.0 program (NetMiner 2015).

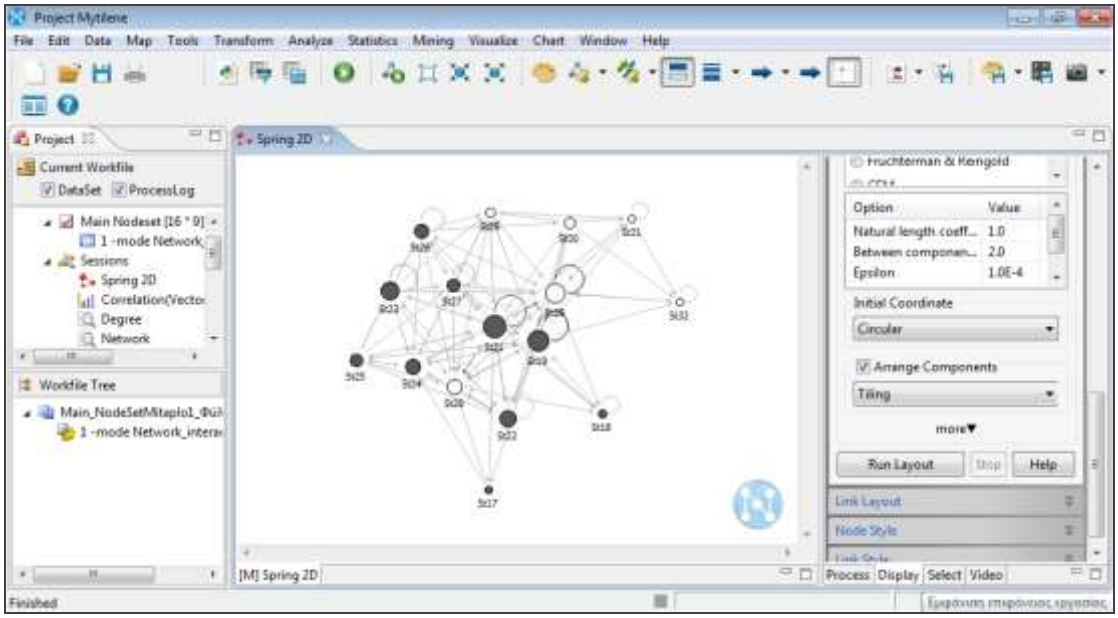

Figure 4. Screenshot from the Cyram NetMiner 4.0 program: Network imaging

Note: For conducting the analysis and visualization of the social network was used the Cyram NetMiner 4.0 program (NetMiner, 2015).

Discussion

The first research question concerns the development of new forms of students' social interaction in the context of their research and geographical action using an educational online environment, according to the socio-cultural constructivist pedagogy. The answer to this question is based on the results of the students' research effort, which focused on the analysis of their socio-cultural constructive interactions in the learning community in the frame of geographic research project. The results showed that the students' interaction density was at a satisfactory level, with full learning exchanges during the project. Students' participation in such a learning network promotes - among others - collective responsibility and synthesis of experiences, socio-cultural synthesis and sharing of knowledge and ideas, respect for the different view, disagreement management, etc. All members participated in the project by creating closed subgroups until the end of the process. Creating these in a research group could limit open communication and collaboration, but in our case there were students who participated in all subgroups and were identified as key members of the activity. Our interest was focused on a closed group with intense interaction and we noticed that all members had pre-existing experience in geographic actions, but these members tried to share and share their knowledge, thoughts and help with members who either wanted them or were not so active. Thus, members of this group played a central role in the network, guiding the discussion, activating the other members, regardless of the group, making a dynamic research team and enhancing the exploratory process. In addition, the retention of working groups and the interaction between students of different groups throughout the action showed the conscious choice of the sample to interact and construct new knowledge, creating an active social network (De Laat, 2002; Aviv et al., 2003; Dawson, 2008; Li & Sun, 2013; 2014; Umar, 2015; Durairaj & Umar, 2015).

The second research question concerns about whether or not the cognitive development and geographic approach to student research are affected in the context of their research and geographical action using an educational online environment, according to the socio-cultural constructivist pedagogy. Agreeing with previous studies (Gunawardena, Lowe, & Anderson, 1997; De Laat, 2002; Aviv et al., 2003; Houtsonen, 2003; Fisher, 2004; Houtsonen, Kankaanrinta, & Rehunen, 2004; Sing, & Khine, 2006; Shin, 2006; De Wever, Schellens, Valcke, & Van Keer, 2006; Lockyer, & Patterson, 2008; De Wever, Keer, Schellens, & Valcke, 2010; Baker et al., 2015; Favier & Van der Schee, 2014), the findings of this study help us to understand the complexity of the knowledge construction by enhancing essential geographic and environmental skills in a Web 2.0 era. The students seemed to follow a screening process, search, comparison and exchange of information, exchange of arguments, further explore and promote other views, as well as to assess the feasibility of the proposed solutions, reading and interpretation maps and other graphical representations of spaces and places. Thus, students develop the skills they need in the real world, such as participative interaction, interpersonal communication, spatial thinking and high cognitive functions (collaboration, judgment, feedback, empathy, etc.).

Limitations – Further Research Prospects

The results should be evaluated under following limitations: the limited number of sample and the absence of the sample's previous experience over 50% regarding the Web 2.0 tools use, without being necessary negative, as it is an initial research assumption. Regarding further action, specific concerns were developed on the future form of this research process and were related mainly to the applications and technologies rapidly evolve. The transition from Web 2.0 to Web 3.0 promotes motion and non-stagnation in an Informatics laboratory (Kreps & Kimppa, 2015; Vieira & Isaías, 2015; Allison & Kendrick, 2015; Ahmed, 2015; Rudman & Bruwer, 2016). Thus, we need further research to use Web 3.0 applications. Will the above applications enable students to develop more skills of cognitive geographic knowledge in the real learning practice?

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