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Contact: isresoffice@gmail.com

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Pre-Service Physics Teachers' Ideas about Teaching and Learning Using Smartphones

Ivana BOGDANOVIC
University of Novi Sad

Abstract: The teachers in primary and secondary education try to get students to put away their smartphones while in the classroom. It can happen that students use their smartphones to text each other, check social networks, and even listen to the music or watch videos, during instructional time. However, skilled teachers find a way to overcome the problem of these interruptions. They manage to make students use smartphones to support learning. The educators stay divided on the issue of whether students should use smartphones in the classrooms. Pre-service physics teachers at Faculty of Sciences of University of Novi Sad are asked about their opinion whether smartphones should be used in the classroom and their ideas for using smartphones in teaching and learning. Three ideas are presented in this paper: inquiry-based learning, project-based learning and playing Kahoot. Stated ideas indeed can be realized in classroom successfully with the use of smartphones. Different approaches to teaching and learning, including stated, impact students' performance in physics, as well as their motivation for learning. Moreover, the impact that technology has on today's schools is very significant. The adoption of technology in education can change both, how teachers teach and how students learn. Accordingly, it can be suggested to implement presented enthusiastic future physics teachers' ideas in school practice.

Keywords: Cell phones, Inquiry-based learning, Kahoot, Physics education, Project-based learning

Introduction

The teachers in primary and secondary education may have problem because students sometimes use their smartphones to text each other, check social networks, and even listen to the music or watch videos, during instructional time. Number of teachers are trying to get students to put away their smartphones while in the classroom in order not to be interrupted. Skilled teachers find a way to overcome the problem of these interruptions by getting students to use smartphones for learning. However, the educators stay divided on the issue of whether students should use smartphones in the classrooms.

Different approaches to teaching and learning impact students' performance in physics, as well as their motivation for learning (Sağlam, 2010; Zouhor, Bogdanović, Skuban & Pavkov-Hrvojević, 2017). Moreover, the impact that technology has on today's schools is very significant (Cvjetićanin, Pećanac, Sakač & Djurendić-Brenesel, 2013; Odadžić, Miljanović, Mandić, Pribićević & Županec, 2017). The adoption of technology in education can change both, how teachers teach and how students learn. New technologies include, not only smart boards, projectors and computers, but also cameras, smartphones... Different types of emerging technologies can be used in education separatly, or they can be combined. Their use can facilitate and make more interesting delivering of physics contents, students' own investigations, evaluation...

Method

With the aim to determine pre-service physics teachers' opinion whether smartphones should be used in the classroom and to find out more about their ideas for using smartphones in teaching and learning, ten students (in different years) at Faculty of Sciences of University of Novi Sad are interviewed. Three ideas described by the students are presented in this paper. Each student was additionally asked to think of physics topic that can be

suitable for teaching and learning using proposed idea and to make photo (or screenshot) of using smartphone as described. The students had one week to do this.

Results and Discussion

Pre-Service Physics Teachers Opinion

Interviewed students seemed very determined when expressing their opinion on using smartphones in the classroom. Three different beliefs could be distinguished: (1) smartphones should be used often, (2) smartphones should be used rarely and (3) smartphones should be banned in schools (Figure 1).

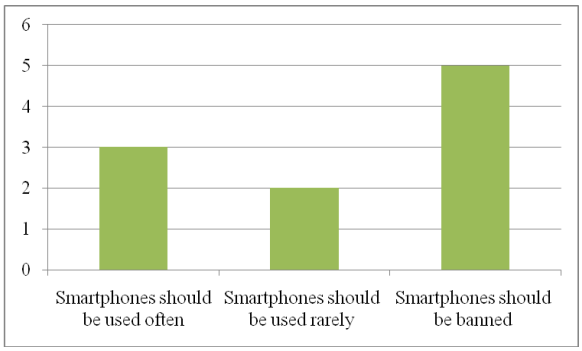

Figure 1. Frequencies of pre-service physics teachers' opinion on using smartphones in schools

Three students expressed very positive opinion about using smartphones in schools. In just few minutes they described, one idea each – how smartphones can facilitate teaching and learning. Their ideas will be described below. Two students said that smartphones should be used rarely with explanation that smartphones are not suitable in classroom because students will not use them as instructed. Half of interviewed students think that smartphones should be completely banned in schools. They think that smartphones can be just interruptions and that students will use them only to entertain themselves and ignore the teacher or in order to cheat on the tests.

Pre-Service Physics Teachers' Ideas

Each student proposed different idea of the use of smartphones in school: (1) inquiry-based learning, (2) project-based learning and (3) playing Kahoot. Although the first student did not use the term inquiry-based learning, his idea was described in detailed and it fit that approach, so it will be widen in accordance to literature review.

Inquiry-based Learning

The first student's idea was that: "The teacher should give instructions to students to prepare themselves during physics class to communicate about selected topic on the next physics class; and for that they can use all the information they can find on the internet by using their smartphones. If they need more time, they should finish their task for homework."

Inquiry-based learning implies involvement in learning that leads to understanding. Students should construct new knowledge on their own. In order to seek for new information or knowledge, students can carry out experiments, observations, research in literature and other. There are various levels of inquiry that can be carried on, described by Banchi and Bell (2008). *Confirmation inquiry* is the first level of inquiry. After topic is delivered by the teacher, that is for what is already known, students are following instructions and carrying out procedures to collect and record data in order to confirm and deepen understandings. *Structured Inquiry* is when the teacher provides the topic in a form of question and gives rough guidelines of the inquiry procedure; students should collect and analyze data in order to formulate their explanations. *Guided Inquiry* is when the teacher proposes the research question, but the students are responsible for designing and carrying out their own procedure to answer given question, and then report their findings. *Open/True Inquiry* is when students are carrying out their own investigation on the topic they have chosen and answer their own questions. Very important phase is reporting of results because students then can exchange their findings and get feedback.

It can be noticed that approach proposed by the student can be categorized as structured inquiry, where students are instructed to use material available on the internet. This student made screenshot of Google search for using smartphone (Figure 1). The student suggested this approach for topic Friction. Additionally, it should be noted that the student stated as a potential obstacle of this approach that: "Maybe students do not have good English knowledge and sites on Serbian are poor with quality physics contents". The student emphasized that when exploring something on the internet, different sources should be considered, their validity should be questioned and students should use text, video material, presentations and other formats.

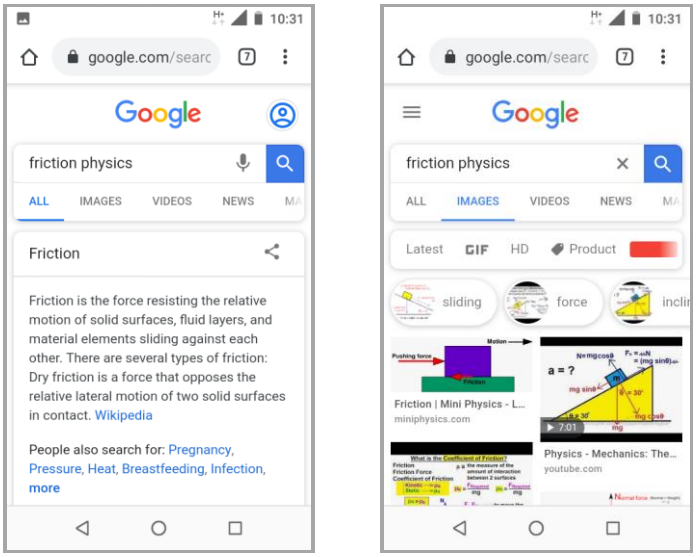

Figure 2. Google search proposed by student

Students at home actually often conduct true inquiry on the topic they are interested in, and for that purpose they use computers or smartphones to search relevant material on the internet; often it is not school content.

Project-based Learning

The second student's idea about using smartphones for implementation of project-based learning was that: "Students can carry out project with the aim to make their own video material about given topic. It is not idea for one physics class but for longer period. I think that during this project realization, students should work in groups and talk and move around the classroom freely." The student who described this idea instead of screenshot said: "Imagine smartphone with camera turned on". The student did not select any topic since thinking that every topic is suitable. This student had experience because of personal involvement in very similar project in physics class.

Project-based learning is very useful in physics teaching since students learn by actively engaging in real-world projects (Holubova, 2008). The teacher sets the task for students who should work on the project, in a group of four to six students, for an extended period of time to respond to a complex question, challenge, or problem. The project-based learning results with students' product and that makes students additionally satisfied with their engagement.

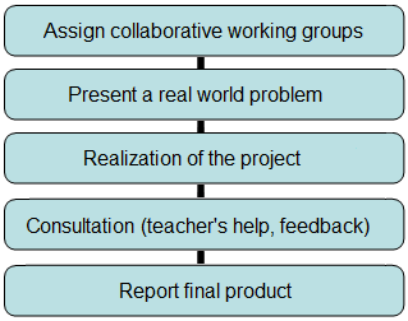

Figure 3. Project-based teaching strategy

In Figure 3. design of project-based teaching strategy is given. The idea of making video material about selected topic is very interesting; it makes possible to implement project-based teaching for any content.

Playing Kahoot

The third student's idea was playing Kahoot. This student had experience with this fun way of answering given questions. The student prepared a quiz (selected topic was History of physics) and other students played it, after what they all agreed that it is great idea.

Kahoot is "a game-based platform that makes learning inclusive, fun and engaging. Instead of looking down into their textbooks or devices, learners are encouraged to look up while playing and connect with each other – we call it a 'campfire moment'." It is free, and very simple to create and play. All instructions are available on the internet (https://kahoot.com/company/).

Figure 4. Screen capture of the quiz question (large screen and smartphone)

In order to become a participant in quiz, a student should open the link (https://kahoot.it) on his/her smartphone or use mobile app, enter the PIN seen on the large screen (smart board or projector can be used) and enter his/her nickname. While playing Kahoot, questions, answer options and related images/videos are displayed on the large screen and smartphones are used for answering (by tapping the box matching the answer one considers correct) (Figure 4). The answer must be given before time runs out. Playing Kahoot is fun way of answering questions, students can compete individually or in groups (correct answers award quiz points) and they get feedback instantly.

Conclusion

Students highly use new technologies in everyday life. However, five out of ten pre-service physics teachers think that smartphones should be completely banned in schools and only three had their own ideas how smartphones could be used. It is probably in correlation with their experience of using smartphones in classroom and it is in accordance with the fact that "old school teachers" still prevail. In schools smartphones can be both, interruption and aid, depending on the teacher's approach. Accordingly, it can be suggested to implement presented enthusiastic future physics teachers' ideas in school practice. Stated ideas indeed can be realized in classroom successfully with the use of smartphones.

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Author Information

Ivana Bogdanovic
University of Novi Sad, Faculty of Sciences
Trg Dositeja Obradovića 4, Novi Sad 21000, Serbia
Contact E-mail: *ivana.bogdanovic@df.uns.ac.rs*

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How to Promote Education for Sustainable Development? Vision of the Educational Situation and Its Contribution to Sustainable Development

Khalid AADA
University of Texas Rio Grande Valle

Abstract: During the last decade, the importance of leaving a rational paradigm, debtor of functionalist and utilitarian models, towards another more congruent with the preservation of natural resources, and therefore of life, has been widely discussed. In the same way, different voices have been raised, pointing out the urgency of inserting these precepts into the educational field, hoping to achieve the true cultural transformation that is needed to consolidate the change. Multiple International Entities promote sustainability in Education as an initiative that should be ambitious, complex and reforming character, given the global scope of the social, economic and environmental situation affecting the planet. Through the exploration of the relationship between education, cultural change and sustainability, this work presents an overview of the educational situation in terms of its collaboration towards sustainable development from a critical vision of the objectives, foundations, challenges of environmental education and improvement opportunities; the aspects that positively impact on conceptual development and educational practice are argued, as well as the way in which new approaches of raising environmental problems and working towards a more sustainable future could be generated. Finally, certain proposed solutions are suggested.

Keywords: Education, Sustainability, Development, Environment

Introduction

"If the essence of community life is based on the possibility of elucidating and integrating the best features of the individuals that constitute it, it is necessary that education, as an instrument of socialization and critical attitude, adopt valid answers to the challenges that humanity is raising" (Novo, 2009).

During the last decade, the importance of leaving a rational paradigm, debtor of functionalist and utilitarian models, towards another more congruent with the preservation of natural resources, and therefore of life, has been widely discussed. In the same way, different voices have been raised, pointing out the urgency of inserting these precepts into the educational field, hoping to achieve the true cultural transformation that is needed to consolidate the change.

However, despite the multiple efforts, there is still a truly holistic, integrative educational proposal that assumes the postulates of the so-called sustainable development, which brings to fruition the systemic vision that underlies this perspective, leaving its genesis in a simple and plain ideological transcription, whose operative outline becomes the new pending subject.

Within this framework, countless debates and controversies have taken place on Education for Sustainable Development and its insertion in the dominant logic of the neoliberal current of the economy (González Gaudiano, Edgar J. 2006). Given this scenario, much remains to be done, especially in countries where arbitrary replication of pragmatic models is the common denominator (Villarruel, 2010). Iberoamerican Journal of Education. Discussion.

The UNESCO Organization in its conference "the decade of Education for Sustainable Development, 2005-2014" announced the importance of the will to improve the quality of life of all human beings, including that of future generations, reconciling the economic growth, social development and environmental protection.

On the other hand, contemporary education for sustainable development is considered today an educational proposal that aims to contribute to the indispensable but necessary processes of sociocultural change to build a sustainable future (Unesco, 2002).

This arises at both local and regional level, because its conceptual development has been promoted in conferences and international forums by multilateral agencies such as the (IUCN) International Union for Conservation of Nature, and the United Nations Educational, Scientific and Cultural Organization (Hopkin and MacKeown, 2002; Tilbury and Calvo, 2005). UNESCO states that the sustainability education initiative has an ambitious, complex and reforming character, given the global scope of the social, economic and environmental situation affecting the planet.

In essence, the decade of Education for Sustainable Development aims to promote solidarity in education that contributes to a correct perception of the state of the world, that is capable of generating responsible attitudes and commitments, and that prepares citizens to be able to make fundamental decisions aimed to the achievement of a culturally plural, social fairness and ecological and sustainable development, that goes beyond the classic anthropocentric positions and that is oriented to the search for more comprehensive and intelligent models of interaction with ecosystems.

It should be noted that the education movement for sustainable development is not homogeneous; its conceptual expressions and practices vary, and not always without tensions (Huckle and Sterling, 1996). However, there are elements that have been fundamental since its origin, and that are still promoted and developed by its main exponents. One of these elements is the critical practice, understood as a pedagogy that integrates both reflection and action (Tilbury, 2003).

This inspires two questions that put culture at the center of educational practice. Putting ourselves within a critical practice and in a context of globalization that often generates changes towards practices and unsustainable values within communities; What role should education play in the purpose of achieving the sustainable development and sustainability of human-natural systems? What to teach and how to teach for this purpose?

Parameters of an Educational Environment

It is important to note that the design of an environmental or sustainable education model is a paradigmatic activity that involves choosing certain fundamental appropriations with respect to the various basic concepts: what is nature and sustainability? How can this reality be known and how can it be taught and learned within education?

What can be found is that, within environmental education, the concept of sustainability according to Orr (1992) is unclear and presents contradictions, it also has several approaches and conceptual frameworks, often inconsistent. It is undeniable that Education for Sustainable Development (ESD) suffers from complicated issues that need to be addressed, but reflecting on its proposals can also drive progress in the various areas and on different insights.

This reflection is considered as a critical exercise that aims to contribute to the change towards a more sustainable future. It is worth mentioning that the proposal of the ESD has raised controversies and criticisms by some sectors related to the field of environmental education (Berryman, 1998; González-Gaudiano, 2003b; Jickling, 2000; Sauvé, 1998), controversies that have been reactivated after the entry into force of the United Nations Decade of Education for Sustainable Development (2005-2014) (ANEA, 2005).

Within this framework, the criticisms related to ESD are of a varied nature, from the process through which it was developed (González-Gaudiano, 2003b), its conceptual basis (Sauve, 1998; Jickling, 2000), to the lack of relevance in the introduction of a new concept in certain contexts (Arias, 1998; González-Gaudiano, 2003ª, 2003b, 2004; Sauvé, 1998), or even to the consideration of the lack of contributions of this approach to environmental education (Arias, 1998).

It is ambitious because it aims to prepare all people, regardless of their professions and social conditions, to plan, confront and resolve the threats that weigh on the sustainability of our planet (National Academy of Environmental Education, 2005).

Action plan for Sustainable Development in Educational Institutions

The initiative is reforming, because it states that education for sustainability focuses on underlying principles and values, instilled through education. It is concerned with the content and purpose of education and in more general terms, for all kinds of learning; it also about all the ways in which education is taught.

Consequently, education for sustainability also addresses pedagogical methods, validation of knowledge and the functioning of educational institutions (UNESCO 2005). This change of model requires diverse actions and instruments that transform our attitudes, our lifestyles, our patterns of social participation, and our conceptions of social instruments and ways of doing politics. These actions can be listed as follows:

1- Promote collaboration between educational institutions and government districts, as well as with productive entities, through the establishment of incentives and stimuli that promote this cooperation.
2- Establish mechanisms for technical and financial support to educational institutions.
3- Establish policies and instruments to promote the expansion and diversification of the educational offer that considers local, regional and national environmental priorities.
4- Establish policies and support instruments for the curricular restructuring processes of the existing academic programs with a view to incorporating sustainability content and approaches with a transversal perspective.
5- Involve educational institutions in programs of action, evaluation and dissemination that seek to improve the environment and the management of natural resources in works related to communities at the local level. In this sense, promote the linking of social service programs in the care of the solution and prevention of environmental problems.
6- Establish programs, in public organizations, to provide greater support to progress in research and technological programs on issues related to sustainable development, which favor the environmental reconversion of the productive plant (at public, private and social levels).

The challenge would then be to give priority to pedagogical and participatory aspects and to use other tools such as school environmental conferences, dynamics of motivation, awareness activities, pedagogical workshops, etc. At the local level, it would be:

1) Build sustainability from the educational centers knowing that it is a process in constant change and learning, which seeks the eco-social balance between human beings and nature, that leads to integrate sustainability habits in the daily life of the educational center;
2) Democratic participation of the entire educational community as an open structure in which all its members, especially students, have a place, and is linked to all aspects of the organization's life: planning, decision-making, action and evaluation;
3) Responsibility as a value that must be administered proportionally; it is not only about detecting where is the issue, but creating collective solutions and alternatives to the environmental problems of the Educational Institution and equity as a value that each member carries, whether student, teacher or institution to contribute according to their capacities and circumstances;
4) Interdisciplinary and holistic approach where aspects of the human being are contemplated: Physical, cognitive, social, emotional ..., in line with multiple intelligences and the work of basic competences;
5) Action-oriented learning, that is, creating the appropriate channels to develop opportunities for action in and from the educational establishment, understood as an attitude that is part of the reflection; and
6) Finally, Collaborative Learning and networking that aims to be a process in which members feel mutually committed to the learning of others, generating a positive interdependence.

On the other hand, environmental literacy actions do not have to be strictly individual or limited to school intervention, because sustainability frameworks require intervention from the society of knowledge, and from the multiplicity of professional contexts, socio-political, business, associative and non-governmental of each territory.

This intervention is related to the educational system that currently plays an important role in sustainable development, which is reflected, for example, in the process of its constitution; in the way it facilitates the meeting of educators from different disciplines and from different latitudes; in its way of promoting the global

vision of the problems, and the centrality of the concept of sustainability that allows us to understand the search for solutions in new terms.

Principles of Basic Education

Leff (2004) classifies education into two basic principles:
1. A new ethic that guides values and behaviors towards the objectives of sustainability and social equity; and,
2. A new conception of the world as complex systems, the reconstitution of knowledge and the discussion of experiences lived.
With a broader approach, which exceeds what is strictly school, Sterling (1996) - on his side - addresses the following points as ESD objectives:
1) Help understand the interdependence of all life forms on the planet, and the repercussions of actions and human decisions in the present and in the future on resources in local and global communities;
2) Become aware of the narrow influence that exists between economy, politics, culture, society, technology and environment, and their role in sustainable development;
3) Develop capacities, competencies, attitudes and positive values to be actively involved in sustainable development at the local, national, regional or international levels, and guide efforts towards greater future equity and sustainability, emphasizing the integration of citizens into decisions related to the environment and the economy;
4) Therefore, show interest in all the proposals that contribute to promoting Environmental Education and Education for Sustainable Development, being necessary to deepen models that integrate the different concepts of sustainability, both in cross-cutting matters and in traditional areas of curriculum

However, it is important to point out that the practice of Environmental Education has generally focused on the study of nature, leaving behind few cases in which they manifest themselves with the "critical" perspectives and the integrative vision necessary to contribute to the changes that the current world situation requires (Huckle, 1988; Fien and Tilbury, 2002).

Regarding the teaching process, education for sustainable development teaches children, adolescents and adults how to think and act sustainably, since our way of acting today influences the living conditions and the margins of action of generations and people who live in other regions of the world. Answering the question: what to teach and how? The importance of:

1) Teaching the potential of the natural environment for human use, including knowledge of the main ecosystems and the processes that sustain them, as well as their conservation and vulnerability to human modification;
2) Teaching that the appendix has an interest for participation in decision-making on environmental problems, as well as management and political-environmental literacy strategies;
3) Teaching how to critically analyze the modes of consumption, as well as the role of the media and the ideological models behind them, and the alternative utopian options; and,
4) Actively involve the entire educational staff in themes and in real environmental conflicts, which allow selecting those practices that are most effective for the search for solutions.

These teachings can be done starting with a theoretical-practical review of the advantages of technological development in different societies, and their impact on nature and the environment; through an analysis of the historical evolution of class conflicts and social movements, as well as their impact on the interaction's society-nature; and finally, the design of an alternative proposal of social life organizations, without leaving behind the actions of the future in community contexts.

Following Dieleman and Juárez (2008), The concept of sustainability is considered as a community project, where it is important to focus attention on the principles and methods to promote the construction of contextual meaning, integral research in action, the promotion of values, critical thinking and the use of multiples strategies.

The question then would be how the ideas presented can serve as a complete set to explore specific goals and teaching's processes, knowledge, skills and attitudes? A template table as below would reflect the links between the environment as a community project, experiential learning and different teaching's dimensions (Dieleman and Juàrez, 2008)

Concepts and Dimensions of Teaching process.	*The environment as a community project*	*Experiential Learning*	*Practice process*
Teaching's Objectives	Being able to understand the relationship between the local, the regional and the global, as well as between nature, the environment and the sustainable.	Being able to work with the practical, analytical, ethical and political aspects of the problem, joining apprehension and understanding.	Being able to use a complete background of images, ideas, examples and practices accumulated through life.
Teaching's methods	Teaching in a set of community-based projects and life projects of the participants themselves.	Teaching through case studies and stays in communities, and building experiences within communities.	Create spaces for sharing background expertise, stimulating the use of all life experiences.
Knowledge	Knowledge of contextual meaning, associated with the territory itself and induced from a different cosmology.	A combination of different types of knowledge: assimilative, accommodative, convergent and divergent.	Environmental knowledge realized through the use of a language of forms, pictures and metaphors.
Skills	Critical thinking, reflexive observation, self-reflection, collaboration and communication skills.	Having the skill to learn and practice.	Skills to experience surprise, perplexity or confusion, to allow feeling (excitement, inconformity, etc.)
Behaviors	Having the will to see oneself as involved in the problem and in the transformations.	Being able to contribute to the awareness and participation process.	Trust one's himself. Stay curious and open-mind to new challenges.

The conception of the Teaching-Learning process, then, aims to achieve an educational quality that rests according to Latapí (2007) in two cases: *"[…] in order to transmit quality, it is necessary to recognize it, and to be able to recognize it, it is necessary to have it. There are no vicious circles or tautologies in this, but the recognition that education is essentially a process of interaction between people, and the quality of the educator depends decisively"*.

From this vision, the education system, without any doubt, will be able to generate and apply knowledge, extend and preserve the culture, considering the set of skills, values and attitudes necessary and relevant for the prevention, protection, conservation of the environment and better distribution of resources, contributing significantly to the sustainable development of the country, tasks that will be carried out with the highest quality and in concert at different levels of government, including the productive sector and the civil society organizations. In particular, there will be national policies and programs that will facilitate the realization of activities in favor of integral actions recognizing regional and local differences and needs (Anuies and Semarnat, 2002).

Final Comments

Experience in recent years has shown that environmental and sustainability education has faced various obstacles, weaknesses and challenges in its path of transformation towards a participatory education that can contribute to social and cultural changes (Dieleman, Hans and Margarita Juárez Nájera, 2008). Environmental educators have emphasized that a strategy of education for sustainability is necessary to:

a) draw a common direction and social articulations, product of consensus, from the federal to the municipal order;

b) offer a national reference to state plans;

c) have an updated overview;

d) overcome immediate actions; gather social and political strength to offer sustenance and coverage to the actions carried out;

e) make efficient financial management capacity for projects; make commitments in the framework of agreements and understandings;

f) and, above all, to guide a public policy that allows positioning education as a central element of national development.

Sustainability is a concept that seeks holistic thinking. It is not a scientific or technical conceptualization; hence it is convenient to explore other ways of knowing the problem; it is different from what the method of approaching reality in contemporary societies dictates (Dieleman 2000 and 2006).

Conclusion

It is important to be aware that in any educational design, teaching goals and methods, as well as knowledge, skills and attitudes are interrelated within a different paradigm. Following a reflexive procedure avoids working within an education program with poorly related or contradictory concepts and approaches. As a second conclusion, the analysis of existing education programs, using various class elements to develop a complete evaluation scheme, adding the key elements that allow to present the current designs in a more open and transparent sense. That may be important in a world where students have more choice, where transparency is sacred, and where education is seen as learning for sustainability (Hesselink et al., 2000).

The discussion should take place within our countries, in our communities, asking what we propose to walk in the direction of sustainability. It is about recovering and evaluating initiatives to learn and to continue building on them. It is important to dialogue with the proposal of education for sustainable development from the approaches that help the environmental education to be built. Various actions and instruments are required to transform our attitudes, our lifestyles, our patterns of social participation, and our conceptions of social instruments and ways of doing politics. The challenge of Environmental Education for Sustainable Development and for educational research on these issues consist in addressing broad diagnoses that allow us to objectify the progress and assess the results of the actions in the short, medium and long term.

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Author Information

Khalid Aada
University of Texas Rio Grande Valle
One West University Blvd,
Brownsville, TX. 78520. USA
Contact E-mail: khalidaada07@gmail.com

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Evaluation of the Project "Artvin Bilim ve Robotikle Renkleniyor" from the Viewpoint of Middle School Students

Sibel ACISLI
Çoruh University

Hatice KUMANDAS OZTURK
Çoruh University

Abstract: The aim of this study is to examine how the middle school students participating in the project "Artvin Bilim ve Robotikle Renkleniyor", which was conducted in Artvin as part of the Scientific and Technological Research Council of Turkey (TÜBİTAK) 4004 Nature Education and Science School program, evaluate the project and the activities in it. In the project, all participants were asked to evaluate the activities with student diaries. Additionally, interviews were conducted with the students on the last day of the project in order to determine their general thoughts on the project and the activities in it. In the study conducted with the qualitative research method, the diaries and end-of-project views of the students were analyzed with content analysis. The data of the study were obtained from a total of 30 students in 6th and 7th grades at six middle schools in Artvin. 19 of the students are female and 11 are male. 14 of these students are in sixth grade and 16 of them are in seventh grade. With the evaluation of the data obtained from the study, the students stated that they found most of the activities informative and fun, that they would like to participate again and that they would recommend the project to their friends. It is seen that students recognize the importance of nature and discover the mutual interaction between nature and science with this project. The students also stated that they liked the learning environment in the project as it made learning enjoyable and that they found it beneficial in terms of enabling them to recognize that active and experiential learning is more permanent. At the end of the analyses, it was observed that the students generally participated in the activities voluntarily and that they had a voluntariness rate of 100% towards the end of the project. Additionally, it was stated that the students aimed to complete the activities on time and were pleased with them.

Keywords: Science school (camp), Middle school student, Student diaries

Introduction

Today, individual and social life necessitates the recognition of knowledge. The contributions of knowledge to individuals and society cause this importance to increase each passing day (Balantekin, 2013). The expected characteristics of humans in the new age can be achieved through raising individuals who know the ways of accessing information and access the most accurate information, analyze the information they obtain, and use technology in daily life by following the developments in science and technology (Kara and Akarsu, 2013). Today, all countries are trying to increase the quality of scientific information and engineering education (Yalçın et al., 2014). Quality science teaching is evaluated as a key point of the world's future in terms of the future of the nations (Yalçım and Şişman, 2018). Students who are raised by learning science and the nature of scientific information and the characteristics of scientific information, approach to science in accordance with the contemporary science understanding (Özden, 2012). In countries where the science and social relations or the correct transmission of information to the social layers are fictionalized well, it is tried to provide the abilities of scientific curiosity, questioning, knowledge generation and associating existent knowledge with the produced knowledge at young ages (Taner et al., 2017). A student who has acquired these abilities would be able to use and produce scientific knowledge in future education steps (Savaş, 2011).

The general purpose of science schools which recently became popular in our country is to demonstrate how closely the scientific facts and concepts are related to daily life and to show that it is enjoyable and entertaining to do science (Birinci Konur et al., 2011). TÜBİTAK which desires a vast majority of the target group, ranging from students to public employees, to interact with science, implemented a program named 4004 - Nature Education and Science Schools (Avcı, 2013). When the studies which reveal the results of projects conducted within the scope of TÜBİTAK 4004 Nature Education and Science Schools projects are examined, Yalçın et al. (2014) stated that almost all of the students appreciated camp activities as a result of the "Who are We: The Engineers of the Future Science Camp" project and the camp positively affected the self-confidence of students towards learning scientific knowledge and participants learned-by-doing throughout the camp; Tekbıyık et al. (2013) determined that the participants of "The Entertaining Exploration of Mysterious World Summer Science Camp II" project completed the camp with positive cognitive and affective acquisitions and students mainly had positive opinions towards the activities; Marulcu, Saylan and Güven (2014) determined that most of the primary-school students participated in the "Little Scientists Science School" project supported by TÜBİTAK found it entertaining and the conducted activities contributed students to associate the subjects they learn in courses with daily life; Konur et al. (2011) stated that science camp influenced students to develop positive attitudes towards the science course and the scientific activities carried out in the camp and scientific environment had significant roles in reaching this conclusion; Göloğlu Demir and Yılmaz (2018) determined that as a result of "Four Days, Four Themes: Science" project the opinions of students towards the project were positive, the project was entertaining for students and students were happy throughout the project.

In this context, it was aimed to determine the opinions middle-school students towards the "Artvin Bilim ve Robotikle Renkleniyor" (Artvin is Enlivened with Science and Robotics) project and the activities of the project which was supported by TÜBİTAK within 4004-Nature Education and Science Schools projects. Thus, answers were sought for the following questions: What are the opinions of students who have participated in the Artvin Bilim ve Robotikle Renkleniyor

1- Project towards the activities conducted in the project?

2- What are the opinions of students towards the project?

Method

Middle-school students who have participated in the "Artvin Bilim ve Robotikle Renkleniyor" project which was conducted in Artvin within the scope of TÜBİTAK 4004 Nature and Science School program were asked to evaluate the project and the activities of the project with student diaries. Furthermore, on the last day of the project, students were interviewed in order to determine their opinions towards the project and the activities of the project. In the study which was conducted with qualitative research method, the diaries of students and the end of the project opinions were analyzed with content analysis. The data of the study was obtained from 30 middle-school students who were studying in 6th and 7th grade of six middle schools in Artvin. 19 of the students were female and 11 of them were male. 14 of these students were studying in sixth grade and 16 of them were studying in seventh grade.

Findings

In the project, all of the participants were asked to evaluate the activities with student diaries at the end of each day. The results of the evaluations were summarized in the table below.

Table 1. The evaluation of student diaries

Activities		Voluntary participation in the activity	Paying attention to complete the activity on time	Contribution to the group	Sharing the opinions with the group	Satisfaction from the activity
Let's Make Our Own Solar System	Yes	28	29	27	28	26
	Partially	2	1	3	1	3
	No	-	-	-	1	1
Let's Learn the Organs of Plants	Yes	28	30	26	26	30
	Partially	2	--	2	--	--
	No	-	--	2	4	--
Robotics	Yes	30	29	26	28	29
	Partially	-	1	4	1	1
	No	-	--	--	1	--
I am Producing Electricity with My Wind Turbine	Yes	30	30	29	29	28
	Partially	--	--	1	1	1
	No	--	--	--	--	1
The Recycling Adventure of Paper	Yes	30	30	30	27	29
	Partially	--	--	--	1	--
	No	--	--	--	2	1
Let's Clean Our Water	Yes	30	29	28	28	30
	Partially	--	1	1	1	--
	No	--	--	1	1	--
Robotics	Yes	29	30	27	28	30
	Partially	1	--	2	1	--
	No	--	--	1	1	1
The Mysterious World of Bugs	Yes	30	30	29	28	30
	Partially	--	--	--		--
	No	--	--	1	2	--
Robotics	Yes	30	29	28	28	30
	Partially	--	1	2	2	--
	No	--	--	--	--	--
What is in the Sky?	Yes	30	30	29	29	30
	Partially	--	--	--	--	--
	No	--	--	1	1	t

When Table 1 was examined, it was observed that students usually volunteered to participate in the activities and their condition of volunteering increased to 100% towards the end of the project. Furthermore, almost all of the students paid attention to complete the activities on time and they stated that they were satisfied with the activities. The conditions of students in working with the group and sharing their opinions with the group slightly decreased on the 2nd and 4th day compared to other days.

In addition to the student diaries, students were interviewed on the last day of the project and the analysis of the results was summarized in the table below.

Table 2. Interview results

Activities			**Number**
The dimension of the Activities	Instructive activities	Let's Make Our Own Solar System	8
		Plant Hunt	6
		I am Making My Own Morse Code	5
		I am Teaching Colors to My Robot	8
		Let's Learn Wild Animals	10
		Robotics 2: The Fastest Robot Contest	10
		What is in the Sky	10
		Basic First Aid	2
		Robotics 3: A Robot that Follows a Line	4
	Entertaining activities	Let's Make Our Own Solar System	2
		I am Making My Own Morse Code	3
		I am Producing Electricity with my Wind Turbine	4
		The Recycling of Paper	2
		Let's Clean Our Water	1
		I am Teaching Colors to My Robot	5
		Let's Learn Wild Animals	11
		Robotics 2: The Fastest Robot Contest	6
		What is in the Sky	3
		Poster	3
		Horon	3
		Basic First Aid	3
	Non-entertaining, non-instructive activity	I had fun in all of the activities	27
		Documentary	1
		Reading book	1
		I am Producing Electricity with My Wind Turbine	1
	Activities that are Desired to be Added	Everything was wonderful	26
		Archery	2
		Nature Trip and Camping	2
Learning Process and Environment	Similar and different aspects of the learning process that takes place in the project and the school	Teachers were active in the school, here, we were active while learning	5
		In the project, everything was more based on the life, in touch with nature and more permanent compared to school	6
		We learned while having fun and based on experiment and observation compared to school	8
		We learned robotic coding in addition to the education in school	3
		Group study and staying in a natural environment	2
	Opinions towards the environment of the project	Everything was beautiful, especially our rooms and the environment where the activities were conducted provided us to establish better relationships with our friends.	20
		The environment was wonderful, learning in this environment was far better.	10
The contribution of the project on the perspective towards nature		I learned how important it is to protect nature	7
		My interest in nature increased	5
Suggestions and the Sustainability of the Project	The desire to re-participate in this project	Yes	30
		No	--
	Recommending the	Yes	30

	project to the friends	No	---
	Suggestions	It could have been longer than 1 week.	4
		We could have more nature trips	2
		The number of individuals in the groups and the group studies could have been reduced.	3

When Table 2 was examined, it was observed that students found most of the activities entertaining and instructive, wanted to participate again and stated that they will recommend to their friends. It can be observed that with the project, students acknowledged the importance of nature and realized that nature and science are interacting with each other Additionally, students found the learning environment in the project pleasant since it makes learning entertaining. Furthermore, students stated that the project was beneficial since it provided them to realize that active learning and learning-by-doing are more permanent.

Discussion and Conclusion

According to the data that was obtained with the study in which the opinions of middle-school students towards the "Artvin Bilim ve Robotikle Renkleniyor" project that was supported within the scope of TÜBİTAK 4004 Nature Education and Science Schools and their opinions towards the activities of the project, it can be observed that students found most of the activities entertaining and instructive, wanted to participate again and stated that they will recommend to their friends. It can be observed that with the project, students acknowledged the importance of nature and realized that nature and science are interacting with each other Additionally, students found the learning environment in the project pleasant since it makes learning entertaining. The conducted studies also indicate similar results (Yalçın et al., 2014; Tekbıyık et al., 2013; Akay, 2013; Göloğlu Demir and Yılmaz, 2018; Marulcu, Saylan and Güven, 2014). Yıldırım, Atila and Doğar (2016) determined that students learn the scientific information in daily life while having fun and found out that this method is more permanent.

Furthermore, students stated that the project was beneficial since it provided them to realize that active learning and learning-by-doing are more permanent. As a result of the analyses, it was observed that students usually volunteered to participate in the activities and their condition of volunteering increased to 100% towards the end of the project. Furthermore, almost all of the students paid attention to complete the activities on time and they stated that they were satisfied with the activities. Additionally, all of the students stated that they want to re-participate in the project and they will recommend the project to their friends. In addition to these results, a couple of students suggested project duration to be longer and to increase the number of nature trips.

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Author Information

Sibel Acisli
Artvin Çoruh University,
Faculty of Education, Department of Mathematics and Science Education, Science Education
Artvin/Turkey
Contact E-mail: sacisli26@hotmail.com

Hatice Kumandas Ozturk
Artvin Çoruh University,
Faculty of Education, Department of Educational Sciences, Measurement and Evaluation in Education
Artvin/Turkey

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Cognitive Levels and Misconceptions of Grade 11 Lebanese Students in Probability

Shehayeb SANAA
Lebanese University

Abstract: The concept of probability is fundamental to students especially at the secondary school level. Learning probability is always linked to logic and reasoning. This paper aims at unveiling the cognitive levels in probability and exploring the probability misconceptions of a sample of 41 grade 11 Lebanese students at the end of their academic year during which they encountered probability as a subject in school for the first time. The approach to data collection is quantitative and qualitative. The 25 item questionnaire in Paul and Hlanganipai (2014) was used to determine the students' cognitive levels in probability based on SOLO taxonomy and using the rubrics used in Watson and Collis (1994). The questionnaire is divided into 5 categories: probability terms and definitions, theoretical probability, Venn diagrams, union and intersection and dependent and independent events. After that 10 students were randomly selected from the sample and interviewed to explore two probability misconceptions: representativeness and equiprobability bias. Results showed that grade 11 students attained level 3 in two of the categories and were able to reach level 2 in two other categories while they remained at level 1 in the fifth categories. As for the students' misconceptions, representativeness misconception was rarely found while equiprobability bias was more prevalent.

Keywords: Mathematics, Probability, Secondary level, Misconceptions, Solo taxonomy

Introduction

Statistical reasoning is essential to many professions such as psychology through making judgments and decisions, medicine through interpretation of risks of medical outcomes, politics through analysis and interpretation of polls and elections, and journalism through explanation and criticism of statistical information (Garfield, 2002). However, all statistical reasoning is probabilistic (Schum, 2001). That is why several researches recommended teaching probability as early as elementary school (Fischbein, 1991).

The study of probability in the 1970s, became a subject in high schools, while later on, it was also introduced in the fifth and sixth grade of the primary school. However, since the 1990s, probability seem to hold an integrated part in the mathematics curriculum from early grades in primary schools internationally. (Andrew, 2009).

The Lebanese curriculum introduces probability concepts in grade 11 and continues in grade12 . Students in grade 11 get acquainted with the notion and vocabulary of probability, calculate probabilities and use the some properties of probability like incompatible and opposite events while in grade 12, they learn conditional probability and total probabilities with random variable studies. (CERD,1997).

Problem Statement

Research findings showed that students face many difficulties when learning probability (Anggara et.al.,2018). The national council of teachers of mathematics recommended introducing probability as early as kindergarten (NCTM, 2000) . Lebanese students start to develop probability concepts in grade 11. The notion of probability is not introduced before that class. (CERD, 1997) . It was noticed that no published research concerning students' hierarchichal probability levels nor misconceptions in probability was implemented in Lebanon. This research

will fill a gap in literature and shed a light on the importance of teaching probability and the way its probability concepts are developed. This study targets curriculum designers and math textbook authors who will take into consideration students' levels and misconceptions in probability.Teachers and coordinators also may benifit from this paper in preparing their lesson plans.

Purpose

The purpose of this research is to unveil the cognitive levels of Lebanese grade 11 students in probability based on the SOLO taxonomy and using the rubrics used in Watson and Collis (1994). It also aims at exploring the students' misconceptions, mainly the equiprobability bias and the representativeness misconception.

Research Questions

The research aimed at answering two research questions:

1. What are the cognitive levels of Lebanese grade 11 students in probability according to levels suggested by Watson and Collis (1993)?
2. What are the Lebanese grade 11 students' misconceptions in the areas of equiprobability and representativeness?

Student Probability Levels

Piaget and Inhelder analyzed children's thinking about probability into the usual stages (pre-operational, concrete-operational, formal operational) .They have concluded that during the intuitive period (before the age of 6-7), the child is not able to distinguish clearly between chance and necessary phenomena and state that a child in a concrete-operational period is neither able to differentiate between certain and random predictions nor formulate predictions, taking into account his experiences form previous similar situations. The concept of probability, as a formal construct, develops only during the formal operational stage and it represents a synthesis between necessary and the possible, they also suggested that children in the primary grades were able to identify all possible outcomes in a one-stage experiment (Piaget & Inhelder, 1951). A child encounters the concept of probability at the level of his concrete operations, at which time he starts to differentiate between a certain and a possible event (Goldberg, 1966). He also noted that the systematic understanding of probability starts not earlier than between the ages of 9 and 12 years and even during that period children solve problems intuitively, and not on the basis of formal reasoning .

In the same opinion, Jones concluded that significant numbers of grades one through three children were not able to list the outcomes of one stage experiment (Jones, 1974). Consistent with Jones's finding, Green observed that more than 62 percent of 11-year-olds students were not able to solve one stage sample space items (Green, 1989). According to him, most English pupils finish secondary school without achieving the level of formal operations.

Fischbein have suggested that the concept of "possible" may develop before the concept of "certainty". According to results of his study, some children develop mathematically mature language for certain and impossible events before they can use it for possible events. (Fischbein et.al.,1991). He also showed that some intuitions in young children's thinking are important in helping their pre-formal probabilistic thinking. These intuitions are a product of personal experience (Fischbein et. al., 1997).

Polaki (2002) also researched probability and suggested four levels of probabilistic thinking, the first being subjective, at which pupils predict the most/least likely event based on subjective judgement, e.g. pupils predict the extracted color to be red, because this is their most favorite color. Transitional probabilistic thinking represents the second level, for which it is significant that students are able to predict the most and the least likely event based on quantitative judgement; which is often invalid, and besides, they may revert to subjective judgements. For the third, informal quantitative probabilistic thinking level it is significant, that pupils correctly predict the most and least likely events, based on quantitative judgements and use numbers informally to compare probabilities. At the fourth level of probabilistic thinking, which is a numerical one, pupils assign a numerical probability and make a valid comparison. (Polaki, 2002).

Another perspective that focused on the hierarchical features was defining the reasoning levels according to different psychological theories. Biggs and Collis (1989) proposed a SOLO model (Structure of the Observed Learning Outcome) to describe cognition levels of probability, which divided students' probability cognition into five levels, namely pre-structural, uni-structural, multi-structural, relational and extended abstract levels.

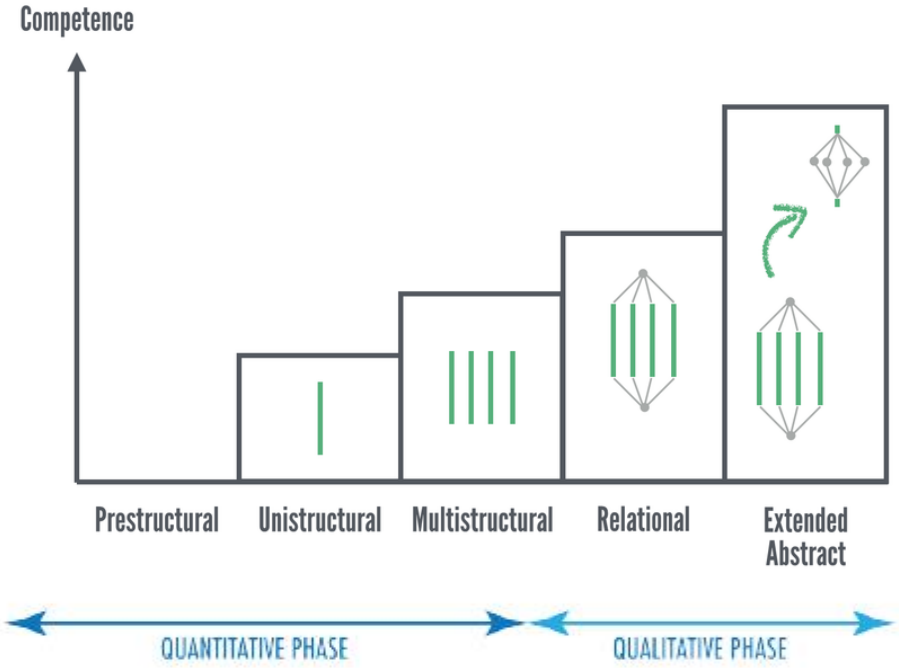

Figure 1. Solo taxonomy (Biggs & Collins, 1982)

Li & Pereira-Mendoza (2002) administered a questionnaire to 567 chinese students from grades 6, 8 and 12 in order to determine their hirerchichal levels in probability in reference to SOLO taxonomy,then 64 students were interviewed to determine their misconceptions. Results showed that most of the students were not able to reach the highest two levels of SOLO but grade 12 students performed better than grades 6 and 8 with no significant difference between grades 6 and 8.

Students' Misconceptions in Probability

Lai Huat Ang et.al,(2014) examined 177 Years 10 and 11 students from two schools who participated in the research study. The two instruments used for this study were 'Misconception on Probability' two-tier multiple choice questionnaire and interviews. Carelessness and Incorrect method were grouped as error-typed whereas, Representativeness, Equiprobability bias, Beliefs and Human control were the four identified specific misconceptions on Probability.

Method

Design of the Research

The design of this study can be classified as descriptive quantitative followed by qualitative as it analyzes data collected from a questionnaire with the aim of classifying students' misconceptions and quantifies variations using Statistical Package for the Social Sciences (SPSS) software-version 23, where participants were generally measured using a questionnaire after which some of them were measured through an interview in order to explore their misconceptions.

The aim of a quantitative research study is to classify features, count them, and construct statistical patterns, paradigms and models in an attempt to explain and demonstrate what has been observed (Babbie, 2010). Qualitative research enriches the research as its main concern is the development of the observed phenomenon, like students misconceptins, through interviews with students (Morse & Field, 1996).

Research Instrument

A set of 25 questions were selected and administered to the students in order to examine the students' SOLO taxonomy levels in probability. The analysis of the responses identified four levels according to level of sophistication in a similar manner to that of Watson and Collis (1994) as cited in Paul & Hlanganipai (2014). The levels were classified according to the following criteria.

Level 1. In interpreting probability situations no analysis or evidence of use of probability principles is demonstrated. Features may include: the use of irrelevant information, subjective judgements, disregarding quantitative information, guessing at random, belief in control of probability and absence of any reason. Responses that use recent experiences to predict or estimate probabilities, availability, are included in this level.

Level 2. Some evidence of the use of probability principles and appropriate quantitative information is evident, but they may be incomplete or are incorrectly used. Probabilistic reasoning based on the assumption of equal likelihood when none exists and the use of the representativeness heuristic is considered to be illustrative of this level.

Level 3. Probability principles are applied correctly used and an awareness of the role of quantification is evident. However, such quantification is precise or numerical.

Level 4. Probability principles are used correctly and relationships are explained quantitatively.The qualitative part was administered through an interview targeting two misconceptions, the equiprobability bias and the representativeness. Six multiple choice questions extracted from the Probability Assessment Test (PAT) prepared by Anyway & Bennet(2004).

The equiprobability bias is the tendency of students to view several outcomes of an experiment as equally likely. For instance, students who have an equiprobability bias think that when two dice are rolled, all the sums possible are equally likely. They do not realize that the sum of 6 for the two dice is more probable than the sum of 2.(Anyway & Bennet,2004). People estimate the likelihood of a sample based on how similar it is to the population. A series of coin tosses that has an equal number of heads and tails is judged to be more likely than a series with a dominant occurrence of heads/tails. (Anyway & Bennet, 2003).

Reliability and Validity

The questionnaire reliability was tested by calculating Cronbach alpha by SPSS. The results showed a cronbach alpha value of 0.847 indicating a high consistency in measurement and good correlation between the items, so the questionnaire can be considered as reliable. Content validity was assured by asking three experts to check the questionnaire items and certify their alignment with the purpose of the research.

Data Analysis

Each of the 25 items of the questionnaire was corrected by the researchers and two math education experts and each answer was marked according to the rubric and students' responses were recorded and coded according to Watson & Collis (1994)'s levels. A statistical computer package, SPSS version 21, was used to process the data. Descriptive statistics was used during data analysis of the questionnaire items. Misconceptions were revealed through analysis of students' interpretations of the multiple choice questionnaire.

Results

Results of the questionnaire were analyzed for each category and for the overall questionnaire. Interviews were analyzed in terms of the targeted misconceptions

Results of the Questionnaire

The respondents' cognitive level frequencies for each item were analyzed and are shown in table 1 The results showed that the overall mean (M) cognitive level was (M) =2.3, with a standard deviation (SD) of 0.51 which

indicates that Lebanese grade 11 students have some evidence of use of probability principles and appropriate quantitative information, but they may be incomplete or are incorrectly used. The modal (Mo) cognitive level for each item was 2.0, showing again that students the probability concept is mainly uni-structural according to SOLO taxonomy which indicates that students may have limited knowledge in probability or know just a few isolated facts. Students are able to answer isolated questions but are not able to see connections between ideas.

Table 1. Classification of Students' Levels

Variables	Mean	Mode	Standard deviation	Skewness
Probability terms and definitions	2.57	2	0.74	0.92
Theoretical probability	2.88	3	0.73	- 0.77
Venn diagrams and proportions	2.55	3	0.85	- 0.33
Union and intersection	1.73	2	0.56	0.59
Dependent and independent events	1.77	1	0.56	-0.065

Table 1 shows that students performed best when answering items related to theoretical probability. An excerpt (figure 2) from a student's answer to one of the items belonging to this category shows the correct use of probability terminology and relationships. Similar items were coded as level 4 according to the rubric

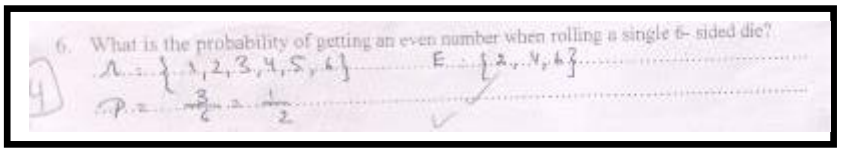

Figure 2. Excerpt from a student's work- item 6

On the other hand, students who showed no analysis or evidence of use of probability principles were coded on level 1. Figure 3 shows an excerpt of students' work which indicates that the student is using a counting principle to answer the question.

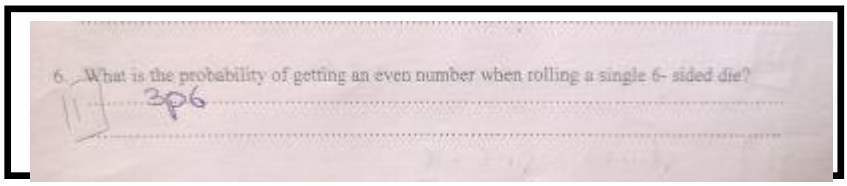

Figure 3. Excerpt of a student's work – item 6

Similar analysis was used to code the other categories. Results showed that students were up to level 3 in two categories only which are theoretical probability and Venn diagrams. Students were classified at level 2 in two categories probability terms and definitions and intersection. Excerpt of a student work in figure 4 showing a wrong answer for items 4 and 5. The student was asked to write the sample space of an experiment. The student answered a completely different question which is: in how many ways can we choose a letter of the word probability? This indicates that the student does not show understanding of the vocabulary related to probability unlike the student's answer in figure 5 which shows a correct writing of the sample space.

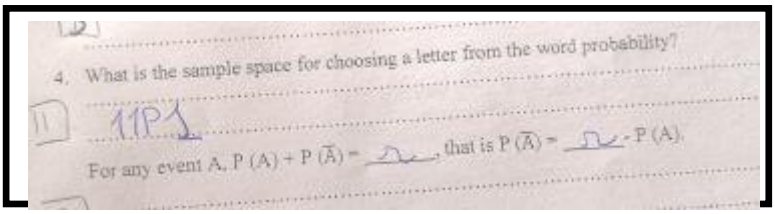

Figure 4. Excerpt of a student's work- item 4

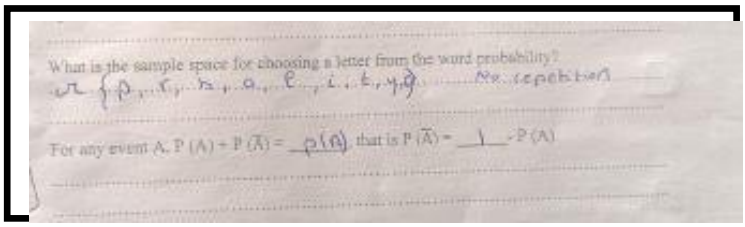

Figure 5. Excerpt of a student's work- item 4

As for the third category which is Venn diagram and proportions, the mean was 2.55 and the mode was 3 indicating that the majority of students are able to apply probability principles in this category as shown in figure 6. However, some students had a problem in identifying the prime numbers as in figure 7 and found no intersection between the two sets. Moreover, they failed to represent the Venn diagrams correctly.

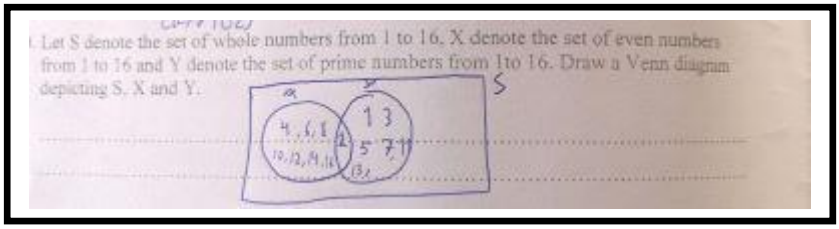

Figure 6. Excerpt of a student's work- item 10

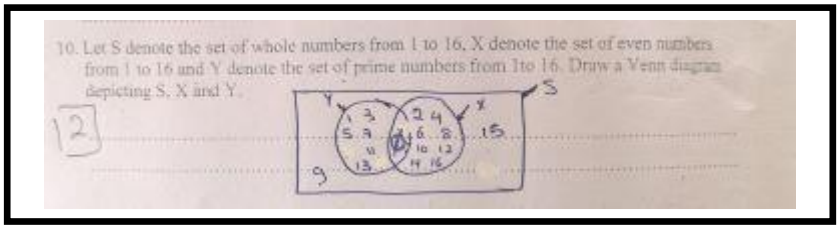

Figure 7. Excerpt of a student's work –item 10

Most of the students were not able to reach level 2 in the last category which is related to dependent and independent events. Students faced many difficulties caused by their inability to identify the sample space and the intended event space .The major reason is that students in Lebanon do not study this concept in grade 11 but in grade 12. Whereas the majority were able to attain level 2 in the category related to union and intersection of events though the mean was 1.73 indicating a difficulty in understanding the concept of sets and numbers.

Results of the Interviews

Ten students were chosen randomly from those who have completed the questionnaire and were interviewed in order to determine their equiprobability and representativeness misconceptions. Items related to these misconceptions were adapted from the PAT test prepared by Anyway (2003). Students were asked to answer each of the multiple choice questions and then justify their choice. Results showed that students have more equiprobability misconceptions than representativeness misconceptions. The equiprobability misconception is evident when students do not recognize that the probabilistic outcomes that they are faced with are not perfectly random.(Gauvrit & Morsanyi, 2014). Selecting choice b for queston 2 in the probability miconceptions test which indicates that all the three results are equally likely when three dice are simultaneously thrown. The justification by most of interviewed students was that the probability for choosing a two 5's and a 3 or three 5's or 5, a 3 and a 6 in any order is P= 1/6 × 1/6 ×1/6=1/216.The same justification was brought up by 5 out of the 10 interviewed students showing that students are confused by choosing the sample space and the event space. As for the representation misconception, it was represented by questions 5 and 6. All the interviwed students answered question 5 correctly insisting that heads and tails are equally likely to occur when a fair coin is tossed 5 times. On the other hand, three of the ten students failed to answer question 6 correctly. They insisted that alternatives (a) 3 5 1 6 and (b) 4 2 6 1 5 are equally likely to occur and have a greater chance to occur than that of (c) 5 2 2 2 2.

Discussion

Results from this study indicated that students' cognitive level was 2.3 which conforms with Paul and Hlanganipai (2014) where the overall mean was 2.14. This signifies that most students operate at level 2 so they have incomplete information of the probability principles and its applications. Students performed least on questions related to dependent and independent events. The main reason is that students get introduced to this concept in grade 12. These results agree with Anggara et. al. (2018) that the most difficult of the probability concepts is the notion of independence. The misconceptions targeted in this study were equiprobability and representativeness which were considered as common misconceptions (Anyway & Benett, 2018).

Conclusion

The purpose of this research was to reveal students' difficulties in learning probability. This study has many limitations in the sense that it targets grade 11 students only. Interviews were made with ten students only. However, the results were aligned with other studies.

Recommendations

Previous research asserts that transition from one level is related to instruction and not to age (Paul & Hlanganipai, 2014). Curriculum designers should take the cognitive levels into consideration while designing school curricula. Teachers also need to get acquainted with these levels in order to prepare their lesson in a way that promote students to the next level. Teachers should be aware of students' misconceptions to address them in their assessment. Future research should address these issues on a larger scale in Lebanon especially the ability of students to grasp probability concepts at an early age.

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Author Information

Sanaa Shehayeb
Lebanese University
Beirut- Lebanon
Contact E-mail:*sanaashehayeb@gmail.com*

Appendix

Questionnaire

1. Define the following terms: probability of an event, An experiment, An outcome, Sample space, An event.

   ……
   ……
2. Write down the sample space for rolling a single die numbered 1 to 6?
   ……
   ……
3. Suppose that the probability of snow is 0.67, what is the probability that it will NOT snow?
   ……
   ……
4. What is the sample space for choosing a letter from the word probability?
   ……
   ……
5. For any event A, P (A) + P ($\bar{A}$) = _____, that is P ($\bar{A}$) = _____- P (A).
   ……
   ……
6. A bag contains 6 red, 3 blue, 2 green, and 1 white balls. A ball is picked at random. Determine the probability is a blue.
   ……
   ……
7. What is the probability of getting an even number when rolling a single 6- sided die?
   ……
   ……
8. What is the probability of landing on an odd number after spinning a spinner with 9 equal sectors numbered 1 through 9?
   ……
   ……
9. What is the probability of getting a 0 after rolling a single die numbered 1 to 6?
   ……
   ……
10. A bag has 20 raffle tickets in it, numbered from 1 to 20. What is the probability of picking out an even number?
    ……
    ……
11. Let S denote the set of whole numbers from 1 to 16, X denote the set of even numbers from 1 to 16 and Y denote the set of prime numbers from 1to 16. Draw a Venn diagram depicting S, X and Y.

    ……
    ……
12. a) Pieces of paper labelled with the numbers 1 to 12 are placed in a box and the box is shaken. One piece of paper is taken out and then replaced. What is the sample space, S? Find n(s).

    ……
    ……

    b) Write down the set A, representing the event of taking a piece of paper labelled with a divisor of 12? Find n (A).

    ……
    ……

c) Write down the set B, representing the event of taking a piece of paper labelled with a prime number. Find n (B).

……
……

d) Represent A, B and S by means of a Venn diagram.

……
……

13. Let E and F be events such that Pr(E)=.6, Pr(F')=.3, and Pr (EUF)=.8. Find Pr (E∩F).

……
……

14. A jar has purple, blue and black sweets in it. The probability that a sweet chosen at random will be purple is 0.2 and the probability that it will be black is 0.6 If I choose a sweet at random, what is the probability that it will be purple or blue.

……
……

15. If dice are the same color, what is the probability of getting 2 or 3 on at least one of the dice?

……
……

16. Suppose our experiment is flipping a coin three times in a row. Let B be the event that we do not get three heads in a row. Find P (B).

……
……
……

17. Two fair dice are rolled. What is the probability that the sum of the values is a prime number?

……
……

18. A school decided that its uniform needed upgrading. The colors on offer were beige or blue or beige and blue. 40% of the school wanted beige, 55% wanted blue and 15%said a combination would be fine. Are the two events independent?

……
……

19. A jar contains 4 white marbles, 5 red marbles, and 6 black marbles. If a marble were selected at random, what is the probability that it is white Or black?

……
……

20. If D and F are mutually exclusive events, with P(D) = 0,3 and P(D or F) = 0.94,find P(F).

……
……

21. Given Pr (E) = 0.5, Pr (F) =0.3, and Pr (E∩F) = 0.1. Determine if E and F are independent events?

……
……

22. A cloth bag has four coins, one R1 coin, three R2 coins and two R5 coin. What is the probability of first selecting a R1 coin and then selecting a R2 coin?

……
……

Misconceptions Questionnaire

1. Five faces of a fair die are painted black, and one face is painted white. The die is rolled six times. Which of the following results is more likely?

a. Black side up on five of the rolls; white side up on the other roll
b. Black side up on all six rolls
c. a and b are equally likely

2. When two dice are simultaneously thrown it is possible that one of the following two results occurs: Result 1: a 5 and a 6 are obtained in any order. Result 2: a 5 is

obtained twice. Select the response that you agree with the most.
a. The probability of obtaining each of these results is equal.
b. There is a higher probability of obtaining result 1.
c. There is a higher probability of obtaining result 2.
d. It is impossible to give an answer.

3. When three fair dice are simultaneously thrown, which of the following results is MOST LIKELY to be obtained?
a. Result 3: Two 5's and a 3
b. All three results are equally likely.
c. Result 1: A 5, a 3 and a 6 in any order
d. Result 2: Three 5's

4. When three dice are simultaneously thrown, which of these three results is LEAST LIKELY to be obtained?
a. Result 1: A 5, a 3 and a 6 in any order
b. Result 2: Three 5's
c. Result 3: Two fives and a 3 in any order
d. All three results are equally unlikely.

5. Which of the sequences is least likely to result from flipping a fair coin 5 times?
a. H H H T T
b. T H H T H
c. T H T T T
d. H T H T H
e. All four sequences are equally likely

6. If a fair die is rolled five times, which of the following ordered sequence of results, if any, is MOST LIKELY to occur?
a. 3 5 1 6 2
b. 4 2 6 1 5
c. 5 2 2 2 2
d. Sequences (a) and (b) are equally likely.
e. All of the above sequences are equally likely.

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IT Strategic Planning and Process Framework for Ethiopian Higher Educational Institution

Mary Charlemaine A. ABAS
University of San Agustin

Patrick D. CERNA
Federal Technological University

Abstract: Ethiopian Higher Educational Institution (EHEI) established an ICT Directorate office for each public universities, colleges and institute, with the same supervisory level as Dean of Colleges, Faculty and Institute to implement and integrates ICT in all aspects of educational system from teaching, learning and research. It has been established a university wide ICT Infrastructure and built capacity to serve the University core processes and outreach the external community with required ICT consultancy services and other research/development requirements. However, to date based on the existing literature and in the case of TVETI, there has been no common and uniform IT manual of policies for each above-mentioned department in ICT Directorate and up to today it has not been assimilated in Senate Legislation of each EHEI. This research study focus on effective IT strategy for the ICT Directorate aligned to the strategic targets and management of Ethiopian Higher Educational Institution (EHEI). The propose IT strategic plan will be included to the existing EHEI goals, objectives and action plan that will be given priority not only as a supporting services but important role in educational decision making and planning. The study aims at designing a IT strategic plan based on the framework as proposed by Alex Cullen and Marc Cecere. SWOT, Critical Success Factors (CSF) and IT Balanced Scorecard will be adopted to analyze the needs of IT in EHEI. This IT master plan will serve as a road map and ICT strategic development plan that will serves as guiding model strategic plan for the adoption, implementation, monitoring, and evaluation of ICT services under ICT Directorate office of EHEI particular TVETI.

Keywords: IT strategic planning, Process framework, CSF, Balance scorecard

Introduction

The role of IT, based on technological advances of the mid-twentieth century, migrated from a technology provider to a strategic partner, adopting administrative models of information structure, which necessarily lead to the modification of the form of action of its professionals, incorporating new knowledge of their processes, in order to promote the generation and dissemination of knowledge between teams [1]. Furthermore, IT contributes to adding value through two specific ways: greater assertiveness in the decision-making process due to increased information quality; and agility in their production, optimizing business processes, contributing to its efficiency [2]. Its impact on education transform not only integrates emerging tools that we have today like eLearning, Machine Learning, Big Data and Internet of Things (IoT) but even integrates IT Usage, Migration and Policies in University Legislation. Educational systems around the world are under increasing pressure to use the new Information and Communication Technologies (ICTs) [3].

According to Moges [4], the adoption and use of ICTs in Ethiopian education have a positive impact on teaching, learning and research. ICT can affect the delivery of education and enable wider access to the same. In addition, it will increase flexibility so that students can access the education regardless of time and geographical barriers. It can influence the way students are taught and how they learn. It would provide the rich environment and motivation for teaching-learning process which seems to have a profound impact on the process of learning in education by offering new possibilities for students and teachers. He then recommends the government of Ethiopia should pass a bill at the national assembly on the use of sophisticated ICT facilities in the educational

system by provision of adequate fund, securing of ICT experts in institutions and schools and ensuring that these facilities are monitored from time to time [4].

Addis Ababa Technical and Vocational Education and Training Institute (TVETI) is an Ethiopian Higher Learning Institution (EHEI) that were established in 2011 by The Council of Ministers Proclamation 245/2011 to produce highly professional and technically efficient TVET teachers and leaders. The driving force for establishing TVETI, among other things , was that there were no institution to train competent and sufficient technical and vocational teachers and leaders based on the outcome based system and occupational standards. At the time of its inception, the institute ran degree programs in 5 occupational sectors namely: automotive, construction, electronics/electrical, information and communication technology and manufacturing technology, and two years later railways and surveying technology departments were opened. Those programs embraced ten specializations, namely, Automotive, Building, Road, Water, ICT, Electrical and Control, Electronics and communications, Manufacturing, Rolling Stock and Surveying. Its mission aims at producing competent, innovative and resourceful Technical and Vocational Education and Training teachers and leaders through the provisions of quality short and long term training, demand based research, technology and consultancy services in support of micro and small scale enterprises.

Ethiopian Higher Educational Institution (EHEI) established an ICT Directorate office for each public universities, colleges and institute, with the same supervisory level as Dean of Colleges, Faculty and Institute to implement and integrates ICT in all aspects of educational system from teaching, learning and research. It has been established a university wide ICT Infrastructure and built capacity to serve the University core processes and outreach the external community with required ICT consultancy services and other research/development requirements. Like most other EHEI, Addis Ababa TVETI ICT Directorate composed of five-sub department namely Network Infrastructure and Services, Teaching -Learning Technology, Business Application Administration & Development, Maintenance & Support Service, Training and Consultancy. It was established in the year 2016 and restructured in July 2018, following the Business process reengineering (BPR) and new structure from Ministry of Education applied to support the core mandates of the Ethiopian Higher Educational Institution. TVETI has recognized the role of ICT as an enabler for the attainment of its goals and strategic objectives directly reporting and accountable to the Director General of the institute. Its mission is to effectively conceive, develop, implement, utilize, and manage appropriate information systems in order to provide integrated, coordinated and customer focused quality ICT services to TVETI in line with its vision, mission and objectives.

Problem Background

EHEI embrace Business Process Re-Engineering (BPR), and many studies have been done focusing on reengineering and implementing BPR in EHEI's. According to Ranganathan & Dhaliwal [5], BPR is a popular management tool for dealing with rapid technological and business changes. Business process reengineering (BPR) is a dramatic change that represents the overhaul of organizational structures, management systems, employee responsibilities and empowerment, performance measurements, incentive systems, skills development, and the use of information technology. A strategy is a plan, a direction, for organizations to develop and achieve their future goals. It is seen as a way to take and defend a unique position in the market, which generates competitive advantage for the organization [6]. Integrating the concept of strategy in IT, it can be defines as a set of decisions taken by the IT management that allow the realization of business strategy. It involves more than technology and infrastructure, the technological options to support the business strategy [7].

In a baseline survey conducted by the MOE [8], it shown that most universities and institutions of higher education in Ethiopia have computers. However, these computers are few and, therefore, shared at a student-computer ratio of 10:1 in most cases. The study also showed that despite the presence of computers, most of the universities lack a network infrastructure and have limited connectivity. The instructors are yet to adopt ICT as a teaching-learning tool, and only a small number of students use computers and the Internet as a learning resource. Moreover, instructors in Adama Science and Technology University seem not to have been exposed to integrate ICT into teaching-learning process. The Ministry of Capacity Building donated ICTs in universities that were mainly used for administrative purposes, thus many instructors may not have realized that computer technology is very useful for instructional purposes in education [9].

While some EHEI currently have developed IT plans or are in the processes, there is little systematic study of the merit of IT strategic planning. Moreover, there has been little emphasis on IT Strategic Planning nor Manual of Policies that guides the implementation, transformation and monitoring of ICT services adopted by EHEI. It

is therefore proposed that several institutions that have developed and implemented IT strategic plans, including most of the standard planning components, be intensively studied to document the outcomes that have resulted from these efforts on a number of criteria. In a similar manner, the status of IT operations should be examined to determine outcomes that have been achieved using the same criteria.

Problem

In EHEI, some instructors have never had an opportunity to use computers for educational purposes nor have received any training in this regard. Although some instructors have recently been exposed to ICT through furthering their studies at higher learning institutions, it appears that the vast majority of instructors are unable to successfully integrate ICT into pedagogy/teaching-learning process [9]. Further, ICT is available in many universities, but there is limited evidence that it has been integrated into the pedagogy/teaching-learning process [10]. According to Parker, Bianchi and Cheah [11], integration is defined as "the process of totally integrating the use of ICT resources such as internet, e-mail, word processing, database, digital scanners, educational software package and the printer into the existing teaching-learning process through learning activities that address the course-area objectives". It appears that the primary reason for the lack of integration is that instructors' knowledge, skills and attitudes in Information Communication Technology (ICT) are inadequate, not only in terms of generic ICT competence, but specifically in integrating it into the pedagogy/teaching-learning process [12].

To date based on the existing literature and in the case of TVETI, there has been no common and uniform IT manual of policies for each above-mentioned department in ICT Directorate and up to today it has not been assimilated in Senate Legislation of each EHEI. This research was to propose an effective IT strategy for the ICT Directorate aligned to the strategic targets and management of Ethiopian Higher Educational Institution (EHEI). The propose IT strategic plan will be included to the existing EHEI goals, objectives and action plan that will be given priority not only as a supporting services but important role in educational decision making and planning. The absence of IT Strategic Plan will cause the use of IT resources on the management of academic activities and support of other management processes will not run perfectly and organized. The main objective in this research are to analyzed critical factors that can be used to develop IT strategic planning in EHEI to produce an IT blueprint that be a guiding model and recommend strategic action for ICT Directorate.

Proposed Solutions

This study aims to design IT strategic plan based on the framework as proposed by Alex Cullen and Marc Cecere [13]. SWOT, Critical Success Factors (CSF) and IT Balanced Scorecard will be adopted to analyze the needs of IT in EHEI. The results of this study are recommended strategic steps to optimize the implementation of IT in TVETI and EHEI in general to improve the performance from ICT Directorate to obtain the benefits by implementing IT in education system in Ethiopia and to form IT Blueprint, which is part of the development plan of TVETI.

IT strategic planning should include six components: (A) Application systems: describes the company business functions; (B) Application development: discussing plans for new systems implementation, and how they should be acquired; (c) Infrastructure: provides information about physical IT assets in the company; (D) Maintenance: provides support and maintenance strategy for application components, and infrastructure; (E) Operations: includes personnel, quality control, user training and support, data center and disaster recovery; (F) Security: involves internal and external security policies, accesses privileges, firewall, and spam procedure of emails and virus protection [14]. These merely coincide with the first five (5) important department/units of ICT Directorate in EHEI with the last function as information security and assurance which allocated to all units and its respective ICT services. The IT environment should empower students, faculty, and staff as they conduct teaching, learning, research, scholarly activities, and effective operation of the University. Adopting the ITSP Framework of Cullen and Cecere [13], a proposed ITSP for EHEI is formulated as deflected in Figure 1, and elaborated in Table 2.

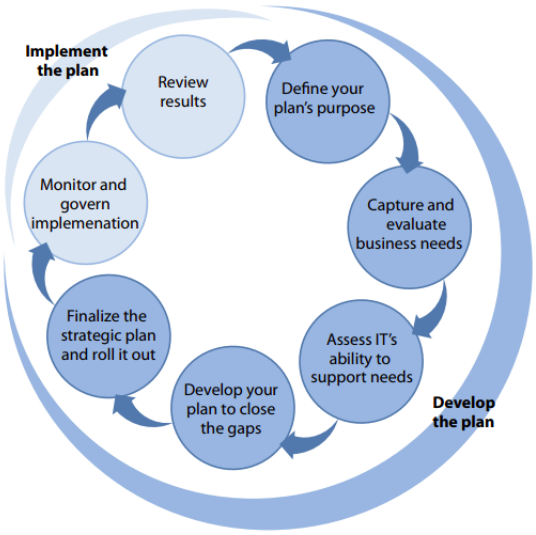

Figure 1: Phases of IT Strategic Planning [13]

This ITSP consists of five phases, with their distinct activities, followed by the ongoing activities of monitoring and governing and reviewing results following rollout [13].

Table 1. Activities of IT Strategic Planning [13]

No	Phases	Description
1	Defines your Plans Purpose	Identify the company (vision, mission, and its state), purpose, scope and stakeholder of strategic planning.
2	Capture and Evaluate Business Needs	Capture and evaluate business needs; in this step, identify the source of business needs, gather and information and analyze it using SWOT analysis
3	Assess IT's ability to support needs	Assess IT's ability to support needs; in this step, do some assessment in IT Division (structure, process and state).
4	Develop your plan to close the Gaps	Develop your plan to close the gaps; in this step, develop strategic IT principles, mapping those strategies identify gap closing and describe IT for company in the future
5	Finalize the strategic plan and roll it out	Finalize the strategic plan and roll it out; in this step, finalize the strategic plan by explain it to Board of Director and approve it, make implementation plan and budgeting,

A. Phase 1 – Defines your Plans Purpose

The first phase is to define the plan's purpose by considering the TVETI mission and vision integrating within it the ICT Directorate own mission and vision. By emphasizing the development of this IT blueprint will guide, give optimal direction, and solve issues relating to utilizing and monitoring of ICT within the educational sector. As presented in Figure 2, it interrogates and aligned the IT Strategic Planning within both TVETI mission/vision and ICT Directorate mission/vision and its respective stakeholders like Director General, Deputy Director General for Academics, Deputy Director General for Administrator, Deputy Directory General for Research, Technology Transfer and Community Services, Director of ICT Directorate, ICT Units/Department Head and Team Leaders, and Finance/Procurement Director.

Figure 2. IT Strategic Plan must aligned ICT Directorate Mission to TVETI Vision

B. Phase 2 – Capture and Evaluate Business Needs

Towards the coordination of each units/departments of ICT directorate, a requirements gathering is employed to each of academic departments, faculty and colleges, administrative office like human resource, finance, student services, medical services, among others. In SWOT Analysis, examining the elements in its environment while environmental opportunities identifies strong and weak aspects of an organization and threats are determined by examining the elements outside its environment. In this sense SWOT Analysis is a strategic planning tool used to evaluate the strengths, weaknesses, opportunities and threats of an organization. It provides information that is helpful in matching the organization's resources and capabilities to the competitive environment in which it operates [15]. Figure 3 represents the SWOT Analysis of the current ICT Directorate in EHEI identifying its strengths, weakness, opportunity and threats. From SWOT analysis, TVETI current IT plan emphasize huge market opportunity but it need to consolidate, doing improvement, and eliminate the problems to gain competitive advantage and stay away from threats. The result of this analysis is used to determine the strategic system and information technology for TVETI.

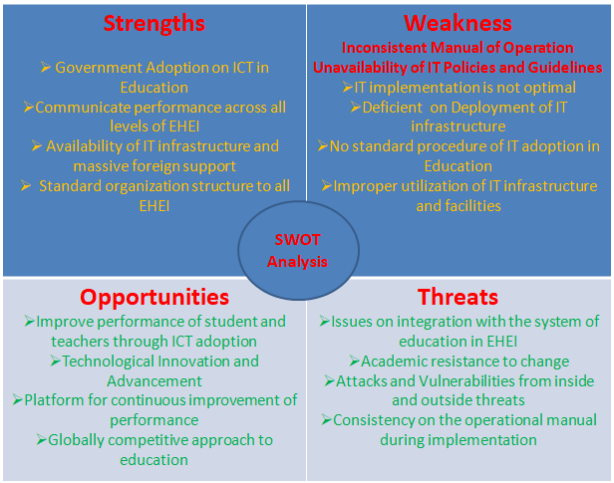

Figure 3: SWOT Analysis of IT Services for TVETI ICT Directorate

C. Phase 3 – Assess IT's ability to support needs

In this phase, the need to formulate and develop a IT Service and Maintenance level Documentation that will initiate, process, monitor and evaluate each services of ICT Directorate in TVETI. For the ICT Technical Support and Maintenance, a computer repair work/service order form is necessary to identify, record and monitor its services as shown in Figure 4. Starting from computer hardware and software installation, upgrades, reconfiguration, troubleshooting, back up and recovery of files, regular preventive and corrective maintenance, etc. should be documented with proper evaluation and monitoring. Moreover, an inventory of all IT equipment, tools and materials/consumables should be conducted religiously for each academic departments labs and offices, administrative offices, support technology office including network devices and network layout. An

information system for inventory purpose using open source technologies, out-of-the-shelf package or in-house development with barcode reader or RFID can be desirable.

COMPUTER REPAIR / DIAGNOSTIC WORK ORDER

Requested By _____ Date _____

Classroom / Office _____

Location _____

Equipment Name: _____

ROP/TC Tag #: _____ Serial No.: _____

Problem (describe fully): _____

_____

_____

_____

Requested By _____ Date _____

Supervisor Approval _____ Date _____

Directions:
1. Put individual request on a separate work order form
2. Submit request to your supervisor for approval
3. After approval supervisor will forward to the business office / technology department.
4. Upon completion, a copy will be returned to the supervisor.

OFFICE USE ONLY

Repair / Diagnostics Completed By: _____

Diagnosis: _____

_____

Results/Options: _____

Approximate Cost: _____ Designated Budget _____

Supervisor Approval _____ Date _____

Figure 4. A sample request form for technical support and computer maintenance

In the case of ICT Business Application Development units/department, a software documentation is ideal that encompasses all written documents and materials dealing with a software product's development and use. For the ICT Teaching-Learning technology adopted a open source technologies for each eLearning Managements, Digital Library and Repository, Thesis and Project Repository, Research Grant Submission and Management System in most EHEI including TVETI. Open source technologies like moodle, DSpace, Koha and Open Journal System were the chosen for this purpose. However, there was no monitoring and evaluation in the usefulness, effectiveness, critical issues and problems concern. A proper documentation on version upgrades, features upgrades and degrades, expansion, problems encountered and solution, and finally backup and recovery. All software development products, whether created by a small team or a large corporation, require some related documentation. Figure 5 shows the different documentation need in building a software application to ensure that developers and stakeholders are headed in the same direction to accomplish the objectives of the project. Several software tools can be used to make software documentation like Microsoft Project Management, Microsoft Visio, Paradigm UML, HP Unified Functional Testing, among others.

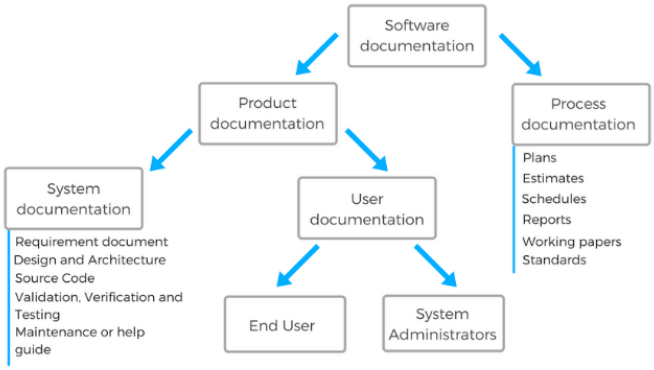

Figure 5.Software development documentation

In ICT Network Infrastructure and Data Center, large percentage of vendors provide either poor documentation on their products or material that appears to be useful, but then have no step by step process on how to install and configure their devices and/or software, which in turn, that documentation is so important to the daily

efficient running of your data center and storage environment. Among those necessary documentation that can help system/network administrator in monitoring and evaluation data center and network infrastructure performance are: (A) Rack elevation documentation, (B) Cable management for both network and power connections, (C) Power and energy management and (D) Automated data center documentation with auto-discovery and REST APIs. According to TechExact [16], possessing the right set of Data Center Documentation is as vital as the systems, active components and redundancies implanted in the data center. Developing Data Center Manuals at the operational level, service level, mechanical, cooling, power, security and structural level; indexing and archiving a full set of data center active and passive components, warranties, support procedures, references, codes and certifications are a glimpse of what needs to be properly developed and organized for any operational data center in an efficient and referenceable data center manual [16]. Hence, several software tools can assist the formulation of this software like Microsoft Vision, Cisco Packet Tracer, Device42, among others.

While ICT Training and Consultancy unit is task arrange training for campus users and staff about newly implemented and developed applications. However, there has been no documentation and monitoring of the training needs assessment, conducted training, and the evaluation of its outcome in TVETI. In Most EHEI, this ICT unit/department the evaluation of effectiveness and its impact to ICT usage and literacy has not been evaluated and documented. There a need to assess the impact of ICT training under this unit/department, using models like Critical Success Factors (CSF), Balance Scorecard and SWOT Analysis. Finally, part of the IT Strategic Planning is a detailed and critical plan for Information Security adoption and implementation. Among information security model in the existing literature, ISO/IEC 27001 is the best-known standard in the family providing requirements for an information security management system (ISMS) [17]. An Information Security Management System concentrates policies, procedures, guidelines, and resources for joint management, on the protection of information assets of organizations. In addition, ISMS consolidates a systematic approach for establishing, implementing, operating, monitoring, revising and improving information security, in line with strategic business goals [18].

According to ISO [17], ISO/IEC 27001 specifies the requirements for establishing, implementing, maintaining and continually improving an information security management system (ISMS). The ISMS presents a systematic approach to keep sensitive information secure. It manages people, processes and IT systems through applying risk management processes. It is implementation it composed six (6) important steps namely: (A) Define information security policy, (B) Define information security policy, (C) Perform a risk assessment, (D) Manage the identified risk, (E) Select controls to be implemented, and (F) Implement controls. BPR is the Process Reengineering Life Cycle (PRLC). It is a six-stage methodology akin to others in the industry for companies to follow during BPR projects. The six sequential stages include (A) Envision new processes, (B) Initiate change, (C) Process diagnosis, (D) Process redesign, (E) Reconstruction and (F) Process monitoring.

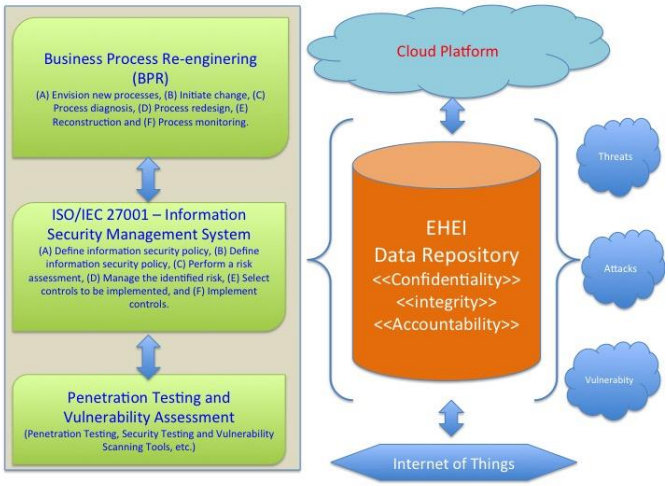

Figure 6. Information Security Model for EHEI

Figure 6 shows the IT Security Model for EHEI. It integrates the phases of BPR and stages of ISO/IEC 27001 aligned together to meet the universities mission and vision as described in Table 1. Vulnerability Assessment and Penetration Testing mechanism is incorporated into the model presenting the tools for practical security application. External application from the cloud and the Internet of things are also considered as it poses threats, attacks, and vulnerabilities not only in internally but also an external source. Confidentiality, integrity, and

availability are basic requirements for business information security and provide the maintenance requirements of the business thereby it is necessary to be considered in the development of the framework.

D. Phase 4 – Develop your plan's to close the gaps

In the fourth step, plan should be develop to close the gaps between the issues and problems encountered by all units/department of ICT Directorate based on there IT services, maintenance, monitoring and evaluation. There are several well known IT services evaluation tool from the existing literature that can be adopted like Balance Scorecard and CSF. The Balanced Scorecard, introduced by Kaplan and Norton in the early 1990s, is a framework for organizations to use to translate their missions and strategies into a comprehensive set of performance measures that enable them to assess how much of their strategies they have achieved and how they can move towards their goals [19]. These measures are normally known as key performance indicators. The conceptualization of the BSC was done with an underlying goal of linking business activities with the strategy, all directed towards achieving the ultimate end result, which is organizational performance [19]. CSFs can be defined as- "those things that must be done if a company is to be successful". CSFs must be few in quantity; quantifiable and manageable [20]. Determining the CSFs have great practical significance as the project manager or any other concerned authority can utilize these factors for the realization of their project. CSFs can be used by actual practitioners wanting to improve their projects success or by fellow researchers studying factors promoting success in IT/IS projects, thus, factors could have a more important effect in determining success of IT projects than that suggested by our work [20]. Based on the initial assessment and observation based on the checklist of Balance Scorecard and CSF, Table 2 presents the recommended approach on to leverage the problems, issues and concern encountered by the IT services of all the unit of ICT Directorate in TVETI.

Table 2. IT Services Strategy and Approaches

No	**Units/Department**	**IT Strategy and Approaches**
1	ICT Infrastructure and Data Center	The Data Center can be divided into (3) types of server infrastructure. The first server can act infrastructure server (e.g. main server, database application server, digital data bank server, proxy server, mail server, backup server, etc.). The second server for teaching-learning information system (e.g. eLearning, digital library, data repository, research grant system, etc.). The third server will server the business application system (e.g. Student Registration, Human Resource, Finance System, etc.). In addition, develop contingency plan and disaster recovery schema to anticipate disaster, overcome security system by using firewall and proxy server.
2	ICT Technical Support and Maintenance	Technical support and maintenance to solve IT/IS management must fulfill ISO 9001:2008 requirement we will make server, computer maintenance checklist and schedule, make backup data checklist and schedule, make user computer maintenance checklist and schedule, develop database application to store IT asset management data.
3	ICT Business Application Software and ICT Teaching-Learning Technology	Business application system development and customization of open source software for Teaching-Learning must adopt a database application to cover all business process, we will develop a web application with dynamic workflow to help top management in monitoring IT project development. A helpdesk web or desktop application to assess users on familiarity and solve issues regarding the IT usage and adoption. To solve data leakage, it is recommended store all shared data in new digital data bank server and restricted all user access. Data warehousing is also necessary to integrates databases from different application, merging and integrating to expand the relationship of its repositories and extract meaningful information for competitive advantage.
4	Information Security and Assurance Policy	Adopting the IT security framework using ISO/IEC 27001 will serve as a guiding model for all EHEI particularly public universities including TVETI on how to implement security of their information systems that support both academic and administrative purposes. Vulnerability Assessment and Penetration Testing is an important security mechanism tools every organization should in all IT infrastructure and services.

E. Phase 5 – Finalize the Strategic P2lan and Roll it Out

Finally, implementation plan and budgeting is made based on gap closing and then the data to higher official of EHEI, pertaining to Senate in TVETI will be presented and finalized in form of IT master plan. This master plan will serve as a road map and ICT strategic development plan that will span a period minimum of 5 to a maximum of 10 years. Through the integration of all the phases, components, activities, and approach of this ITSP for EHEI, a process framework as shown in Figure 7 is then formulated that will serves as guiding model strategic plan for the adoption, implementation, monitoring, and evaluation of ICT services under ICT Directorate office of EHEI particular TVETI.

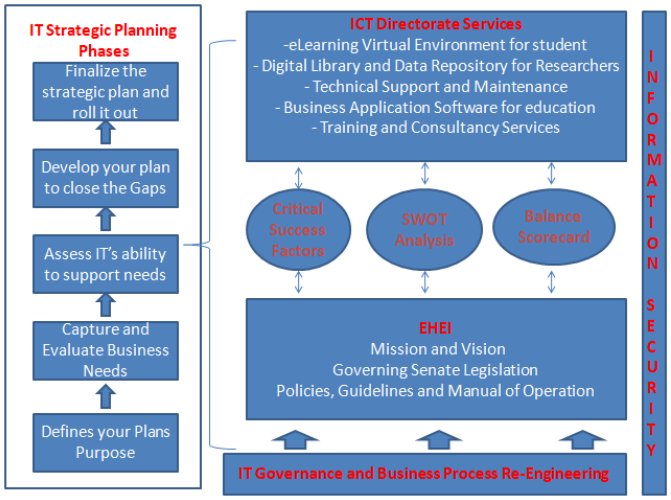

Figure 7. IT Strategic Planning and Process for EHEI

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Author Information

Mary Charlemaine A. Abas
Department of Electronics and Communication Engineering
University of San Agustin
Iloilo City, Philippines
Contact E-mail: mcaabas@ieee.org

Patrick D. Cerna
Department of Information and Communication Technology
Federal Technological University
Addis Ababa, Ethiopia

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Multi-faceted Assessment of Special Field Competences of Social Studies Teachers

Ozkan AKMAN
Gaziantep University

Abstract: It is a well-known fact that in order to advance as a society and to achieve prosperity in developed countries, good education must be provided in schools. However, in order to provide a good education in the schools, that is to be successful for the students, the quality of teaching in the school should be increased. The success graph in schools cannot be raised significantly without qualified teachers. In other words, good teachers are needed to have good students. Considering that teachers are trained in institutions that train teachers, these institutions have great responsibilities. However, the desired quality of teachers also depends on the existence of a number of standards. One of the ways to achieve this standard is teacher competencies. The aim of this study is to examine the special field competencies of social studies teachers in terms of various variables. The participants were working in the various provinces of Turkey consists of 450 social studies teachers. The research was obtained by using quantitative research methods. Data collection tool was prepared by using special field competence scale developed by the researcher. Data analysis was performed using SPSS 22.00 package program. According to the results obtained; As a gender variable, a significant result was obtained in favor of female teachers. Significant results were obtained in favor of men according to the high school and bachelor's degree. The number and quality of in-service training programs for teachers should be increased based on the conclusion that teachers receiving in-service training have higher perceptions of teaching qualifications than teachers who do not take them in-service. Teachers should be provided with the skills to collaborate with colleagues and evaluate themselves more objectively. Using these skills, studies should be conducted to make teachers realize that they have educational needs.

Keywords: Social studies teachers, Special field competencies

Introduction

It is a well-known fact that in order to advance as a society and to achieve prosperity in developed countries, good education must be provided in schools. However, it is necessary to increase the quality of teaching in schools in order to provide a good education in the schools, that is, for the students to be successful. Improving the quality of teaching is also possible with qualified teachers (Seferoğlu, 2004). In a school he attended in Izmir in 1925, Atatürk stated that lar those who save nations are only teachers and emphasized that teaching is a very important and demanding profession (Tekışık, 2003).

Although the educational policy of many countries encourages higher education to improve student achievement, questions remain about what quality education means. Part of this problem is the determination of teacher characteristics, especially in terms of student achievement. This is a fundamental issue inherent in the policy discussions about which qualifications will be supported. Teacher employment, how teachers 'fees will be, and how teachers are appointed to ensure equality and adequacy in teachers' educational outcomes are another challenge.

Goldhaber and Brewer (2000) in a study they have done in order to increase teacher qualifications in the name of the students have emphasized that teachers have a great impact on the success of students. The importance of the higher education that teachers have made in the name of self-improvement clearly shows this situation.
In this sense, the Ministry of National Education (MONE) reveals the necessity of supporting the existing teachers to contribute to their academic studies. The qualified and always renewing teacher's positive effect on

the students is undoubtedly a great fact. In addition, many researchers are especially important in terms of increasing the quality of teacher candidates who prefer master and doctoral degrees in teacher employment (Boyd, Lankford, Loeb, Rockoff & Wyckoff, 2008). Although most studies that predict the effect of teacher qualifications have focused on the characteristics of teachers, in the studies conducted to understand whether the qualifications of school faculty members will have a contextual effect on student achievement; teacher competencies have been shown as an effect of teachers' success on school success. The negative effects of low school academic achievement; supportive, more knowledgeable and more talented teachers in schools with the transfer of teachers argued that can be reduced (Clotfelter, Ladd & Vigdor, 2007).

The main purpose of the recent policy initiatives of major states, such as the development of international teacher qualifications aimed at teachers' qualifications and distribution, is to ensure that schools in their education systems work with high-quality active teachers. However, the problem for a qualified teacher still remains (Rice, 2003).

It is known that some teachers are more effective than others in gaining student gains. With regard to teacher qualifications in the last two decades, teacher supply and demand have been an important issue for both education researchers and governments. However, although the subject of teacher supply and demand is of great interest and importance, it has brought important discussions (Darling-Hammond, 2000). The number of teachers includes qualifications, deficiencies, and many factors that are not easy to assess, measure and predict. As a result, many researches on these issues have revealed contradictory findings and conclusions. Many published reports, beginning in the early 1980s, focused on the possibility of serious national teacher shortages in the early 1990s. These estimates have become an important agenda item for governments (Malen & Rice, 2004). The reduction in population growth all over the world teaching force in the early 1970s, demand for teachers all over the world as well as in Turkey has brought the problem. However, researchers predicted that in the 1980s, teacher supply would decrease and demand for teachers would increase. These analysts indicated that less and less qualified university graduates chose to teach, that more children of the "population explosion" generation entered school, and that student enrollment increased (Hanushek, Kain & Rivkin, 1998). Moreover, this increasing imbalance between supply and demand will, according to this view, increase further due to inadequate teacher problems. These analysts argued that the higher teacher level is the greatest source of demand for new teachers and an important factor behind predicted shortages. Some analysts have argued that the teacher supply is adequate and will continue, not particularly high. Research on teacher supply and the adequacy of school staff generally focuses mainly on understanding the problem of inadequate teachers and staff. In the simplest terms, teacher deficiencies arise when there is a lack of demand or the number of funded teaching positions exceeds the supply or the number of teachers available. As a result, such research typically aims to assess the amount of teachers present, the amount of teachers they need, and the gap between the two (Kane, Rockoff & Staiger, 2008).

Another issue is whether or not it focuses on the actual harmony between the needs of these schools and the qualifications of existing teachers, rather than focusing on whether there are enough teachers available. In other words, the focus is on shifting the adequacy of the amount of teachers towards the adequacy of teacher quality. The high number of teachers does not mean being a qualified teacher. According to the data of the Ministry of National Education, there are approximately one million teachers in our country today. This number corresponds to the total population of some countries in the world. However, international evaluation shows that we are not very good at education in commission reports. The premise behind this analysis is to determine a definite determination as to whether there are problems in teacher supply, to examine the qualifications of teachers, and especially to evaluate the distribution and qualifications of teachers among schools and students. The Ministry of National Education can use two general strategies to reduce the shortcomings between the wishes and demands of certain types of teachers. One involves changing the requested amount and the other involves changing the amount supplied. The first strategy is to reduce the demand for certain types of teachers by eliminating existing or new teaching positions (Gelbal and Kelecioğlu, 2007).

It is likely that efforts to anticipate and quantify teachers' supply, demand, and deficiencies, all of the above-mentioned reasons, often have different consequences. Therefore, the Ministry of National Education should not forget that research on teacher supply, demand and deficiencies has to focus on quality as well as on quantity (Gürşimşek, 1998). The availability of a sufficient number of teachers is a major problem in a country, but the real harmony between the needs of schools and the qualifications of teachers employed should be emphasized. One of the most controversial issues today is the question of how to identify and measure qualified teachers and quality teaching. One of the most important characteristics of a qualified teacher is the fact that education and preparation in the subjects or fields he teaches are accepted by all. A qualified teacher is the person who has full knowledge of the field (knowing what to teach) and teaching skills, ie pedagogical knowledge (knowing how to

teach) (Akman and Güven, 2015a). Knowledge of the field and pedagogy does not, of course, guarantee quality teaching or even qualified teachers, but both are prerequisites. However, nowadays there is another fact besides knowledge of field and pedagogy; it is also technology knowledge. The qualified teacher must have full knowledge of the field, pedagogy and technology knowledge and be able to combine these three situations in teaching. As a result, beyond the issue of insufficient number of teachers, assessment of teacher qualifications and quality has become a major issue in itself (Akman & Güven, 2015b). The aim of this study is to examine the specific field competencies of social studies teachers within the framework of the literature described above.

Method

In this section, the design of the research consists of participants, data collection tools and data analysis.

Research Design:

This research is one of the quantitative research methods. In this research conducted within the framework of quantitative research approach, screening model was utilized. The screening model is a research model that aims to describe a past or present situation as it exists (Karasar, 1999). By taking this model into consideration, special field competencies of social studies teachers were tried to be described.

Participants of the Study:

The participants of the study consisted of 450 social studies teachers working in Gaziantep provinces and districts.

Data Collection Tools*:*

The data of the research were obtained from the social studies special field competence scale developed by the author. The scale was obtained from a 5-point Likert-type scale consisting of 40 items to measure 20 sub-competencies under 5 main headings.

Data Analysis:

Data were analyzed using SPSS 22.00 package program.

Results

Table 1. Social Studies Teachers' Opinions about the Specific Field Competencies Independent Groups T Test Results by Gender

Gender	**n**	**x**	**ss**	**sd**	**t**	**p**
Man	200	4.18	16.49	448	1.029	**0.04**
Woman	250	4.22	23.86			
Total	450					

When Table 1 was examined, a significant result was obtained in favor of women by gender in relation to the special field competencies of social studies teachers ($p < 0.05$). It was observed that female teachers had more specific field competencies than men.

Table 2. One-Way Analysis of Variance (ANOVA) Results of Social Studies Teachers' Opinions about Special Field Competencies by Type of High School Graduated

Type of High School Graduated	**n**	**x**	**ss**	**F**	**p**
General high school	105	4.28	16,95	1.146	**0.03**
Anatolian High School	245	4.18	17.46		
Vocational high School	100	4.06	28.45		
Total	450	4.20	21.02		

When Table 2 was examined, it was found that the opinions of social studies teachers about their special qualifications were found to be significant in favor of vocational high school according to the type of high school graduated ($p < 0.05$). It is thought that such a result is obtained due to the fact that the teachers studying in vocational high schools have more application areas.

Table 3. The Independent Group T Test Results of Social Studies Teachers' Opinions about Special Field Competencies According to Their Status of In-Service Training

In-Service Training Status	**n**	**x**	**ss**	**sd**	**t**	**p**
Yes	285	4.85	19.26	448	4.646	0.02
No	165	4.08	22.43			
Total	450					

When Table 3 was examined, significant results were obtained in favor of the special field competencies of in-service trainers according to the status of in-service training of social studies teachers ($p < 0.05$). it is seen that in-service training activities have a great contribution to teachers' special field competencies.

Table 4. Special Field Proficiency Perceptions of Social Studies Teachers

Area of Proficiency	**x**	**ss**	**Degree**
Planning and Organizing the Teaching Process	4.16	4.26	Enough
Learning-Teaching Process	4.19	2.53	Enough
Monitoring and Evaluation	4.08	1.89	Enough
Collaborating with School, Family and Society	3.88	4.01	Enough
Providing Professional Development	4.38	2.47	**Excellent**
Total	4.07	13.26	Enough

When Table 4 is examined, it is observed that the social studies teachers' perceptions of special competence are generally sufficient, while the basic sub-dimension, professional development, is excellent.

Conclusion, Discussion and Suggestions

The aim of this study is to determine the special proficiency perceptions of social studies teachers with "Social Studies Teachers Special Field Proficiency Scale" developed by the researcher. In general, when the results are examined, it is seen that social studies teachers have sufficient level of special field competencies. It was observed that the results ranged between 3.88 and 4.38 in different sub-dimensions. When the related literature is examined, it is seen that similar results have been reached (Kuğuoğlu, 2004; Kahramanoğlu & Yusuf, 2013).

When the results of the study were examined, a significant difference was found in favor of women by gender according to social studies teachers' perception of special field competence. Similar results were obtained when the literature was examined (Aktağ and Walter, 2005; Çapri and Çelikkaleli, 2008).

Similarly, it was observed that the teachers who participated in the in-service training activities had higher special field competencies than those who did not. According to the type of high school graduates, it is observed that the teachers who have graduated from vocational high schools have more special field competencies.

In the light of these results; In-service training activities are very important in the development of teachers. Teachers should be provided with the skills to collaborate with colleagues and evaluate themselves more objectively. Using these skills, studies should be conducted to make teachers realize that they have educational needs.

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Author Information

Ozkan Akman
Gaziantep University
Gaziantep University Nizip of Education Faculty
Gaziantep / Turkey
Contact E-mail: akmanozkan@hotmail.com

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Intrinsic and Extrinsic Motivation in Technology Education

Ossi AUTIO
University of Helsinki

Abstract: The purpose of this study was to determine the elements motivating comprehensive school students to study technology. The research was carried out as a qualitative case study and the material was collected through individual theme interviews. Each test participant represented a different case of motivation towards technology education. In choosing individuals for the study the main criteria were gender, negative or positive motivation and competence in the field of technology. This study found that the artifact to be made in school and the student's freedom of choice had significant effect on motivation in all test participants. Instead, curiosity and intellectual challenge seemed to be the main elements among technological talents. Although, we must be careful with final conclusions as the research group was relatively small, we can conclude that there were more signs of intrinsic motivation among students with high technological competence whereas extrinsic motivation was emphasized in the other students.

Keywords: Technology education, Intrinsic motivation, Extrinsic motivation, Technological talent

Introduction

The term motivation is derived from the Latin verb movere (to move). The idea of movement reflected in such commonsense ideas about motivation as something that gets us going, keeps us moving, and helps us complete tasks (Pintrich & Schunk, 2002). Since the formal beginnings of education (Dewey, 1913), motivation has been viewed as the primary determinant of student learning and school success. Research consistently reveals that motivation is critical not only to current academic functioning, but also to students beliefs in their future success as students and in their expectation of having positive school experiences (Shernoff, Csikszentmiahlyi, Schneider, & Shernoff, 2003). Furthermore, motivation is one lens with which to investigate factors that contribute to students´ interest, engagement and persistence in learning activities (Gilman & Anderman, 2006).

Most contemporary theories tend to emphasize one or more aspects that facilitate this process (Roeser, Strobel, & Quihuis, 2002). Gottfried (1990) used the term academic intrinsic motivation in a broad sense to depict a special kind of motivation for school learning. Academic intrinsic motivation involves the enjoyment of school learning and is characterized by a mastery orientation; involving curiosity, persistence and the learning of challenging, difficult and novel tasks.

Motivation involves goals that provide impetus for and direction to action. Cognitive views of motivation are united in their emphasis on the importance of goals. Goals may not be well formulated and may change with experience, but the point is that individuals have something in mind that they are trying to attain or avoid. Motivation requires activity – physical or mental. Physical activity entails effort, persistence, and other overt actions. Mental activity includes such cognitive actions as planning, rehearsing, organizing, monitoring, making decisions, solving problems, and assessing progress. Finally motivated activity is instigated and sustained. Starting toward a goal is important and often difficult because it involves making a commitment to change and taking the first step. But motivational processes are critically important to sustain action. Many major goals are long-term such as to get good grades to be accepted into college or saving money for retirement (Pintrich & Schunk, 2002).

Deci and Ryan (1985) were interested in whether individuals engage in academic tasks for the intrinsic benefits associated with the task, or in order to receive some type of extrinsic reward. Self-determination theory (SDT)

focuses on the degree to which an individual's behavior is self-motivated and self-determined. SDT posits the existence of three major types of motivational constructs namely intrinsic motivation, extrinsic motivation, and amotivation. Intrinsic motivation refers to engaging in activities for themselves, out of pleasure, fun, and enjoyment. On the other hand, extrinsic motivation refers to engaging in activities for outcomes that are separate from the activity. According to Deci and Ryan (2002) four forms of extrinsic motivation have been proposed.

1. External regulation involves engaging in an activity to obtain rewards or avoid punishment. In this level, students would not be intrinsically motivated or show high interest, but they would tend to behave well and try to do work to obtain rewards or avoid punishment.
2. Introjected regulation refers to behaviors performed to avoid guilt and internal pressure and entails the internalization of past external controls. In this level, students are not doing work solely for the rewards or to avoid punishment. The feeling of guilt is actually internal to the person, but the source is still somewhat external.
3. Identified regulation individuals engage out of choice in the activity that is not interesting per se. In this case, students want to do the tasks because it is important for them, even if it is more of utilitarian reasons, rather than intrinsic interest in the task.
4. Integrated regulation deals with behaviors that while not emitted out of fun, are nevertheless fully internalized in the individuals self and value system. The final level is still instrumental, rather than autotelic as in intrinsic motivation, but represents a form of self-determination and autonomy.

In addition to intrinsic and extrinsic motivation, a third motivational construct is amotivation, which occurs when amotivated individuals do not perceive contingencies between their actions and subsequent outcomes. Amotivation can be seen as the relative lack of motivation to engage in a certain behavior (Vallerand, 1997). Amotivation has been found to typically yield negative outcomes: e.g., anxiety, distraction, dropping out, and negative affect (McDonough & Crocker, 2007; Pelletier, Fortier, Vallerand, & Briere, 2001).

Furthermore, Deci and Ryan (2002) assume that according to basic needs theory (BNT), there are three main intrinsic needs involved in self-determination. The three psychological needs motivate the self to initiate behavior and specify nutriments that are essential for psychological health and wellbeing of an individual. These needs include the need for competence, need for autonomy and the need for relatedness. These needs are seen as universal necessities that are innate not learned and seen in humanity across time, gender and culture (Chirkov, Ryan, Kim, & Kaplan, 2003)

Competence concerns an individual´s need to feel a sense of mastery through effective interaction within their environment. The inherent need for autonomy is fulfilled when people perceive that they are the origin of their choices and decisions, and that they are acting in accord with their integrated sense of themselves. The third need for relatedness, corresponds to feeling securely attached to and being respected by significant others.

Table 1. Simplified descriptions of a behavior in amotivation, extrinsic- and intrinsic motivation

AMOTIVATION *non regulation*	*EXTRINSIC MOTIVATION* *external-, introjected-, identified-, integrated regulation*	*INTRINSIC MOTIVATION* *intrinsic regulation*
COMPETECE		
Do not feel at all competent and experience no success	Feel a little competent in certain environments, but is not able to control possible outcomes	Feel very competent in all environments, is able to control outcomes and experiences success
AUTONOMY		
No autonomy: No sense of having chosen to do the behavior	Very little autonomy: The reason for doing the behaviour is to please friends, parents, teacher etc.	Very high autonomy: Would definitely choose to engage in this behavior anytime
RELATEDNESS		
No relatedness: Do not feel connected to others in context of behavior. Possible feel even unwelcome	Very little or negative relatedness: Do not feel connected to others or feel pressure from friends, parents and society to be in the context	High relatedness: Feel meaningfully connected to others in context

In this study, the elements motivating comprehensive school students to study technology education were classified according to the basic need theory (BNT). After the interviews with test participants, the elements

motivating the test subjects were classified into themes. First theme - need for competence was formed from needs, interest, character, physical abilities, technological talent and personal hobbies. Need for autonomy incorporated for example products to be made in lessons, freedom of choice in materials and techniques, student's internal feedback, and evaluation. Need for relatedness incorporated for example teacher, and teacher – student interaction, classroom atmosphere, parents, and friends.

Methodology

The aim of this research was to examine comprehensive school students´ motivation in technology education and to determine interaction of the elements motivating comprehensive school students to study technology education. In addition, we tried to find out if there was a difference between intrinsic and extrinsic motivation. The main research questions were:

1. What are the main elements motivating comprehensive school students to study technology?
2. What is the main difference in building intrinsic and extrinsic motivation?

The research was carried out as a qualitative case study (Merriam, 1988) and the data was collected from individual theme interviews. The interviews were first tape-recorded and transcribed. Themes were identified and the portraits of each subject established (Lightfoot, 1983). Later the data was analyzed using the content analysis methodology. The analysis was carried out through determining out the interesting and essential elements motivating students in technology education. These findings were later classified by the themes and finally reported in the conclusions.

Case study research excels at bringing us to an understanding about a complex issue or object and can extend experience or add strength to what is already known through previous research. Case studies emphasize detailed contextual analysis of a limited number of events or conditions and their relationships (Stake, 1995). It is correct that the case study is a detailed examination of a single example, but it is not true that a case study cannot provide reliable information about the broader class (Flyvbjerg, 2006).

The test participants consisted of four different students each having a different background in motivation towards technology education. In the choice of individuals to be tested the main consideration was given to gender, technological talent and to negative and positive motivation in technology education.

Three boys and one girl took part in the study. Three of them studied in Helsinki area and one of them in a rural village, which lies about 150 kilometers from Helsinki. In the school curriculums there was nothing different compared with normal Finnish comprehensive schools. At the primary level (grades 1-6) pupils are 7 to 13 years old, at the secondary level (grades 7-9) pupils are 14 to 16 years old and in the upper secondary school pupils are 17 to 19 years old. In grades 1-7, craft and technology education is a compulsory subject, about 2-3 hours a week, even though in grades 1-2 subject contents are closer to hobby crafts. In grades 8-9 and in upper secondary school there is no compulsory technology education, but pupils can take elective studies for about 2-4 hours per week. Since the background of each test subject was somewhat different we named them characteristically as follows:

Subject 1 - rebel
Subject 3 - academic theoretician
Subject 5 - academic multi talent
Subject 6 - non academic technology talent

Result

Since each participant had different experiences in technology education, in the following section we describe each test participant's educational history and the main elements accounting their motivation.

The themes accounting for motivation are described in tables, which show the elements that had the greatest effect (identified with bold and underlined text) as well as elements that had less meaning for the participants' motivation (shown in bold or normal text). The elements may have had negative or positive effects on a participant's motivation. The direction can be interpreted from the context. Besides, the elements with negative effect are marked * in the tables. The significance of the elements is based on the participants' direct comments, which were documented during the interviews.

Subject 1 – Rebel

The first test participant represented a girl who had chosen technology lessons in secondary school. She lives with her mother and older brother. Her mother works in the library and her father is a production manager.

Subject 1 considers technology education important because it is a necessary counterbalance to the theoretical subjects. Her first role model was her grandfather, and she has been interested in technology since childhood. The first noticeable increase in motivation was found when craft and technology classes started in primary school, and she learned something valuable about technology education. Later, there was some reduction in motivation because the new teacher was too domineering and demanding. Yet especially in secondary school the motivation again increased because Subject 1 liked to work with large machines, and there were more materials and interesting projects to choose from. The highest point in her motivation came when she had completed building her electric guitar and took it home. After finishing secondary school, Subject 1 thinks that her activity in technology education will decrease, but that her attitude towards technology in general will remain positive, but diminished.

From the interview we can conclude that Subject 1's motivation in her early childhood was based on external or introjected regulation and her grandfather was a highly valued role model. In the continuum of her motivation sensation seeking seemed to be an interesting element. According to Zuckerman (1994), sensation seeking is a personality feature that shows up in attempts to engage in new, varying, complicated, and intensive experience. In seeking this kind of experience, the person is willing to take physical, social, and financial risks. This kind of behavior is a typical sign of intrinsic motivation among some persons. Building an electric guitar demonstrated such behavior in Subject 1's career in technology education.

Subject 1 remembers the work of making the guitar as the most agreeable project of all. The impressive and valuable product that she had made for her own use motivates her significantly, but also increases her interest in other products. Other main elements in her motivation were classroom environment and the atmosphere of the classes, which was usually relaxed, and the group was smaller than in other subjects. The effect of the school curriculum had also been important because the school has offered a sufficient number of alternatives. Wood-, metal-, and electrical work all belong to the curriculum. In making the electric guitar, for instance, several different skills and materials were combined.

The themes accounting for Subject 1's motivation are described in table 2, which show the elements that had the greatest effect (identified with bold and underlined text) as well as elements that had less meaning for the participants' motivation (shown in bold or normal text).

Table 2. Main elements behind the motivation of Subject 1

NEED FOR AUTONOMY	COMPETENCE	RELATEDNESS / SOCIAL RELATIONS
- **Product /artefact**	- **Needs**	- **Classroom atmosphere**
- **Freedom of choice**	- **Interest**	- **Grandfather**
- **Internal feedback**	- **Physical abilities**	- Parents
- **Evaluation**		- New teacher

Subject 2 – Academic theoretician

The second test subject represents a boy who has not chosen any technology education lessons in secondary school. He lives with his mother and elder brother. Both parents are lawyers and Subject 2 is willing to pursue the same career.

Subject 2 did not have any interest in technology education in early childhood because he was not familiar with it at all. The first remarkable increase in interest and motivation came when technology education started in primary school, and for the first time he learned some valuable technical skills. Later the motivation increased again when he could concentrate more on his own interests. In secondary school, he encountered some difficulties in his work because his skills were limited and the motivation decreased. After finishing school, Subject 2 thinks that he will not have any activities in technology education because he will be concentrating on his academic career. So his motivation to engage in technology education may well reduce close to zero after his school years.

In the continuum of Subject 2's motivation, we can see that he could move from amotivation to identified regulation where individuals engage out of choice in the activity that is not interesting per se. The product to be made and freedom of choice in products and materials seemed to be the main elements in his motivation. Unfortunately, these elements had only a short-term effect on his behavior.

According to Subject 2, technology education is not a significant matter in his life. Indeed, he considers it to be merely the hobby of a small minority of people. At home academic values are also appreciated to a considerably higher degree than vocational education. Subject 2´s thoughts regarding technology education reflect those values and attitudes that come from home. He places value neither on the craft nor on vocational education in the field of technology.

During his first school years, however, Subject 2 liked technology education. Then the product and the freedom of choice were some of his most significant sources of motivation. When he proceeded to more difficult and challenging work, his skills and abilities were no longer enough and his general interest gradually came to an end. The themes accounting for Subject 2´s motivation are described in table 3.

Table 3. Main elements behind the motivation of Subject 2

NEED FOR AUTONOMY	COMPETENCE	RELATEDNESS / SOCIAL RELATIONS
- **Product /artefact**	- **Character** *	- **Parents** *
- **Freedom of choice**	- **Needs** *	- **Friends** *
- Evaluation *	- **Interest** *	
	- Physical abilities *	

* Amotivation

Subject 3 - Academic multi talent

The third test participant spent his first school years in a normal primary school, but at secondary and upper secondary level he studied in Helsinki University Training School, which is one of the highest ranked upper secondary schools in Finland. He lives with his father and mother and one younger brother. Both parents are Masters of Science in technology and they both work in State Technical Research Centre. Also quite many of his older relatives have studied in the University of Technology. So, in this case, the technological talent may have been in genes for a longer time.

Subject 3 became familiar with technology education already in early childhood while he played with Lego and worked with radio controlled (RC) cars. The whole family was very competent in technology and especially mother was very supportive and fixed toys with the children. Subject 3's motivation was based on child's curiosity and he always wanted to know how toys work. Though in primary school he was not especially interested in technology education and he did not think that he learned much valuable skills. At the secondary school level there was more freedom of choice in projects and working was in general more challenging. The whole classroom in technology education was well organized. There were plenty of different materials and machines and tools were in good order. The teacher was also very competent and could create inspiring and open atmosphere, but still the working was based on a rational process with planning, investigation, implementation, and evaluation. It was easy to talk with the teacher and feedback from the teacher was rewarding and developed skills and technical thinking further.

In upper secondary school, he had to concentrate more on academic subjects and he was not at all sure that he will choose a technology related profession in the future. He was interested in physics, chemistry and mathematics, but still he wanted to find a counterbalance between theory and practice. Computers gave him a new change to develop his technological competence without being too theoretical. The themes accounting for Subject 3´s motivation are described in table 4.

Table 4. Main elements behind the motivation of Subject 3

NEED FOR AUTONOMY	COMPETENCE	RELATEDNESS / SOCIAL RELATIONS
-**Curiosity** - **Freedom of choice** **- Process (planning, investigation, implementation, evaluation)**	- **Talent** **- Hobbies (Lego, RC, Computers)** - Interest	- **Teacher** **- Technically oriented and supportive family** - Friends with common interest - Feedback from the teacher

Subject 4 – Nonacademic technology talent

The last test subject studied technology education in primary and secondary school in a relatively small school about 150 kilometers from Helsinki. He lives with his mother and father and had two elder brothers and two sisters. His father works as a taxi driver, but is a main owner of a local bus company. His mother works as a bank officer.

Subject 4 became familiar with technology education already in early childhood while he built with Lego and followed his elder brothers. There were plenty of inspiring stimuli at home. Father had good facilities to work with cars and had different tools of all kind and machines available. Thus the school was the first identifiable element to affect his skills, there was any special increase in his motivation in primary school level. In secondary school, especially electronics gave him some more challenge and in general he felt much better when he had more freedom and his choices were respected, because this was not the case in several other school subjects. According to him, there was always a sufficient supply of materials. Also tools and machines were in good condition in classrooms where technology education was taught. The teacher was also a significant element. He could create an open, intellectually challenging atmosphere.

Subject 4 was gifted with his hands and so he could concretely see his development from his products and he felt comfortable in technology education classes, but still he thinks that his competence and motivation developed even more with his hobbies than in school. When, he was older and more skilful his two elder brothers accepted him to repair cars with them. So his competence developed further and affected his motivation positive.

According to Ryan and Deci (2000) competence concerns an individual´s need to feel a sense of mastery through effective interaction within their environment. Subject 4 is a good example of a student, who usually chooses and prefers subjects and tasks in which they are good and can show their competence (Byman, 2002). Subject 4's motivation in other school subjects was quite low, but in technology education he developed to a level where behavior was internalized in the individual´s self and value system. Research supports this hypothesis in a variety of life contexts (Vallerand, 1997). The themes accounting for Subject 4´s motivation are described in table 5.

Table 5. Main elements behind the motivation of Subject 4

NEED FOR AUTONOMY	COMPETENCE	RELATEDNESS / SOCIAL RELATIONS
- **Product** **- Freedom of choice** - Internal feedback -Working process	-**Talent** -**Interest** **-Needs** - **Hobbies (Lego, cars)**	- **Teacher** **- Atmosphere in technology education lessons** **- Parents and brothers** -Challenging and inspiring working atmosphere

Discussion

Of all the elements in motivation, the freedom of choice and the artefact to be made seemed to have the most remarkable effect on motivation which for its part would have emphasized the external motivation or situational

interest. Nevertheless, it seems that among some students these elements have affected even intrinsic motivation by expanding the amount of internal feedback. Hence, among technological talents, curiosity and intellectual challenge seemed to be the main elements in motivation. According to Deci and Ryan (1985), one way to achieve intrinsic motivation is to expand the feeling of autonomy among students. That is what happens when there is freedom of choice in materials, techniques, and in products to be made. The feeling of autonomy is especially important for older students who want and need more autonomy in their decisions. Some research in other life contexts such as education in general has also shown that high levels of autonomous motivation toward education lead to high academic performance (Burton, Lydon, D´Alessandro, & Koestner, 2006; Gottfried, Fleming, & Gottfried, 1994).

Need for competence: talent, students´ own needs, interests, and technology-related hobbies were definitely more important elements in technology education among technology talents. Instead, these elements may have had a negative effect in motivation among less talented test participants. According to Byman (2002), students usually choose and prefer subjects and tasks in which they are good and can show their competence. It seems that if we ask students to do too difficult tasks in technology education with limited competence, the motivation is based only on extrinsic forms.

Need for relatedness / social relations – for example teacher, teacher–student interaction, classroom atmosphere, and parents were also found to be important elements in all test participants, but not as essential as those elements in need for autonomy and competence. It seems, that classroom atmosphere and teacher-student interaction were more important in making the whole environment suitable than in directly influencing motivation. Reeve, Bolt and Cai (1999) have shown that teachers who support students´ freedom of choice and autonomy in decisions create more intrinsic motivation than those who are willing to control their students. Autonomy support is evident when an authority figure respects and takes the subordinate's perspective promotes choices and encourages decision-making (Ratelle, Larose, Guay, & Senecal, 2005).

In addition, an additional theme that is not directly included in the basic need theory seemed to have an important effect on motivation. The entire classroom environment with available tools and machines appeared to be important for motivation among all test participants. According to the test participants, the classroom in technology education should have enough space for everybody, enough materials, and tools in good order. Deci and Ryan (1985) argue that informal learning environments which offer optimal challenge, plenty of different stimuli, and a chance to feel autonomy achieves effective motivation. According to Stipek (1996), it is even more important to pay attention to provide an optimal and suitable learning environment than to concentrate on students' personal problems in terms of motivation.

Suitable learning environment and atmosphere are seen as typical features of a positive affect. Positive affect for its part facilitates flexible thinking and problem solving, and enhances performance, even where the tasks to be done are complex, difficult and important (Isen & Reeve, 2005). Furthermore, Isen and Reeve (2005) indicate that positive affect does foster intrinsic motivation, and enjoyment and performance of enjoyable tasks, but not at the expense of responsible work behavior in uninteresting tasks that must be done.

Other special elements in motivation – for example values in society, nursery school, grandparents, friends, and group size in the lessons had some effect on motivation among test participants, but proved to be less important in the formation of motivation in technology education in this study. In figure1 the interaction between the main elements of motivation based on the empirical data from the test participants' interviews is presented. The interaction is not self-evident and we must be careful with final conclusions as the research group was relatively small. However, from the test subjects' interviews we can conclude that there were more signs of intrinsic motivation in technological talents test group and extrinsic motivation was emphasized in others.

We can assume that both intrinsic and extrinsic motivation are at first step based on environment which includes: parents, supportive family and tools and machines at school and home. In long term, the most remarkable difference between intrinsic and extrinsic motivation seems to be in interest, curiosity and intelectual challenge. These elements affected hobbies and freedom of choice in several different learning situations at home and in school and finally generated intrinsic motivation. Although, the freedom of choice is important in generating the feeling of autonomy, it is possible that it will lead to situations where the product to be made is the most important element in motivation. In case just the product to be made is more important than interest and intellectual challenge, this will lead to extrinsic motivation. Hidi and McLaren (1990), states that individual interest develops slowly and tends to have long-lasting effects on a person's knowledge and values, whereas situational interest is an emotional state that is evoked suddenly by something in the immediate environment and may have only a short-term effect on an individual's knowledge and values.

Talent, physical abilities, competence and interest were definitely important elements in technology education. However, these elements may have had a negative effect in motivation among less talented test participants. According to Byman (2002), students usually choose tasks in which they are good at. It seems that if we ask students to do too difficult tasks in technology education with limited competence, the motivation is based only on extrinsic forms.

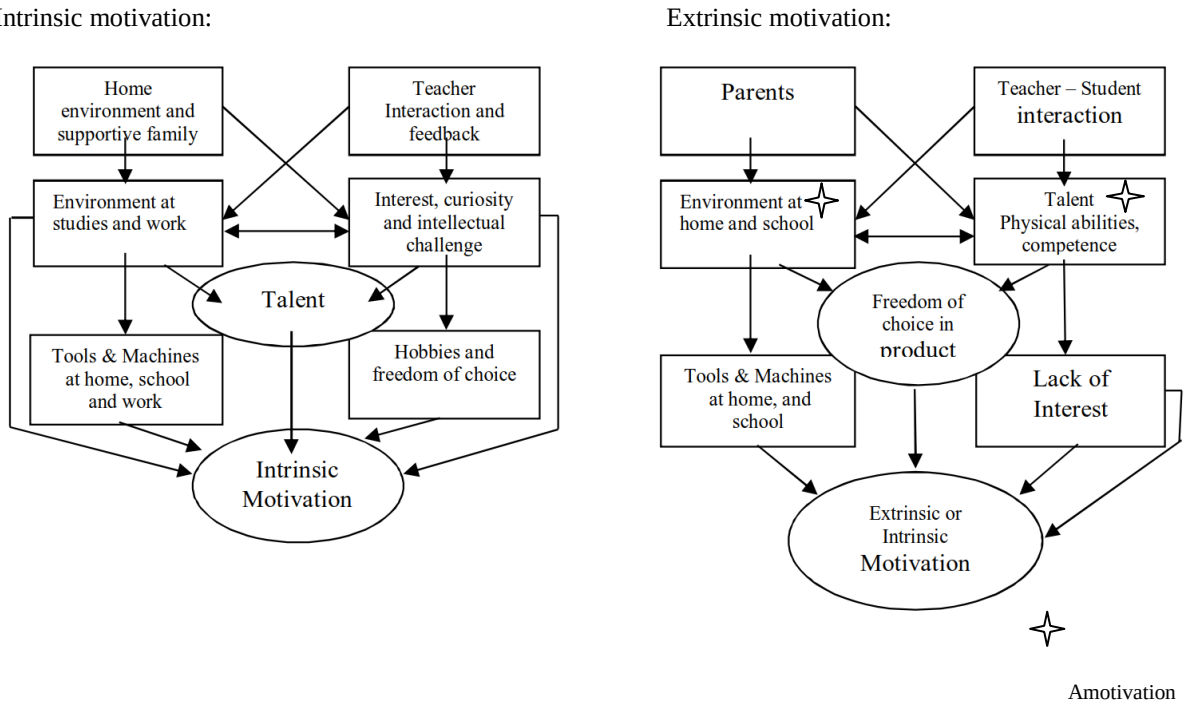

Figure 1. Interaction between the main elements behind intrinsic and extrinsic motivation

Conclusions

For a long time, motivation has been viewed as the primary determinant of students' learning and school success. Motivation is critical not only to current academic functioning, but also to students' beliefs in their future success as students. Although, our research group was numerically small, this fact was noticed in this study as well.

It is not surprising that both boys and girls are attracted to technology education because they enjoy working with their hands and like the independence and chance for creativity provided by these classes (Silverman & Pritchard, 1996). Students who typically enroll in technology education are attracted to the types of projects they will be engaged in (Weber & Custer, 2005). It seems that several other school subjects have more motivational problems than technology education. Additional studies, based on time sampling methods suggest that these negative perceptions are not limited to one or two of the hardest class subjects, but are pervasive across the entire school curriculum (Shernoff et al., 2003). We can assume that all subjects could use more practical methods, which give the students more independence, autonomy and the chance to use their own creativity.

In Finnish schools it appears to be the case that some students value neither crafts nor vocational education. Common opinion is that, the university is definitely a better and more respected place to in which to study than vocational school. Usually, these views of technology education reflect those values and attitudes that come from home, and these attitudes are adopted already at an early age (Autio, Hietenoro, & Ruismäki, 2009). Although an academic career is usually more valued than practical work, there should be a better balance between practical and academic subjects, at least in the lower grades and even at the high school level. On the other hand, motivation in technology education can be significantly improved by developing special programs (Mammes, 2004), where teachers are aware of the differing interests of both genders and consider ways of making the environment and the subject attractive to all (Silverman & Pritchard, 1996).

When teachers try to find ways to promote student's motivation during relatively uninteresting learning activities, they can successfully do so by promoting the value of the task. One way teachers can help students value what they may deem uninteresting is by providing a rationale that identifies the lesson's otherwise hidden value, helps students understand why the lesson is genuinely worth their effort (Jang, 2008).

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Author Information

Ossi Autio
Department of teacher education
University of Helsinki, Finland
Contact E-mail: ossi.autio@helsinki.fi

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Investigating Science Misconceptions of Pre-service Early Childhood Education teachers at the Lebanese University, Faculty of Education

Eman SHAABAN
Lebanese University

Imane ABOU ALI
Lebanese University

Hanadi CHATILA
Lebanese University

Abstract: Teacher preparation programs aim mainly to develop both pedagogical and content knowledge of pre-service teachers. Graduate teachers should master all concepts and approaches related to their teaching field. In the Lebanese context Early Childhood Education (ECE) graduates should be able to teach languages, science and math from Kindergarten to grade 3 (K-3). As science educators at the Lebanese University, Faculty of Education, the researchers noticed that ECE pre-service teachers lack mastery in basic scientific concepts. This research aims to identify science misconceptions, compare ECE pre-service science teachers' conceptions over the three years, and propose new strategies and techniques to overcome any misconceptions. For this purpose 150 pre-service ECE teachers distributed over the three year of the ECE preparation program completed an open ended questionnaire to merge their conceptions. Quantitative and qualitative analysis of the data collected was performed. Results show that pre-service ECE teachers hold major scientific misconceptions over the three years in all science related areas.

Keywords: ECE preparation program, Science misconceptions, Conceptual change

Introduction

Pre-service Teacher Education Programs

Teacher preparation programs (TPPs) are generally designed to enable prospective teachers gaining a foundation of knowledge about pedagogy and subject matter, as well as offering them early exposure to practical classroom experience (Feuer et al., 2013).

The National Council for Teacher Education has defined teacher education as a program of education, research and training of candidates to teach from preprimary to higher education level. Some of the most important objectives of teacher education are as follows: 1. Imparting an adequate knowledge of the subject matter; 2. Equipping the teachers with necessary pedagogic skills; 3. Enabling the teacher to acquire understanding of child psychology; 4. Developing proper attitudes towards teaching; 5. Developing self-confidence in the teachers; 6. Enabling teachers to make proper use of instructional facilities; 7. Enabling teachers to understand the significance of individual differences of child (National Council for Teacher Education, NCTE, 2010).

Teacher Education Program in Early Childhood Education (ECE)

Early Childhood Education (ECE) aims at total child development in a learning environment that is joyful, child-centered, play and activity-based. Teacher education programs in ECE should develop in the trainee concepts, competencies, attitudes and skills related to implementation of developmentally appropriate

curriculum based on: cognitive and language development, health and nutrition, social, emotional, physical and psychomotor development, aesthetic development, creativity and play, program planning and school organization, community mobilization and participation. These requirements call for a teacher educator who has a sound educational philosophy of ECE, besides specialized content and methodology skills pertaining to the above areas (NCTE, 2010).

According to Liang (2009) ECE training programs do not focus on teaching science. ECE teacher feel more confident while teaching languages, math and social studies, than teaching lessons about scientific exploration. Furthermore, many ECE teachers claimed that they are less prepared to teach science compared to other disciplines (Wenner, 1993). According to 1997 National Education Goals Report, ECE teachers felt unable to teach science (National Education Goals Panels, 1997). ECE pre-service teachers take few science related courses (Khalid, 2001). However, teachers play an important role in reducing the misconceptions of students, for that reason, it is important for teachers' and pre-service teachers' training programs to pay special attention to teachers' misconceptions (Kanli, 2014).

Overview of the Faculty of Education of the Lebanese University

The mission of the Faculty of Education of the Lebanese University is educating early childhood, elementary and high school teachers, in addition to other pedagogic frameworks. It grants Bachelor degrees in Education and Teaching Diplomas in different specialized majors, as well as Professional Master Degrees (Lebanese University Official Website). Similar to American and Bologna-reformed European systems of higher education, Lebanese higher education utilizes three progressive cycles: Bachelors level (3 years), Masters level (2 years), and Doctoral level (3 years), or the French model, Licence, Master, and Doctorat (LMD). The Lebanese University has begun implementing this three-cycle structure in their faculties in 2005, though implementation has not been immediate or uniform. Noting that, the language of instruction in Lebanon can depend on the institution attended, but programs of study are typically offered in Arabic, English, or French. (El Takach, Rawas & Dokmak, 2018).

ECE Pre-service Teaching Program at the Lebanese University, Faculty of Education

At the Lebanese University, Faculty of Education pre-service ECE teachers undergo three-year teacher preparation courses, following LMD program. The program includes formal university studies with practical experiences in schools. In the Lebanese context Early Childhood Education (ECE) graduates should be able to teach languages, science and math from K-3. The courses typically comprises units in curriculum, psychology, computer fundamentals and its applications, classroom management, evaluation and assessment, human rights, puppet workshop and theater, sociology of education, educating children with special needs, foreign language activities, arabic activities, mathematics activities, action research as well as classroom practice, with a total of 180 credits. The ECE preparation program includes only four courses that are directly related to science: teaching science in ECE; science activities; environmental education; and health education. In addition, there are two other courses which are indirectly related to science: early childhood services and care and an observation course. Throughout those years student-teachers are encouraged to develop their reflective skills through different means, especially practicum courses through practicing micro and macro teaching, writing reflection papers, portfolios and projects.

Conception, Misconception and Conceptual change

Giordan (1987) defined conceptions as a set of images that learners possesses before any teaching process. Giordan and De Vecchi (1987) defined conceptions as "a set of explanatory, coordinated ideas, and coherent images used by learners when confronted with a problematic situation". According to Astolfi (1997) learners have already-there existing ideas that even if it is scientifically wrong serves as a functional explanation for them. Clément (2006) emphasized that conceptions are the results of the interaction between knowledge, values and practices according to the KVP Model. Conceptions in didactics are learners' previously held ideas related to a scientific topic, these previous ideas, can be more or less organized, more or less coherent, more or less scientific (Clément, 2010).

The term misconception or alternative conception simply means an idea or explanation that differs from the accepted scientific concept. A misconception can be defined as the knowledge of an individual about a

concept that is essentially different from the commonly endorsed scientific implication of this concept (Yağbasan & Gülçiçek, 2003). Some alternative conceptions arise as students try to make sense of the world and naturally occurring phenomena around them. Other alternative conceptions form when students construct explanations with insufficient information. Also, alternative conceptions can also result from incorrect or partially correct explanations given by teachers, parents, or the media. The role of the media can be considered an important factor in creating confusions and misconceptions among students. The influence of the media was seemingly a major factor in developing student knowledge and shaping their thinking. The presence of misconceptions can also be attributed to ineffective classroom science instruction. Some students, during the conversation, complained that their science classes did not have any real impact on their knowledge (Khalid, 2001). Once formed, alternative conceptions can be persistent even in the face of discrepant events or careful instruction. According to Wandersee, Mintzes and Novak (1994) often science teachers possesses the same alternative conceptions as their students (as cited in Chiappetta & Koballa, 2010). Student teachers' conceptions could affect the teaching approaches the student teachers eventually take in the classroom (Gustafson, & Rowell, 1995).

However, alternative conceptions are developmental in nature, they often change as students develop their ability to think abstractly (Chiappetta & Koballa, 2010). For many science topics, there are certain instructional strategies that seems promising in moving students towards more scientifically accepted ideas. Driver (1988) proposed an instructional strategy for conceptual change which leads to conceptual development of students' initial ideas toward more scientific conceptions. In this strategy the teacher begins with orientation which focuses on what to be learned; this is followed by elicitation where students are asked to present their ideas of the concept under study; then the teacher probes students to clarify their ideas; then he creates a discrepant event that causes students to see that their conceptions may be incorrect (conflict); then students are engaged in a variety of learning activities to acquire the desired conceptions (construction phase); then the teacher should evaluate students' learning; then students can apply their knowledge in a new situation; finally, the teaching experience ends by a review of what is learned by asking students to describe how there conceptions changed (as cited in Chiappetta & Koballa, 20101). Another important instructional model for inducing conceptual change is the 5 E learning model which is compromised of the following stages: Engagement: arise the interest of students, determine what they know about the topic and motivate them to learn more. Exploration: design an instructional event to give students concrete experiences with the key concepts of the topic. Explanation: encourage students to explain their finding; provide plenty of time for discussion, build from students' findings toward defining, explaining and describing the concepts that are the focus of investigation. Elaboration: give students more instructions so that they might form rich connections with what they know and what they are expected to learn; show applications of the concepts related to everyday life. Evaluation: Assess what students are learning at many points during the instruction. End the 5 phases with an assessment to measure how well students mastered the instructional objectives.

Problem of the Study

According to the study of Ayoubi (2017) there is scarcity of research done in science education: from 6545 publications, only 122 are related to science education and only 2 were addressing science in primary classes or 0.03% of the sample based on analysis of research in education in the Arab World between 2011 and 2015

.

As science educators at the Lebanese University, Faculty of Education the researchers noticed that ECE pre-service teachers do not master the science subject matter content knowledge. When pre-service ECE teachers were presenting their science related projects in the course of teaching science many misconceptions were diagnosed by the researchers. The pre-service teachers have either incorrect or wrong scientific knowledge related to major scientific concepts taught at preschool and primary school.

Student teachers enter the classroom with a range of conceptions of science as a result of their past experiences and opportunities related to science (Hassard, 1990). Science teacher educators should consider the repertoire of conceptions brought by student teachers during the training program (Aguirre, Haggerty, & Linder, 1990). The aim of this research is to investigate science misconceptions of ECE-pre service teachers, compare ECE pre-service science teachers' conceptions over the three years and propose methods for conceptual change.

Methodology

This study implemented a mixed research design where both quantitative and qualitative data were collected to investigate science misconceptions of pre service-ECE teachers enrolled at the Lebanese University, Faculty of Education.

Participants

150 pre-service ECE teachers in the Lebanese University, Faculty of Education, distributed over a three-year preparation program during the academic year 2018-2019 participated in this study. 54 participants were enrolled in the 1st year; 40 in the 2nd year and 56 in the 3rd year. In each year the students are distributed over three sections: Arabic, French and English with majority as females.

Instrument

Open-ended questions are one among the various methods used in measuring misconceptions (Tsai & Chou, 2002). In this study an open-ended questionnaire composed of 11 items was administered in order to infer science misconceptions of pre-service ECE teachers at the Lebanese University, Faculty of Education. The items of the questionnaire covered the major science concepts taught from K-3 according to the Lebanese curriculum. Seven items of the questionnaire were related to biology: open ended questions about plants' needs, importance and benefits of plants, body systems and organic food groups; a concept map to be completed about the five senses; and a schema to be drawn by participants related to pathway followed by food inside the body. Two items of the questionnaire were related to chemistry about states of matter and water cycle and another two items related to physics about mass, density and weight.

The questionnaire was first written in English and piloted on 10 pre-service teachers that did not participate in the study, then some items were adjusted based on the results. Then, the questionnaire was translated to French and Arabic by specialists in the field of science education. It was administered in the presence of at least one of the researchers of the study.

Data analysis

Students' answers were analyzed according to the criteria presented in table 1.

Table 1. Criteria of data analysis

Questions		Criteria		
	Biology questions	**Complete**	**Incomplete**	**Wrong**
1.	State the essential elements that a green plant needs for its growth.	State the four elements: H2O and minerals, CO2, Chlorophyll and light	States three or two elements out of four	State Less than two elements
2.	In your opinion, what would happen if all plants disappear?	State the three criteria (level of oxygen decreases, amount of biomass decreases and disequilibrium) that lead to death (no life)	State the three criteria without no life	None
3.	In your opinion, what is the importance of plants in our life?	The importance related to three aspects: Environmental: purifying air Economic: gives fruits, decoration, paper, petrol… Society: decorative.	Provide two aspects	None
4.	Complete the following diagram: the first row (1) with the sense and the second row (2) with the corresponding organ.	Write the five senses and their organs correctly	One sense or organ missing	More than one sense or organ is missing

5.	State the body systems	State the twelve systems	One to Four systems are missing	State less than eight systems
6.	Name the four organic food groups with one example of food for each.	Name the four organic groups: proteins, lipids, carbohydrates and vitamins	One group is missing	More than one group is missing
7.	Draw the labelled pathway (with arrows) of a piece of cake in your body starting from the mouth.	All the labelled organs of the digestive system and the absorption and the pathway presented by arrows	All the labelled organs of the digestive system and the pathway without absorption	Some labelled organs or none without pathway and/or absorption
Chemistry questions		**Complete**	**Incomplete**	**Wrong**
8.	Draw the water cycle in the box including all the processes.	All the processes are mentioned: evaporation, condensation and precipitation	One process is missing	More than one process is missing
9.	Draw the particles of water in the three states	The three drawings are correct	One is not correct	More then one is not correct
Physics questions		**Complete**	**Incomplete**	**Wrong**
10.	Why does oil float on the top of water?	The density of oil is less than the density of water	The term "density" is not used e.g Water is heavier than oil	Wrong answer
11.	What is the difference between mass and weight?	The two definitions are correct	One is not correct	None

Results and Discussion

The questionnaire administered to the 150 participants was composed of 11 open ended questions distributed over the three science subjects: biology, physics and chemistry.

Figure 1 shows the results related to biology focusing on plant needs, benefits and importance, systems of the body, the five senses, the organic groups of food, and the pathway followed by food in the body.

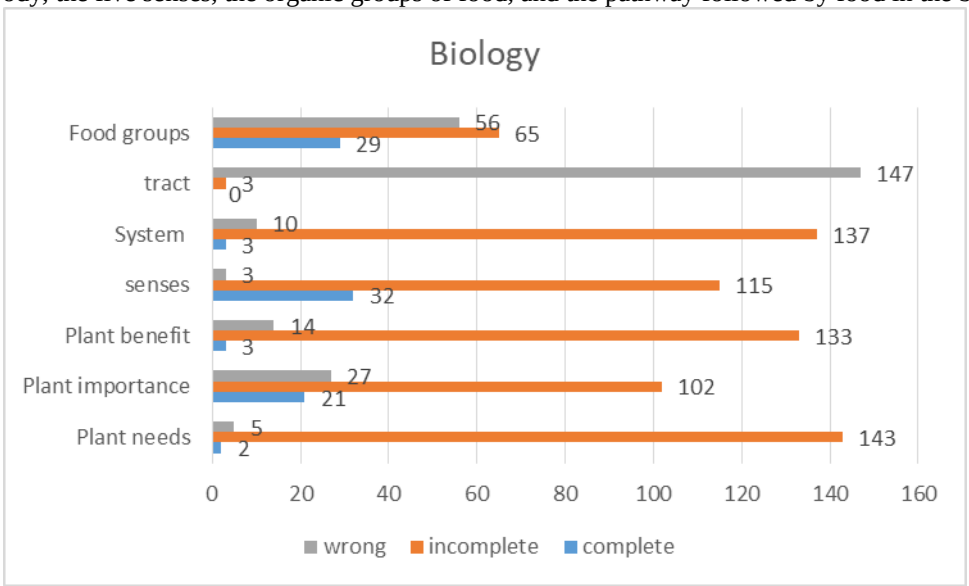

Figure 1. Answers related to biology questions

The results show that the majority of pre-service ECE teachers have incomplete or incorrect ideas related to the basic biology concepts that is taught at the kindergarten and elementary level, first cycle.

Participants were not able to identify all plant needs, only 2 out of 150 mentioned the importance of chlorophyll for green plants to manufacture their organic food. Very few mentioned minerals, others mentioned sun as the only source of light and others mentioned air without specifying CO2. Thus, we might conclude that the majority of participants have misconceptions related to needs of green plants. Based on previous research students tend to give plants human characteristics, especially when it comes to considering what plants need to grow (Abou Ali,1999). The role of light and nutrients in plant growth seems to be especially difficult for elementary students. For example, students may view sunlight as useful but not essential for plant growth. According to Giordan & De Vecchi (1990) the major students' misconception is that plants take in all the substances they need to grow from the soil.

In addition, only 14 % of the participants mentioned that without plants there is no life. The majority of the answers focused on the release of oxygen, few mentioned disequilibria in the food chain. Only 2 % mentioned the three-axis related to the benefits of green plants: the environmental, economic and social. Thus, there is a misconception related to the vital role played by green plant in nature.

Related to the five senses only 21 % answered completely and the majority have incomplete or wrong answers specifically related to the organ responsible for the sense of touch mentioning the hand or leg instead of the skin. This is a common misconception in children and obviously in adults too.

As for the systems of the body only 2 % were able to mention all the 12 systems and 91 % have incomplete answers mentioning between 3 to 6 systems maximum. The most common systems mentioned were the digestive system, the respiratory system, the circulatory system, the reproductive system, the excretory system and the nervous system. The incomplete knowledge of ECE pre-service teachers about the systems of the body might lead to misconception related to interactions between these systems to perform proper body functions.

Moreover, when the participants were asked to draw the pathway or tract followed by food inside the body most of them drew a complete continuous tube from mouth to anus without mentioning the absorption of food to the circulatory system to be distributed to all body organs. These results are consistent with study of Clement (1991) which identified 5 representations or conceptions: One continuous tube from the mouth till urination (misconception) which was very frequent; two tubes: separate digestive and urinary system (without circulatory system); only digestive system: water comes out of the anus; only urinary system; three systems: digestive circulatory and excretory systems (correct conception or scientific concept). Students think that our systems operate in isolation from each other (e.g. the circulatory, respiratory and excretory systems are not connected to each other). Moreover, some did not mention the organs, others mixed the organs of the digestive and respiratory system and few misplaced the organs (Figure 2). Again, this leads to the conclusion that pre-service teachers have misconception related to interactions between the different systems of the body. Similarly, other studies showed that science student teachers have a lack of knowledge or misconceptions in relation to the digestive system, one of the misconceptions that the student teachers have was that they drew the digestive system as a single open-ended structure which starts in the mouth and ends in the stomach in the shape of a bag. Some student teachers drew the digestive system as organs with no associations with each other (Cardak, 2015).

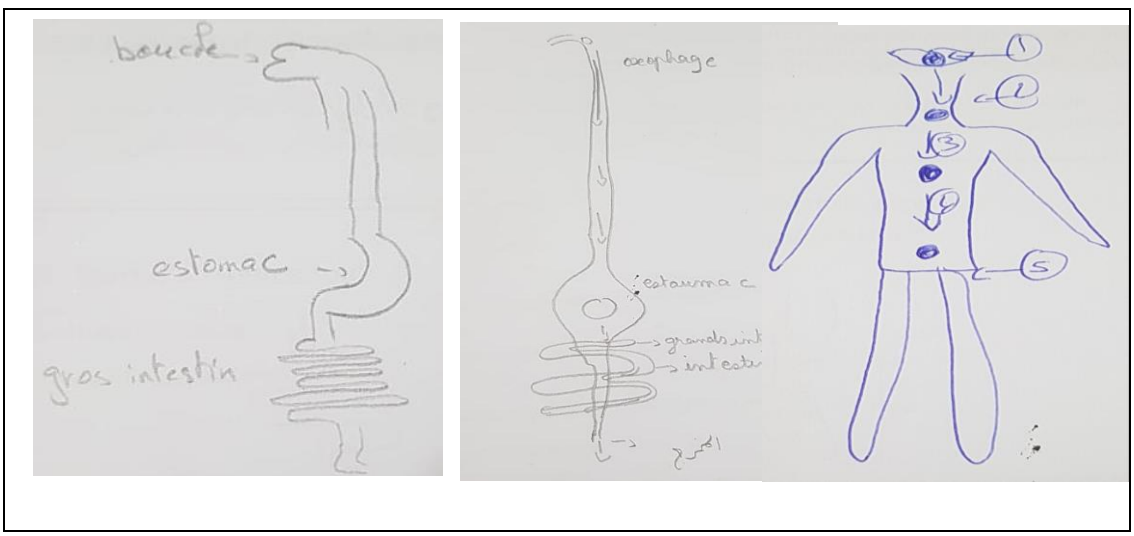

Figure 2. Misconception related to the pathway of food

Finally, only 19 % mentioned all the food groups and the majority did not mention vitamins as an organic food category, others mixed up between minerals and vitamins. This shows a misconception related to classification of food as organic and inorganic.

On the other hand, 4 questions were related to physical science subject about states of matter, water cycle, the relation between mass, weight and density. Figure 3 shows the distribution of the participants' answers related to these questions.

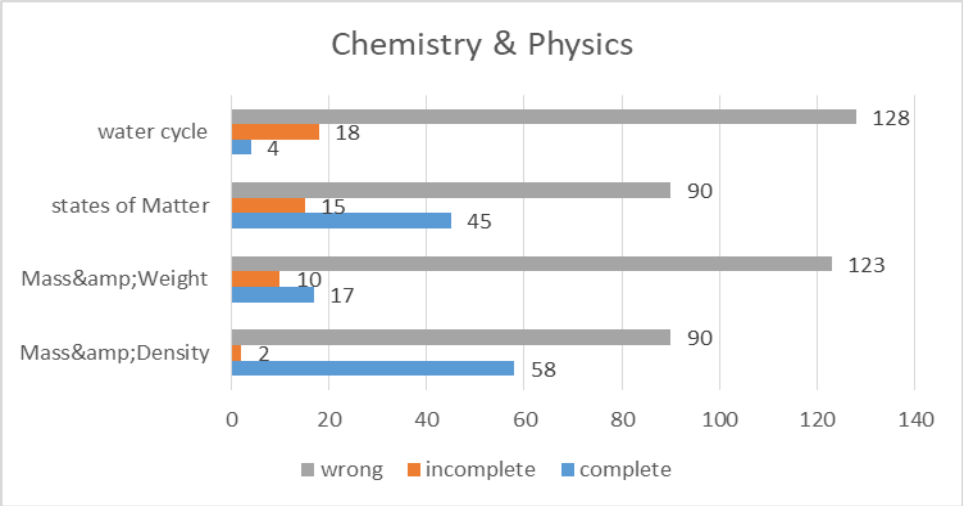

Figure 3. Answers related to physics and chemistry

60 % of the participants had wrong answers when asked why oil floats on water. The analysis of the answers showed confusion between mass and density indicating a misconception related to these physical concepts. In the literature many misconceptions related to floating and sinking were identified: a heavier object, no matter what its size or shape, could not float as easily as a lighter object; a larger, heavier object will not float as well as a smaller, lighter object made from the same material (e.g. a big block of wood and a smaller block of the same wood), an object will float higher in a bigger container of water; In order for an object to float, there must be a greater weight of water than the weight of the object; things float if they are light and sink if they are heavy.

Similarly, 82 % were confused between mass and weight, the majority were not able to define mass, few just mentioned the formula weight= mass x g. Studies show that despite the fact that mass and weight are two fundamental concepts in physics, they are not well understood by students (Gönen, 2008). Mullet and Gervais (1990) showed that the concepts of weight and mass are both understood as one concept, that of weight. Students think that mass and volume are the same and that mass and weight are the same.

In addition, the analysis of the drawings related to the states of matter showed that only 30 % were able to draw the correct figures in the three states. The majority showed a common misconception about matter with the inability to imagine the molecular level drawing ice as cube, water as liquid and gas as air (Figure 4). The misconception is that microscopic particles have the same properties as the macroscopic object they make up: ice particles melt, iron particles rust, all particles expand when heated, concrete particles are hard, cheese particles are soft etc. In congruence earlier studies showed that children have misconceptions related to solid and liquid, they think that substances that are not hard and rigid cannot be solid and particles of solid cannot move while liquid and gases are not completely made up of particles (Stavy, 1990; Stavy & Stachel, 1985).

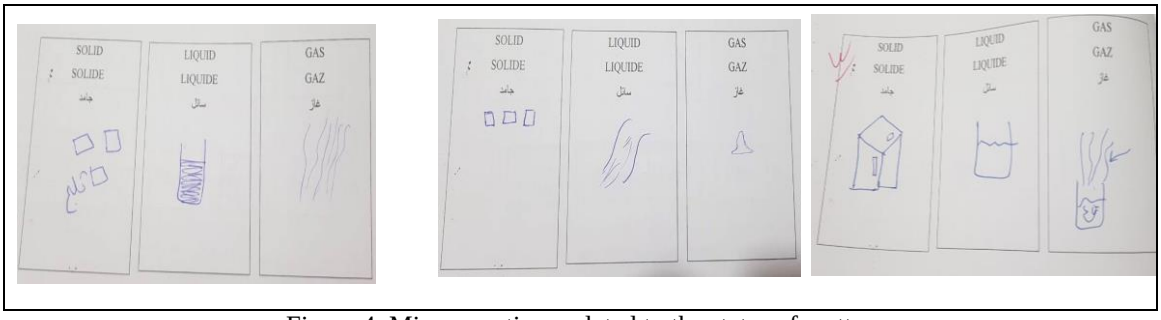

Figure 4. Misconceptions related to the states of matter

85 % of the participants were not able to draw completely and correctly the water cycle. The majority mentioned only evaporation and missed the other processes like condensation, precipitation and filtration (Figure 5). Our results are in congruence with other studies which showed that students have misconceptions related to water cycle. According to Cardak (2009) university students have misconceptions related to water cycle considering only evaporation of water from earth to the atmosphere and its return by condensation.

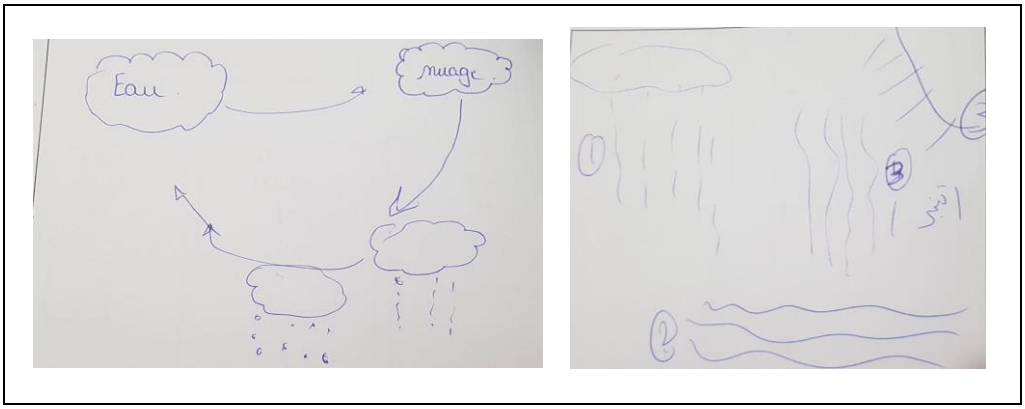

Figure 5. Misconception related to water cycle

In addition, the results related to the 11 questions were compared between the three years, table 2 shows the results related to biology and table 3 shows the results related to chemistry and physics.

Table 2. Comparison between the three years related to biology questions

Biology	Complete			Incomplete			Wrong		
	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
Plant needs	2	0	0	51	40	52	1	0	4
Plant importance	4	3	14	35	31	36	15	6	6
Plant benefit	0	3	0	50	34	49	4	3	7
Senses	8	8	16	43	32	40	3	0	0
Systems	1	0	2	49	38	50	4	2	4
Tract of food	0	0	0	2	1	0	52	39	56
Food groups	12	7	10	21	19	25	21	14	21

The analysis of the data shows approximately the same results in the three years related to plant needs, plant benefits, senses, systems and food groups. Slight difference related to importance of plants. This shows that there is no evolution in pre-service ECE teachers' conceptions over the three years of the preparation program implemented at the Faculty of Education at the Lebanese university. Thus, the courses related to science taken by pre-service teacher over the three years did not lead to any conceptual change related to major biology concepts taught at the classes that they are supposed to teach (K-3) after they graduate.

Table 3. Comparison between the three years related to physics and chemistry questions

Physics & chemistry	Complete			Incomplete			Wrong		
	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
Mass & Density	21	17	20	2	0	0	31	23	36
Mass& Weight	5	0	12	5	1	4	44	39	40
States of Matter	11	18	16	2	4	9	41	18	31
Water cycle	1	1	2	6	5	7	47	34	47

Similarly, the data presented in table 3 show approximately the same results in the three years related mass and density, mass and weight and water cycle. Slight difference related to states of matter. Thus, the same can be concluded related to misconception in major physical science concepts that persisted through the three years of the preparation program.

Conclusion and Recommendations

Our study aimed to investigate science misconception among pre-service ECE teachers following a three years preparation program at the Lebanese University, Faculty of Education. The results identified many misconceptions related to basic science concepts taught in KG and cycle 1 (K-3) in the Lebanese curriculum. Moreover, the misconceptions were common among pre-service ECE teachers throughout the three-year preparation program. Thus, our study highlights a major gap in the ECE preparation program at the Lebanese University related to science conceptual understanding. The direct and indirect science courses taken did not lead to any conceptual change among ECE pre-service teachers. Therefore, we recommend adding more courses related to science and teaching for conceptual change. This is consistent with the study of Liang (2009) which recommended courses involving children's science education in pre-service ECE teachers' preparation programs. Similarly, the study done at the Lebanese University, Faculty of Education, by El Takach (2018) emphasized on the need for adding more science courses for ECE teachers related to the nature and history of science. According to many researches, science may be a particularly important domain in early childhood, serving not only to build a basis for future scientific understanding but also to build important skills and attitudes for learning. To fill this gap, we highly recommend the implementation of new teaching strategies like 5 E model for conceptual change that is to make conceptions change or evolve towards real scientific concepts. According to the study performed by Shaaban & Abou Ali (2018) the implementation of inquiry-based teaching methodologies integrating technology during a training program for in service biology secondary teachers enhanced their scientific knowledge and skills. Similarly, the study of Sarabando, Cravino & Soares (2016) showed that the use of computer simulation helped the students to understand the concepts of weight and mass.

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Author Information

Eman Shaaban
Lebanese University, Faculty of Education
Beirut / Lebanon
Contact E-mail: eman_shaaban19@hotmail.com

Imane Abou Ali
Lebanese University, Faculty of Education
Beirut / Lebanon

Hanadi Chatila
Lebanese University, Faculty of Education
Beirut / Lebanon

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Quality of Life at Patients with Malignancies

Zhaklina TRAJKOVSKA-ANCHEVSKA
PHI University clinic for Hematology

Ivan TRAJKOV
Ss. Cyril and Methodius University in Skopje

Abstract: The subject of this research is the quality of life at patients with Myeloma Multiplex at diagnosis and during therapy within 6 to 12 months. The research aims to analyze patients to be able to continue activities which will contribute for improving their quality of life as a priority task for patient, his family, health institutions and social environment. This research was conducted at the University Clinic for Hematology, period from 2009 to 2012. It covers patients with multiple myeloma. Total of 80 patients, using the EORTC QLQ C30 ver. 3.0 standardized questionnaires for quality of life that analyzed the physical, cognitive, emotional, personal and social functions related to the patients. It also analyzed and general health and quality of life. Physical functioning at diagnosis is 27.5 during treatment 59.5, significantly improved. Personal functioning at patients at the diagnosis is 17.9, during therapy -36.4. Emotional functioning at patients at diagnosis is 39.9, during the therapy over 73.3. Cognitive functioning was at diagnosis 55.2, during treatment 72.5. Social functioning was 26.2 at the diagnosis; during the treatment 50.8. Financial difficulties were at diagnosis's 76.2 and 72.5 during treatment. Overall health and quality of life has a value of 23.9, and during therapy 58.8.Quality of life at patients with myeloma multiplex was significantly improved as a result of on time diagnosis and treatment with modern medicaments and the role of social worker with the application of certain social skills, continuous counseling, guidance and education for their reintegration in the community.

Keywords: Quality of life, Patient, Health

Introduction

The quality of life is defined as the perception of the individual for his own position in life in the context of the culture and the system of values in which he lives, and as well as according to his goals, expectations, standards and interests that hi will archive. It is a wide concept that constitutes the physical health of the individual, psychological status, material independence, social relations and their significant relationships and characteristics with the external environment. (WHO, 1995).

In scientific literature we come across a different understanding of the concept of quality life. There are also several theories and standardized questionnaires for its measurement, but there is still no harmonization of the definition or a universally accepted standards for its measurement.

The models and definitions of quality of life differ between themselves in their psychological aspects, which is the different considerations of individuals. However, although there are individual views, the establishment of a unique terminology for achieving uniformity in scientific research and the application of quality-of-life models in practice is further consistently pursued. It is based on a detailed assessment of the similarities and differences within values, considerations, and behavior for what quality of life means. According to the European Quality of Life Surveys methodology, there are four components for life satisfaction: access to material resources, social support, social affiliation and work difficulties (work complexity).

The first component is directly related to the economic sphere, which is the quality level of the organization's system, while the other components have a social category, and the fourth is being related to the living standard or the need for additional professional engagement.

The quality of life is a concept that includes the emotional, physical, mental, behavioral, and social components, a sense of total satisfaction from life, based on the mental readiness of the individual whose life is valued. The quality of life is a multi-layered structure system that encompasses the behavior and cognitive capacity of the individual, the emotional well-being and the abilities needed to achieve the family, professional and social role.

There are objective versus subjective indicators of quality of life and it has been shown that objective measures (socioeconomic status assessment) are not sufficient for an explanation of the quality of life, and therefore it is necessary to include the subjective assessment. Objective measures are normative indicators for reality, while subjective ones indicate the differences of the individual in the observing and experiencing the real living conditions. If the basic needs of the individual are met, the increase in material goods does not have a significant impact on the subjective measure of quality of life. On the other hand, these indicators fail to measure how people perceive their own lives and therefore the conclusion cannot be given solely based on objective indicators. A certain level of satisfaction of living needs that is considered as necessary but not enough for quality living conditions.

There are many different approaches for measuring the quality of life. Hence, from the way it is measured, the definition depends and what is measured also. Depending on the objectives and the subject, research on measuring or assessing the quality of life can be quite different. The assessment is developed based and depending on the methodological approach of different disciplines in the context of their objective and philosophical views.

Today there is a whole industry that deals with measuring the quality of life, in the literature it is said that there are about 1200 different assessment instruments, especially in the last 20 years. Although they are numerous, they can be divided into specific in terms of disease, generic, individual, and others. Regardless of which instruments are applied, they should contain levels that will explain the objective state of operation and the subjective nature. Quality of life is associated with modern medicine from the bio psychosocial aspect because it provides ethical progress in the methods of clinical evaluation. It is based on the health care, including medical care and promotion of health, the subjective well-being of the individual or group, the impact of disability and mental health on the quality of life. Reforms of the social and health care system, especially in the Western countries, lead to an increase in the needs of the individual, and the use of quality of life as an indicator of the satisfaction of the services.

The quality of life in the context of health implies functional ability, degree and quality of social interaction, psychological balance, somatic sensations, or satisfaction in life. In conditions of living and good health, a person is able to maintain the subjective quality of life, which is adaptive and functional, but in situations where there is a negative impact on the functioning of the individual, there is a disturbance of the homeostasis and a declining in the quality of life.

Measuring the quality of life related to health is based on health questionnaires that have their own characteristics, formulated and standardized with a specific scientific methodology.

Medical advances allow the application of a variety of targeted therapeutic approaches to the treatment of malignant diseases, which are basically characterized by long-term treatment of the patient, frequent hospitalization, complications that are symptomatic of various organ systems. It should be noted that today's therapy results in these patients report prolonging the survival time and improving the quality of life. This fact directs the interest not only in the effectiveness of the methods and the treatment, but also on the bio psychosocial factors in the treatment of diseases and living with the malignant nature of the disease.

Data reporting on the success achieved in the treatment of malignant diseases, beside the different therapeutic approaches, have a common feature that connects all patients, which is the timely diagnosis of malignant disease. The best results of therapy and the highest patient survival rates are achieved only in a situation of early detection of malignant disease and early onset (starting) of treatment.

The focus of this paper is hematological malignancies that disrupt the function of the hematopoietic system, which can lead to the emergence of multisystem symptomatology, which is often fatal for the patient. Hematological diseases are 9.5% of the total number of malignant diseases at the human population. Multiple

myeloma is a malignant hematological disease and belongs to the group of lymph proliferative disorders. Multiple myeloma represents about 1% of all malignant diseases and over 10% of total malignant hematological diseases. The incidence of this disease is about 3 cases per 100,000 inhabitants per year. The etiology of this disease is unknown. Causes can be multifactorial. Multiple myeloma manifests itself most often at the age of 50 to 70 years, with a peak incidence in the seventh decade of life, slightly more in the male population. Modern statistics show an increase in the incidence of this disease at younger age groups. Although MM is a bone marrow disease in which pathological plasmocytes are proliferated, the clinical picture of this disease in the diagnosis may be different, depending on the stage of the disease and the disorders caused by the disease.

The most common symptom of the diagnosis is pain localized in the chest and back, very rarely in the bones of the limbs. The pain is emphasized by the movement, which is due to the lytic changes, primarily in the splenic bones.

Initially, the pain is "rheumatic" and has a migratory character; it can be strong in a certain time frame or followed by long painless periods, with progression to be constant and very pronounced. There are other symptoms that are considered as major criteria in the diagnosis of this disease.

For this reason, one of the main objectives of the health systems in many countries should be the programs for the prevention of these diseases, the screening programs for the at-risk populations defined by modern research for epidemiology, the incidence and prevalence of malignant diseases.

Working methods

The following methods are used in this research:
- Descriptive method
- Comparative method
- Analytical-explicit method

The descriptive method is applied in the analysis of the patient's medical documentation, which enables us to describe and determine the health status of patients with MM at the beginning and during treatment. Based on this method, we came to knowledge of the health condition of patients with MM, based on the results contained in the health records.

The comparative method allowed us to examine and determine the health status of patients with MM at the beginning of the treatment and during treatment, and at the same time to determine the similarities and differences in their quality of life.

We used the analytical-explicative method in order to analyze, explain and present the theoretical basis of the problem that we are investigating which works with the purpose of the research.

Sample of the survey

In this study, 80 patients with malignant hematological disease- myeloma multiplex were analyzed. In this study we have a quota sample. With a quota sample, 80 patients with MM who have been diagnosed and treated have been selected at the PHI University Clinic for Hematology - Skopje.

Research instruments

In accordance with the research techniques in this paper, the following instruments were applied:
Standardized questionnaire for interviewing patients with MM with an assessment scale and record lists of medical documentation for recording data on the health condition of patients with MM. The instruments are intended for patients with MM who are treated at the PHI University Clinic for Hematology in Skopje.

The EORTC QLQ C30 questionnaire of the European Organization for Research and Treatment of Cancer (the section on quality of life research) has been translated and validated in 81 languages and has been used in more than 3,000 studies worldwide.

Today, all new research uses version 3.0 (EORTC QLQ-C30 version 3.0), which is applied in this research. The questionnaire contains specific models' parts for specific malignant diseases. The questionnaire contains closed-type questions with previous assertions (not at all, a little, often and more often) from one to four (1-4), and the respondents having the task of declaring one of these four claims in accordance with their views and considerations. The questions are related to their physical activity, emotional, cognitive, family, social and financial conditions, as well as the impact of therapy on their quality of life. The questionnaire is divided into 5 categories. The introductory part of the questionnaire contains the following general data: sex, age, place of residence (city, village), education level, marital status, working status (employees, unemployed, and pensioners), income (salary, no, and help from a third person). In the second category are the functional abilities: physical functioning, emotional, cognitive, social functioning. The third categories cover issues related to the symptoms associated with the disease and are the result of the impact of the therapy. The fourth category refers to the financial difficulties of patients. The fifth category provides data on the general health and quality of life. The general health and quality of life at the beginning and during treatment were measured with the scale of assessment where patient had a task of ranking the response from 1 to 7 (from very poor to excellent).

Results and Discussion

Regarding the distribution of patients by age, larger part, that is, 33.75% are classified in the group from 51-60 years, while 27.5% in the age group 61-70 years. The analysis of the demographic characteristics group of patients in this paper showed that the majority, that is, 80% live in an urban environment, while 20% live in a rural environment. The research group of patients, 53% are pensioners, 23% are employed and 16% unemployed.

At diagnosing - Problems with physical functioning were "more often" in 58.3% of the respondents, while "often" in 15% of the respondents. The patient response rates range from 0 to 86.7. The level of physical functioning of the respondents is 27.5, which represents a low level of physical functioning.

During the treatment- therapy - problems with physical functioning were "more often" in 18.3% of the respondents, while "often" in 22.8% of the respondents. The patient response rates range from 13.33 to 100. The level of physical functioning of the patients is 59.5, which represents the intermediate level of physical functioning. At diagnosing - Problems with personal functioning were "more often" in 70.0% of the respondents, while "often" in 13.3% of the respondents. The level of personal functioning of the respondents is with a value of 17.91, which represents a low level of personal functioning.

During the treatment – Problems with personal functioning were "more often" at 40.0% of the respondents, and "often" in 22.5% of the respondents. The level of personal functioning of the respondents is 36.46, which represents a low level of personal functioning. At diagnosis – Problems with emotional functioning were "more often" at 34.4% of the respondents and "often" in 18.1% of the respondents. The level of emotional functioning among the examinees was with a value of 39.91, which represents a low level of emotional functioning.

During treatment - Problems with emotional functioning were "more often" in 3.8% of the respondents, while "often" in 12.8% of the respondents. The patient response rates range from 13.33 to 100. The level of emotional functioning of the patients is 73.34, which represents a high level of emotional functioning. At diagnosing - 19.4% of respondents had problems with cognitive function "more often", while "often" at 20% of respondents. The level of cognitive functioning of the examinees is with a value of 55.21, which shows an intermediate level of cognitive functioning.

During therapy - Problems with cognitive function "more often" are absent among the examinees, while "often" in 25% of the examinees. The patient response rates range from 33.33 to 100. The level of cognitive functioning of the subjects is 72.5, indicating a high level of cognitive function. At diagnosing - Problems with social functioning were "more often" in 49.4% of the respondents, while "often" in 23.8% of the respondents. The level of social functioning among the respondents is with a value of 26.25, which represents a low level of social functioning.

During the treatment - 12.5% of the respondents had problems with social functioning "more often", while "often" at 31.9% of the respondents. The values of patient responses range from 0 to 100. The level of social functioning of the respondents is 50.83, which represents an intermediate level of social functioning.

The symptom group includes those symptom's that appears as a direct consequence of the disease and its destructive effects on the rest of the organic systems, or if after the treatment with chemotherapy appear as side effects of the used medicaments.

In the analysis of non-specific symptoms (fatigue, loss of appetite) that can certainly be considered like determinants that contribute to disorder the quality of life at patients, a significant improvement is confirmed in the direction of reducing the level of their expression, which also leads into improving the social functioning of patients and the occurrence of a subjective feeling of improved health. This altered and improved condition is observed in the larger group of patients under analysis when assessing the characteristics of their quality of life. The extent of the therapeutic response achieved leads to a proportional dependence on the elimination of the severity of these symptoms.

From the investigated group of patients in the category of financial difficulties, there was no significant difference, following them from the beginning at diagnosis and during the treatment. The general health and quality of life of this researched group of patients are very difficult to describe numerically. The attitudes and considerations of the patients made it easier to assess the characteristics of their disease. However, although a multidimensional approach to data analysis is applied, it is clear that these components represent a synthesis of the full evaluation of the health status, including parameters that define the disease and the quality of life parameters of the researched group of patients with multiple myeloma.

Conclusion

According to the results of the research, the general hypothesis confirms that the quality of life changes from the period of diagnosis of the disease, during the treatment and in the further course of the disease. Specific hypotheses have been confirmed with a significant difference in the physical, emotional, personal and social functioning of patients with MM during diagnosis and during therapy for a period of 6 to 12 months, as well as the application of appropriate therapy that changes the quality of life.

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Author Information

Ivan Trajkov
Ss. Cyril and Methodius University in Skopje,
Faculty of Philosophy
Blvd. Goce Delcev no. 9, Skopje
Contact E-mail: *ivantrajkov@hotmail.com*

Zhaklina Trajkovska-Anchevska
PHI University clinic for Hematology-Skopje
Blvd. Majka Tereza no. 17, Skopje

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Lebanese Biology Teachers Perceptions and Practice of Conceptual Integration

Hanadi CHATILA
Lebanese University

Abstract: This paper investigates Lebanese high school biology teachers' perceptions and practice of Conceptual Integration among different science subject areas in the biology class. Fifty Lebanese in-service high school teachers completed a questionnaire about their perceptions of conceptual integration. Then, ten of them participated in a focus group to discuss the implementation of Conceptual Integration through an activity presented in the grade 10 biology program. The findings show that although teachers acknowledge the importance of integrating physics and chemistry in their biology teaching, they avoid implementing Conceptual Integration. In addition, they lack the right knowledge about what Conceptual Integration is and how to approach it in their practice. The study shed the light on the urge to revisit the teacher education program at the Faculty of Education at the Lebanese University, at the pedagogical level to include Conceptual Integration as a main strategy to teach Sciences and at the content knowledge level to highlight the one paradigm of science that includes various science disciplines sharing the same features of the "nature of Science".

Keywords: Conceptual integration, Biology education, Teacher education

Introduction

Shulman (1987) highlighted seven basics categories for teaching knowledge that include: subject matter knowledge (SMK), pedagogical content knowledge (PCK), curricular knowledge, general pedagogical knowledge, knowledge of the learners and their characteristics, knowledge of educational contexts and knowledge of educational purposes. In science education, subject matter knowledge is defined as the knowledge of both specific topics of the curriculum and the epistemology of science and the nature of scientific knowledge (Mizzi, 2013).

In this context, Lederman (2013) stated that science is a paradigm and scientists should perceive science as a complete body of knowledge. Thus, there is integration among the different scientific subject areas since they share the same epistemology and nature of knowledge, and, therefore, the integration of those different areas in the teaching and learning of any related discipline is a must for meaningful learning.

In the constructivist approach, students interpret the new knowledge according to what they already know, and the nature and the level of the new knowledge integration depends on their existing knowledge. So, meaningful learning can effectively build their knowledge structures (Ausubel, 2012; Tuysuz, Bektas, Geban, Ozturk& Yalvac, 2016) to reach a conceptual integration among different disciplines involved in their learning (DiSessa, 1993; Matthews, 1993).

Theoretical Framework and Literature Review

Conceptual Integration

Conceptual Integration proposed by Fauconnier and Turner (2002) can be defined as the learners' capability to use their pre-requisite knowledge or concepts in a certain science subject whilst they are learning a concept or topic in another science subject (Taber, 2008). It offers insight into our way of thinking, creating and

understanding the world around us (Fauconnier & Turner, 2002). Taber (2005) considers Conceptual Integration as the learner knowledge structures which are organized to allow connections between different areas.

Conceptual Integration has become an area of interest in science education. Research studies have highlighted its importance since it is necessary for meaningful learning (Taber, 2005; 2008) and for overcoming misconceptions (Ganaras, Duman & Larcher, 2008).

In science teaching and learning, Conceptual Integration can be achieved among different areas of science only when learners have the adequate prior knowledge and the learning process that promote meaningful learning (DiSessa, 1993; Matthews, 1993; Taber, 2005). In addition, Conceptual Integration is believed to be important and necessary for the development of scientific literacy in science learning (Lederman, 2013; Tuysuz et al., 2016).

In this context, Conceptual Integration can be considered as the method employed by scientists. Science is expected to produce a large coherent and internal consistent body of knowledge distributed over different subject areas that may be represented by a single framework. Therefore, when scientists face a problem, they investigate the whole scientific paradigm rather than examine only one area or one discipline in order to reach and generate their conclusions (Chalmers, 1999; Lederman, 2013).

Moreover, the nature of scientific knowledge that involves an ongoing empirical research producing contradictory results to the general paradigm should not affect that coherence and internal consistency because any anomaly should be investigated and explained (Taber, 2005; 2008).

In his turn, Novak (2011) considered Conceptual Integration as essential for meaningful conceptual understanding in science. Since all scientific concepts are interrelated, topics should not be taught separately. Thus, we cannot think about each concept separately, and therefore an integrated science curriculum has become necessary to meaningful efficient learning.

Research studies around the world have identified limited connections among content elements in both students' knowledge and curricula. Accordingly, multiple countries have reformed their science curricula and sought the implementation of curriculum integration, e.g. Next Generation Science Standards NGSS (2013) reform, in an attempt to achieve meaningful learning to include disciplinary core concepts and interdisciplinary ones as a means to establish connections among science contents. The principal goal is to enable students to develop a well-connected science understanding (Opitz, Neumann, Bernholt, & Harms, 2017).

Conceptual Integration affects not only the conceptual understanding of scientific concepts but also the learners' epistemic and epistemological beliefs. Learning is not separated from the learners' beliefs about the nature of knowledge. In fact, in a given learning situation students tend to anticipate through their epistemic beliefs the "what" to be learned and the "how" to deal with that learning situation (Bromme, Piesch & Stahl, 2010). The epistemological beliefs in science refer to the learners' understanding of a concept or theory, to how it is built up, including their knowledge about the process of knowing about scientific knowledge. So, those beliefs may affect the learners' scientific skills development such as decision making and problem-solving (Hofer, 2001).

As the Conceptual Integration involves combining different topics areas or disciplines, it helps students act like scientists. For example, when teachers teach a certain advanced concept in biology, they should use more basics ideas and fundamental concepts taken in biology, physics or chemistry topics to reach a more meaningful learning.

The literature on science education has mainly focused on teaching strategies and students' conceptual understanding of a content area; however, little research has investigated Conceptual Integration, especially for middle and high school science teaching and learning (Tuysuz et al., 2016). Research studies on Conceptual Integration research studies are mainly directed towards the understanding of concepts at college and university levels, and these studies often deal with specific Physics and chemistry concepts.

The Lebanese Curriculum

In the Lebanese schooling system, biology is taught separately from other science disciplines (chemistry and physics) at both the intermediate and secondary levels. It is taught under the name of Earth and Life Sciences from grade seven up to grade nine, and in the secondary level it is taught differently across grades under the

titles of "Life Sciences" to Life Science Baccalaureate students and "Scientific Literacy" to Socio-Economic Baccalaureate students.

Although the Lebanese curriculum (1997) is not a competence-based curriculum ,it highlights the integration among different disciplines in its general and specific objectives.

The Lebanese Science curriculum is rich in content, details and concepts with a great emphasis on knowledge and skills. Students should learn through exploring, investigating and describing their experiences in order to achieve meaningful learning (Chatila & Al Husseiny, 2017).

Through their objectives, the Lebanese Biology curricula (1997) enable students to explore the integration of disciplines. For example, one of the objectives the Life and Earth Sciences curriculum is to "Permit the students to identify integrated domains within different disciplines and be able to transfer them to different fields."

Research Problem

Being a science educator investigating both the pre and in-service teacher development programs of biology teachers at the Faculty of Education at the Lebanese University, the researcher has noticed that Conceptual Integration in Biology is not well approached by biology teachers.

A thorough review of the literature shows that Conceptual Integration has not been investigated in the general Lebanese educational school system, especially in Science and Biology.

The current study investigates Biology teachers' perceptions and practice of Conceptual Integration in biology classes and addresses the following questions:

1- What are the in-service Lebanese biology teachers' views about the conceptual integration of biology and physics and/or chemistry?
2- Do biology teachers promote Conceptual Integration in their teaching?
3- What are the barriers to Conceptual Integration?

Method

The study consists of two main parts: The first part of the study is designed to investigate Lebanese biology teachers' perceptions of Conceptual Integration. An open-ended questionnaire was administered to 50 Lebanese high school in-service biology teachers who have at least two years of teaching experience in order to investigate their views about Conceptual Integration. The questionnaire includes five questions:

1- Do you integrate physics/chemistry concepts in your teaching?
   - If yes, explain how and give an example.
   - If not, explain why you don't.
2- Do you have any difficulties in teaching about topics where the conceptual integration can be realized? If yes, state those difficulties.
3- Do you use different instructional strategies/methods while teaching about topics where Conceptual Integration is required?
4- Do you cooperate with physics/chemistry teachers when needed? If yes, explain how.
5- Do you investigate the conceptual integration while preparing your lesson by
   i- checking the curriculum to find out the level of integration?
   ii- asking physics/chemistry teachers?

In the second part of the study the researcher further investigates the teachers' perceptions and their practice of Conceptual Integration in Biology in a focus group in which ten Lebanese Grade Ten biology in-service teachers explain a biology concept.

A focus group discussion is a qualitative approach technique where a group of individuals discuss a specific topic, concept or idea in order to gain a thorough and deep understanding of issue in question (O.nyumba, Wilson, Derrick & Mukherjee, 2018).

The researcher selected the biology concept of "transport and upward movement of crude sap in plant" as an example in the focus group discussion. The concept, which is presented in the Grade Ten Life Sciences national textbook in the second chapter as 'Activity 2' (p36-37), was selected as one of the concepts that requires integration of a physics fundamental concept.

The focus group aimed to discuss the following questions with the teachers:

1- How would they explain Activity 2 in order to know how they
   i- perceive the word "pressure"
   ii- connect physics and biology?
2- Does the activity present all the required information for a meaningful understanding of the concept.

The ten participants were selected from the sample of teachers who had participated in the first part of the study based on their motivation and availability. They teach Biology in English, have a minimum of five years of teaching experience, and hold a Bachelor's Degree in Biology from the Faculty of Sciences as well as a Master's Degree in Science Education-Teaching Biology from the Faculty of Education from the Lebanese University. Data was collected and analysed to answer the research questions.

Crude Sap Transportation

Crude sap is a mixture of water and dissolved minerals that is absorbed by the root and moves upwards through the xylem of the plant. The conduction of crude sap upward the plant via the xylem is subject to root pressure caused by osmosis, transpiration and physical forces, namely cohesion and adhesion forces.

Root pressure

It is the result of osmosis. (Water enters the plant through its root by osmosis. It is the passage of water from the low salt concentration medium to the high salt concentration medium through the cell membrane to make the salt concentration equal). Since the root is higher in salt concentration than the salt, water flows from the soil to the roots, knowing that the root does not allow the passive movement of the salt across the root cell membrane. However, it does allow water, minerals and small organic compounds to pass from the soil to the plant passively. And when the salt concentration inside the root becomes too low, the cell membrane actively transports salts into the root.

Transpiration

It takes place when the plant loses water through the leaf surface primarily from the stomata, or pores in the surface of the leaf used for respiration and photosynthesis. Warm weather and the wind increase the transpiration rate, and consequently the plant draws more water from the roots, which, in turn, take up more water from the soil.

However, the transpiration rate decreases with humidity since evaporation occurs more slowly, which decreases water absorption from the root.

Cohesion and Adhesion forces

Those forces are known as capillary action. They involve the diameter of the xylem and the chemical properties of water. Cohesion force is caused by the hydrogen bond between the molecules of water, as they have a strong attraction to each other causing the molecules to stick together. Cohesion force occurs when the molecules of water adhere to the surface of the xylem.

As the plant transpires, it draws water up through the xylem. Every time a water molecule evaporates, another water molecule is pulled up through the xylem. Through the effect of the adhesion force between the water molecule and the side of the xylem, water molecules overcome the force of gravitation and move up instead of falling back down through a process called capillary action. Therefore, both cohesion and adhesion forces create such a strong attraction that capillary action pushes water to the top end of the tallest trees.

It obvious that the biological concept of crude sap transportation requires the conceptual integration of both the physical concept of pressure and the chemical concept of cohesion and adhesion forces (Plant – Absorption, Conduction, Rise of Cell Sap & Transportation, 2015).

Crude Sap Transportation in the Lebanese Grade Ten Life Sciences textbook

The concept of crude sap transport and movement is presented in grade ten Life Sciences national textbook in the second chapter as 'Activity 2' (p36-37).

The introduction of the activity, as shown in figure 1, proposes two questions about the crude sap transportation: "How can you prove this transportation?" and "what are the mechanisms that permit the moving sap to ascend?

In this study the researcher is interested in the second question where the conceptual integration is identified. The mechanism of the upward movement of the crude sap is presented in "Doc. e", "Doc. f" and "Doc. g" found on page 37, as shown in figure 2.

By analysing the two documents presented in figures 1 and 2, we notice that:

1- "Doc. e" and "Doc. f" present evidence of root pressure without explaining where this pressure is coming from. There is no mentioning of "osmosis", which causes the accumulation of water in the root, in turn, causing the pressure.
2- "Doc. g" discusses the capillarity action and relates absorption to transpiration. However, the textbook only mentions "cohesion forces", denying the presence of "adhesion forces", knowing that capillarity action requires both forces to allow the upward movement of water.

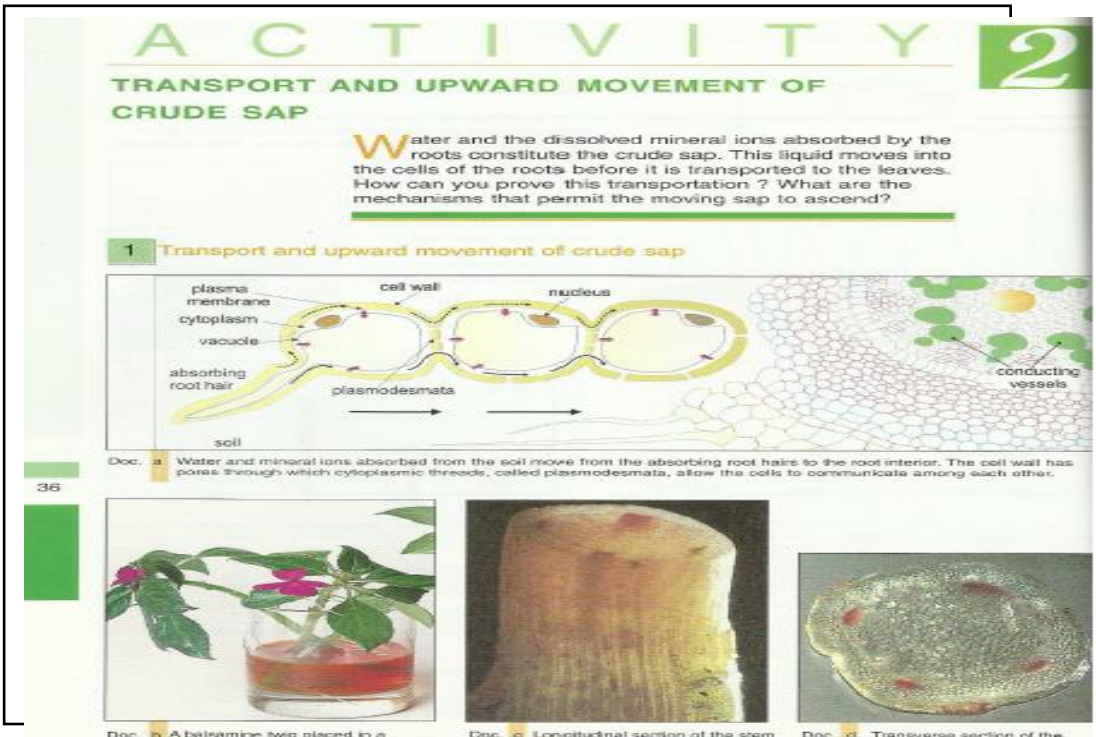

Figure 1.Activity 2, page 36. Life and Earth Sciences, Basic Education, 10th grade, National Textbook (1998)

Therefore, the activity presented in the textbook is descriptive in nature, does not target the cause of the mechanisms and is missing some major information. However, in order to understand the concept of crude sap ascendant movement, the student must have a sound understanding about

- root pressure origin, which originates from the transportation of water from the soil to root due to difference of concentration and to the semi-permeable nature of the root cell membrane.
- capillarity action, including the origin and function of cohesion and adhesion forces.
- Transpiration

Therefore, in order to be able to apply Conceptual Integration, students must know about "osmosis" from Biology and "pressure" and "Capillarity: Cohesion and Adhesion forces" from Physics.

By referring to the Biology and Physics Lebanese curricula, the researcher has found that the two concepts of "osmosis" and "capillarity: adhesion and cohesion forces" are not present in the high school science curriculum. So, they do not represent pre-requisite knowledge for students. Only the concept of "pressure" is present in the grade 9 physics program and represents prior knowledge for grade 10 students.

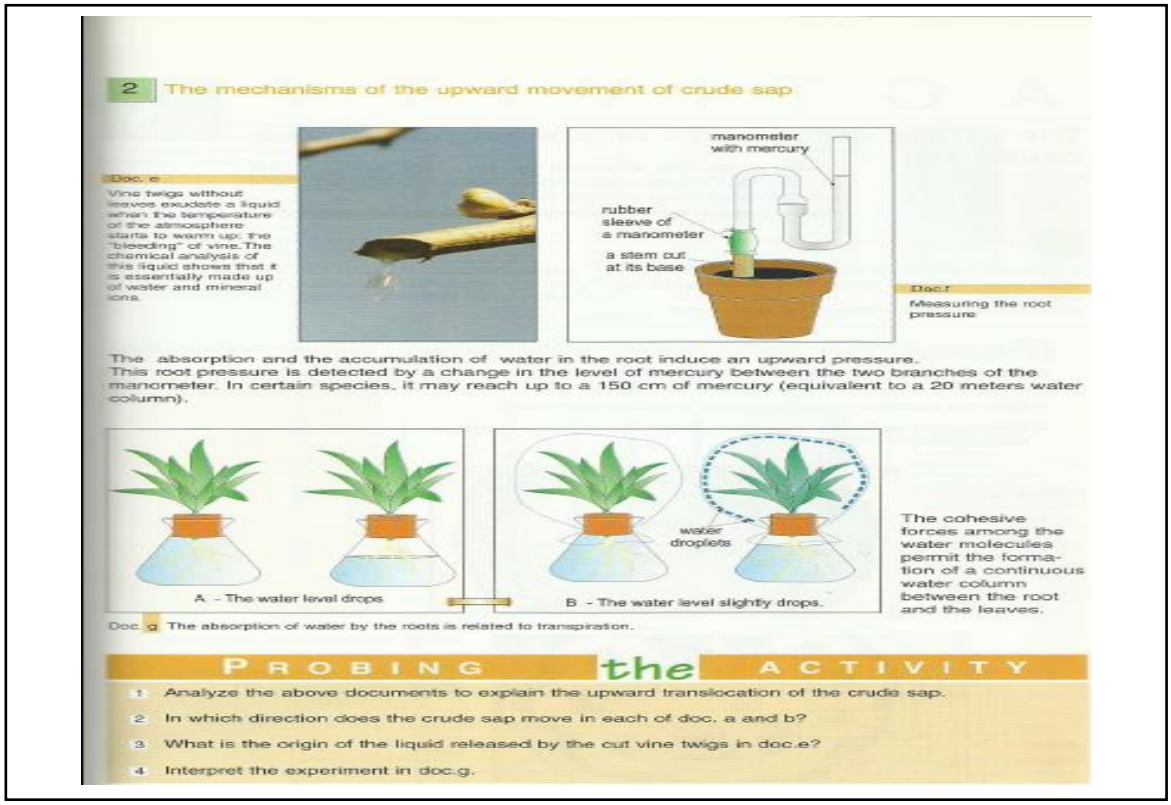

Figure 2. Activity 2, page 37. *Life and Earth Sciences*, Basic Education, 10th grade, National textbook (1998)

Results and Discussion

Questionnaire

Regarding the first question about integrating physics and chemistry in biology, all participants responded that they do integrate other science topics in their teaching, and that they provide many examples from the Lebanese Biology curriculum. For instance, electricity is integrated in the nervous system and organic chemistry in photosynthesis.

The second question addresses the difficulties the teachers face in integrating concepts from physics or chemistry. Only 16 out of 50 participants (32%) stated that they have some difficulties. According to their answers those difficulties may be caused by:

- The curriculum: The absence of pre-requisite knowledge that is mainly due to the curriculum. Many concepts required for integration are barely, if ever, taught, with makes it difficult for biology teachers to integrate them in their teaching. Some teachers' responses follow below:

  "Sometimes physics and chemistry concepts are not known by students."
  "Weak pre-exquisite form difficulties in instructing topics."
  "The complete absence of knowledge about the integrated concept in the curriculum, and the lack of this concept across other subjects."
  "Usually students not having the needed pre-requisite or being unable to understand the physics or chemistry ideas for lacking basic information or not really understanding those subjects."
  "Student pre-requisite is approximatively null or weak in physics concepts mainly those integrated in neurology."

"Maybe when the concept isn't yet explained by the chemistry or physics teacher. Therefore, it will consume more time to explain it. Also, we might need more teaching strategies to make it easier and simpler."

- Students' misconceptions: Participating teachers reported that students usually have many misconceptions regarding physics and chemistry concepts. Those misconceptions are often due to the nature of the abstract concepts and the teaching strategies used by physics and chemistry teachers, which only renders integration difficult and requires the biology teacher to explain the related concepts to ensure that integration is well achieved.

  "Students misconceptions and their forgetting of main concepts."
  "Sometimes I face problems with students because they have misconceptions in many concepts."
- Another factor that, according to the teachers, may lead to difficulty in applying conceptual integration is students' attitudes towards science in general, and their perceptions about science topic areas. One teacher stated

  "Because some students are not involved or interested in biology"

  These teachers highlight the idea that students perceive science as separate disciplines, and that students can't connect between them. This factor may be due to the curriculum that lacks the main part of epistemology and nature of science.

  In addition, the participating teachers mentioned that students sometimes have negative attitudes towards physics and chemistry, which makes it hard for them to work on Conceptual Integration.

  "Students often think that chemistry and physics, as physical sciences, are largely independent from biology, a life science. So, they tend to be not concerned in the topic where conceptual integration is made. Some students are not interested in physics or chemistry which make them feel frustrated."

Concerning the instructional strategies that teachers may use during conceptual integration, only 11 out of 50 (22%) participant stated that they did change their teaching strategies and methods for the purpose of integration, while the majority (78%) made some modifications to their strategies in order to encourage and enhance students' conceptual integration. All of the teachers stressed active learning strategies and methods such as cooperative learning and discussions which help students use their prerequisite knowledge.

"Mainly by asking students to predict outcomes using their acquired knowledge from physics or chemistry. Trying not to give them the direct answer but to encourage them to use their minds through class discussion so that they remember concepts and link them with the topic we are dealing with. Sometimes I pose a problem for them and ask them to do a research using their pre-requisite knowledge in chemistry or physics. In this case they can use internet websites or their books as a reference or ask their chemistry and physics teachers."
"When topics can be integrated I usually starts with brainstorming to use the students' prerequisites."
"I use different instructional strategies like brainstorming in order to detect students' misconceptions and understanding."

Some teachers go further and use resources from the integrated topic areas. One teacher stated, for example using images or even visit the lab
"I use images from other subjects that help to clear the idea I want to explain."
"Sometimes it requires to visit chemistry or physics lab. To discuss a certain objective."

When asked in the fifth question about their collaboration with physics and chemistry teachers when needed, more than half (56%) of the participants responded that they don't cooperate. They argued that they don't need to ask the other teachers, and when they need extra information about a certain topic, they do their own research.

" I usually depend on internet search."
"Usually I google such cases."
"I refer to references and internet to elaborate my knowledge of the integrated topics."

However, 44 % of the teachers stated that they do cooperate with their peers, mainly to check what students know about the integrated topics, or to ask them to explain a certain concept required for integration.

"Sometimes, I ask the teacher to explain the concept before I would reach the required topic, or I ask if the concept is explained yet."
"To check if they took food (lipids, carbohydrates, proteins) in organic chemistry or to check if they took potential difference in physics."

Some teachers reported that they seek help to understand the integrated concept, or to ask for the right strategy in order to address it in the biology class and to better know the level of integration.

"Mainly if I have no idea or little information about concepts."
"In the time of lesson plan preparation, when I face any concept that is related to physics or chemistry, I tend to communicate with my peers in school by calling them or taking an appointment at break times. During the meeting, I try to clearly understand the chemistry or physics concept (to be integrated in my biology lesson) in order not to face any problem during the lesson and to maintain a standard teaching pattern and thus does not let the class deviate from the topic. This would help me to be better equipped in answering questions asked by the students during the period."
"I ask the teacher if this concept was treated, and sometimes I ask more information to make sure about them."
"I ask the teachers some questions that can help me."

Many Teachers also highlighted the conceptual integration and their cooperation with their peers in science projects:

"I cooperate with chemistry or physics teachers when I asked students to do a project related to common topics like pollution."
"Such cooperation is necessary during science fair."

Regarding whether teachers investigate conceptual integration during their preparation, 86% of the participants stated that they do. The majority of the participating teachers (around 81%) explained that they check the curriculum, while the rest choose to ask their peer physics or chemistry teachers.

Focus Group

In response to the first question on how they explain the upward movement of crude sap, nine out of ten participants stated that they follow the textbook and the teacher's guide instructions and ask students to answer the questions presented in "probing the activity" section without adding any extra information for their students.

"I follow the textbook, and don't use any other document."
"for our students in grade ten, the information in the textbook is enough for them."

Only one teacher stated that he/she provides their students with extra handouts from another resource because he/she thinks that the textbook does not provide enough information.

"The activity present in the textbook is not enough… it lacks information about adhesion force. I use other resources when teaching this concept."

As for the question related to "how they perceive the word "pressure," all the participants agreed that "Doc. f" provides evidence for the presence of pressure and that is what the students need to know at this stage. They don't go further in their explanation. They don't recall any information about pressure from physics, and students are always satisfied with the information provided in the textbook.

"for root pressure, the textbook includes an activity that show evidence about this pressure, but we do not explain how this pressure come".
"I don't recall the definition of pressure from physics, the concept is simple and well known by students".

When asked about the mechanism that causes root pressure, only four teachers talked about "osmosis", whereas the rest hesitated about the process. One teacher stated
"I forgot those info. because I don't teach them. I learned about root pressure at university and that was more than ten years ago".

Six of the participants stressed that students don't have to know the origin of "root pressure"; what is required is the presence of that pressure only. However, the other four were hesitant about that and considered that the curriculum is not clear about this point.

"if my students ask about extra information, I ask them to research it and that will be outside the required info."

When asked about "cohesion force" mentioned in "Doc. g", all the participants agreed that students don't have any prior knowledge about that type of force, and that they explain it briefly as mentioned in the textbook without going into details. They argued that cohesion force is a physics concept that they don't have to explain in detail, reiterating that what is present in the textbook is enough for the students to know.

"I am a biology teacher, it is not my job to teach about forces, beside I don't know how to teach it correctly… that is why I prefer to give the definition present in the textbook".
"*there is no time to teach extra concept". "we don't have to make things complicated to our students".*

With respect to the teaching strategies they use, all the teachers stated that they follow the same strategies they usually adopt in their class, by mainly using PowerPoint presentations and the textbook.

Regarding the connection between biology and physics, the participants agreed that the concept in this activity includes physical concepts of pressure and forces. They, however, stated that they neither take this into account during their preparation nor do they cooperate with the physics teachers.

Discussion

The findings clearly show that Lebanese biology teachers who participated in the study face difficulties in approaching conceptual integration in the classroom. Both results of the focus group and the open-ended questionnaire highlight those barriers.

In fact, teachers are not familiar with the concept of Conceptual Integration, and they always perceive the integration from the teacher and content rather than from the student's perspective. They all agree on the necessity of the integration in the open-ended questionnaire, but when asked about the HOW of the integration, it comes as thematic integration implemented by the teacher and considered very superficial, rather than the integration that tackles the prior knowledge of the students and enhance the mobilization of the knowledge to create a new schema in their minds.

Knowing that the Lebanese curriculum is a disciplinary non-integrated curriculum, students don't always have the required prerequisites to practice conceptual integration, and teachers are not aware of how to integrate the required concepts and to what level. This is confirmed by research studies about the importance of the integrated curriculum in producing meaningful learning and in enabling students to connect among different content areas (Opitz et al., 2017).

In addition, a barrier highlighted by the participants is their own content knowledge. They clearly state that sometimes they lack basic understanding about the integrated topics and that they hesitate to address them deeply to avoid any confusion. This barrier was evident in the focus group discussion when only one of the ten participants was able to identify the information gap in the activity and used additional resources other than the textbook. On the top of that comes their perceptions of science, as they consider themselves biology teachers who are not required to deal with non-biological concepts or to cooperate with non-biology teachers. In this context, 56% of the participant asserted that they refuse to cooperate with physics and chemistry teachers, reflecting their view of science as separate disciplines, which is the logical outcome of adopting a disciplinary curriculum. This attitude may also be due to their teaching preparation program that does not enable them to approach the integrated concepts as scientists, contradicting the core value of the nature of science which deals with science as one paradigm (Chalmers, 1999; Lederman, 2013).

Students misconceptions were also considered as main barrier for conceptual integration, as teachers avoid recalling information from the other disciplines because students always have misconceptions in those areas of knowledge. The teachers considered that Conceptual Integration may lead them into a path different than the one they had planned for, as they may be obliged to clarify and correct the misconceptions of the integrated concept, which can be time consuming and confusing for them, being not well trained to deal with such situations.

Conclusion

The main purpose of the study was to investigate Biology teachers' views about and practice of Conceptual Integration in biology. The results show that there are differences between how teachers perceive conceptual

integration and how they practice it in class. In fact, although they all acknowledge the integration of physics and chemistry in biology and the necessity of mobilizing students' conceptions to reach conceptual integration, they do not quite apply it into their practice. Many factors lie behind those findings, mainly the curriculum, students' misconceptions and teachers' view about science. In addition, the study reveals that teachers lack the pedagogical knowledge about what Conceptual Integration is and how it should be implemented in class. They are not well equipped with the adequate strategies, tools and assessment for successful implementation of Conceptual Integration. The findings of this study are consistent with those reported by similar studies about Conceptual Integration (Taber, 2008; Tuysuz et al., 2016).

Recommendations

The Lebanese school science curriculum should be reformed in order to become an integrated curriculum that deals with science as one paradigm. In addition, the findings of the study shed the light on the urge to revisit the teacher education program at the Faculty of Education at both the pedagogical level to include Conceptual Integration as a main strategy to teach Sciences and at the content knowledge level to highlight the one paradigm of science that includes various science disciplines sharing the same features of the "nature of Science".

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Author Information

Hanadi Chatila
Lebanese University
Beirut, Lebanon
Contact E-mail:Hanadi.chatila@ul.edu.lb

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The Development of Science Education Pedagogical Content Knowledge Competences in the Early Childhood Teacher Education Program at the Lebanese University, Faculty of Education

Hanadi CHATILA
Lebanese University

Imane ABOU ALI
Lebanese University

Mariam RAAD
Lebanese University

Eman SHAABAN
Lebanese University

Abstract: This paper investigates to what extetnt the Early Childhood Education (ECE) initial teachers education preperation program at the Lebanese University Faculty of Education, develop pre-service teachers' Pedagogical Content Knowlede competences (PCK) to teach science for early years. For this purpose, an original analysis framework was developed by the researchers after extensive review of the existing literature and theories covering science education for early childhood education teaching program. To assess the development of science education PCK competences over the three years of the program, a questionnaire, developed and validated by the researchers, was completed by 56 graduate ECE pre-service teachers, measuring the content knowledge. In addition, content analysis of the science lesson plans completed by the pre-service teachers during their training sessions and retreived from their portfolios, associated with an interview with their trainers. The findings show that competences related to content knowledge are not developed, whereas the development of other competences varies between not and fairly developed.

Keywords: Science education, Early childhood education, Pedagogical content knowledge, Competences

Introduction

Young children have intuitive curiosity that enables them to practice scientific inquiry as a natural relationship with their very direct environment as an epistemological component of their adaptation. This practice takes place on both practical and conceptual levels. Zeece (1999) considers that children are engaged in scientific thinking and practice long before their schooling year.

When investigating Early Childhood Education (ECE), the developmental stage must be defined. Lebanon embraces the UNESCO 's definition for this stage "Early childhood, defined as the period from birth to eight years old, is a time of remarkable growth with brain development at its peak", UNESCO. (n.d.).

This period in the Lebanese educational system is divided into three sub-stages: First, from birth to three years old, in which kids stay at home or attend daycare due to the choice and needs of the family. Second, from three to six years old, in which children attend kindergarten which is not obligatory, but all the Lebanese children attend two till three years. And the final third stage from six to eight years old which is the first cycle of the elementary education.

Science Education in ECE

The importance of teaching science is that it can enable us to think critically. Without scientific knowledge, we are wholly dependent on experts. So, science empowered people to become active citizens rather than observers (El Tacksh, 2018; Michaels, Shouse & Schweingruber, 2008).

Young children are non-stop explorers, they start exploring their environment on their own at an early age. While exploring, they develop their capacities to observe and discover the world around them (Jirout & Zimmerman, 2015), and therefore they tend to construct their own concepts and generalize them as they are growing. And this natural process as a developmental side can be more convenient and supportive to child's developmental needs.

According to National Science Teachers Association NSTA (n.d) learning science in the early ages is characterized by:

1- Young children have the ability and the capacity to engage in scientific practice. And they can learn science on a conceptual level in addition to practice.
2- Young children learn science more accurately when adults prepare and enrich the environment with the supportive setting.
3- The more young children have exposure to exploration and experimentation, the more they have chances to develop their own scientific skills and knowledge. The enriched environment allows more chances to observe patterns, propose hypotheses, and construct their own knowledge.
4- Young children can inquire science in both; formal prepared settings, and informal settings. Through playing and their daily life
5- Young children accumulate scientific knowledge and skills and can transfer them to another subjects.
6- Young children can learn more deeply when they share positively in the activities.

Young Children and Scientific Inquiry

People thinks differently about science. Some considers it as a pure fact known as "school science" and others see it as a body of knowledge that includes along with facts and concepts laws, theories, and models that may explain how does the natural world work.

However, science educators perceive it, in addition to the body of knowledge, as an "inquiry" in other words the process of investigating and finding out.

Science inquiry refers to "the diverse ways in which scientists study the natural world and propose explanations based on evidence from their work" (National Science Research Council, 1996, p. 23).

Early Childhood educators highlights the rationale behind the importance of science in the early childhood classroom, on the basis on a number of variables. Stakeholders suggest that children at their early stages have a great potential to learn and therefore they should be provided with a rich and challenging environment for their learning, with the recognition of the power of their thinking and learning (worth, 2010). Early Childhood Science Education plays a key role in the development of life skills and promoting positive attitudes towards learning. Research studies have reported its impact on student career interest in science or engineering more than in another grade level (Anders et al., 2012).

The development of scientific thinking is considered as a main goal of the early childhood science curriculum. Therefore, when talking about science for young children, it is assumed that it would be a blended interplay that includes in addition to scientific facts, that are extremely important to enable children build their own understanding of basic concepts, also that blended knowledge includes inquiry which is well elaborated through scientific reasoning, the nature of science, and doing science, where young children are guided to ask questions and conduct investigations.

To assure the right challenging environment, stimulate the scientific curiosity and develop the thinking skills, the focus should be on the curriculum and also on the teachers, mainly on the teacher initial preparation programs.

Early Childhood Pre-service Teaching Program at the Lebanese University, Faculty of Education

At the Lebanese University, Faculty of Education pre-service ECE teachers course adapts the LMD program that was implemented in 2009-2010. The program comprises theoretical formal courses along with practical ones in schools and childcares. It aims mainly to develop the pre-service teachers Pedagogical Content Knowledge PCK competences by providing various courses units in curriculum studies, child psychology, classroom management, evaluation and assessment, teaching methodology, action research and others as well as classroom practice, and content courses related to science, math and languages, with a total of 180 credits.

Noting that the program offers the degree in three main languages, Arabic, French and English and the language of instruction varies accordingly, but all pre-service teachers receive the same degree at the end of the three years of preparation.

Science Education in ECE at the Lebanese University, Faculty of Education

Science education is present in the program, in both theoretical and practical courses. There are four theoretical courses that are directly related to science, where only one addresses the pedagogical knowledge and the other three are content related. In addition, there is one theoretical course that includes scientific themes.

The theoretical courses names, descriptions and time of delivery in the program and are presented in the table below.

Table 1. ECE science education theoretical courses

Course	Description	Time of delivery
Health and Nutrition	Content knowledge	First year
Science Activities	Content knowledge	First year
Teaching Science for ECE	Science education pedagogical knowledge	Second year
Early Childhood Services and Care	General ECE pedagogical knowledge	Second year
Environmental Education	Content knowledge + pedagogical knowledge	Third year

In addition to the theoretical courses, science education takes part in the three practical courses that are distributed over the second and third year of the program. Throughout those practical courses, pre-service teachers are to observe teaching sessions, practice micro and macro teaching and design their own portfolios. Pre-service ECE teachers are required to observe, prepare and practice science activities for preschoolers and science lessons for cycle one students (grades 1-3). All the preparations and reflection papers they write are kept in their portfolios.

Problem of the Study

Being science and ECE educators at the Lebanese University, Faculty of Education, we have noticed that ECE pre-service teachers face difficulties in science content knowledge. Their practice showed that they hold many scientific misconceptions about basic scientific concepts taught at preschool and primary school, due mainly to incomplete or wrong scientific knowledge related to those concepts.

The aim of this research is to investigate to what extetnt the Early Childhood Education ECE initial teachers education preperation program at the Lebanese University Faculty of Education, develop pre-service teachers' PCK competences to teach science for early years.

PCK Components Related to the Present Research

According to Shulman (1987), the general description of PCK includes three main components: knowledge of topics regularly taught in the subject area, the knowledge of forms of representation of those concepts, and the knowledge of students‟ understanding of the topics.

Research in PCK have developed many frameworks and expanded the components of PCK (van Driel, Berry & Merinik, 2014; Alonzo, Kobarg & Seidel, 2012). This research aims to investigates ECE pre-service teachers PCK to teach science, and it is assumed that the graduate ECE teachers should master all the scientific concepts

related to their areas of teaching, that matches with the Lebanese ECE curriculum requirement in science, and all the pedagogical knowledge related to science teaching methods and assessment. The suggested PCK components for this study are presented in figure 1 below:

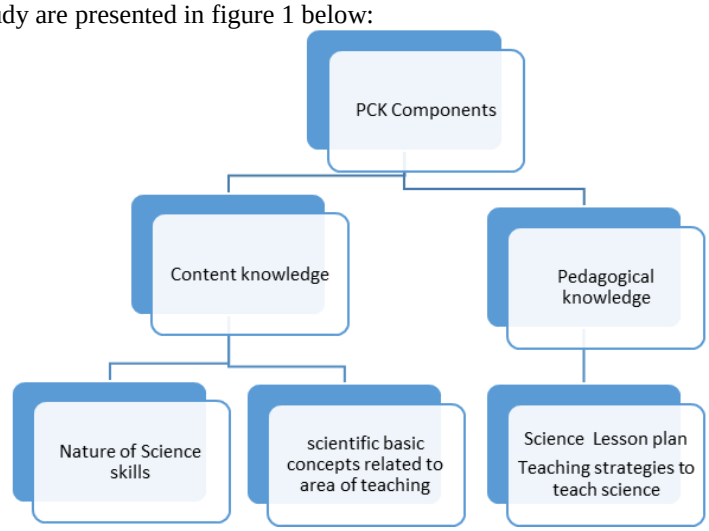

Figure 1. ECE pre-service PCK components to teach science

Related to the content knowledge, the scientific themes required by the Lebanese curriculum in Preschool and cycle one, are presented in tables 2 and 3 (Center for Educational Research and Development, CERD, 1997).

Table 2. Scientific themes required by the Lebanese curriculum for preschoolers (CERD, 1997)

Theme	**KG1**	**KG2**
People and their community	Man (Senses) Professions Transportation	Food Professions Transportation Means of communication Machines
Natural environment	Animals Plants Seasons	Animals Plants Rocks Air Water

Table 3. The scoop and sequence of science in cycle one (CERD, 1997)

Theme	**Grade one**	**Grade two**	**Grade three**
Plants and their habitats	• Growth and needs of plants	• Parts of a garden • Seasonal plants	• Parts of a plant Forest, desert and sea plants
Animals and their habitats	• Growth and needs of animals	• Similarity, variation and difference in animals	• Forest, desert and sea animals. • Sea pollution
Man and the environment	Included in the other themes.	Included in the other themes.	Included in the other themes.
Matter and Energy	• The sun. • Clouds. • Air Water	• Nonliving things. • Water cycle. • States of water	• Heat sources. • Properties of states of matter. • Force concept
Earth and the Universe	• Day and night. • The four seasons	• Apparent movements of sun. • Movement of shadows. • Times of day	• Phases of moon. • Temperature. • Breakdown of rocks

Moreover, the Lebanese curriculum emphasizes on developing children's science skills (NOS) like observation, analysis, discovery, deduction and problem-solving skills in order to acquire knowledge based on their personal experiences and their interaction with the surrounding environment (CERD, 1997).
Three research questions are addressed in this study

1- To what extent ECE pre-service teachers master the major and basics scientific concepts required to teach ECE science?
2- To what extent ECE pre-service teachers master the pedagogical knowledge required to teach ECE science?
3- What are the challenges faced by ECE pre-service teachers when teaching science?

It is assumed that if ECE pre-service teachers can master the basics scientific concepts of the topics related to their teaching areas and the nature of science NOS skills then they have developed their content knowledge. It was also assumed that if they can prepare a science lesson and use a variety of strategies in their teaching, then they have developed their pedagogical knowledge.

Method

This is a descriptive study that aims to explore ECE pre-service teacher's science education PCK competences development after attending the initial preparation program at the Lebanese University, Faculty of Education. So, for its exploratory nature a mixed research design where both quantitative and qualitative data were collected to answer the research questions. A questionnaire, science lesson plan analysis and an interview were conducted.

Participants

A convenient sample from third year ECE pre-service teachers was selected to participate in the study. The sample included Fifty-six participants distributed over three sections: Arabic, French and English. All participants had completed the science related theoretical courses presented in table 1, three practical units and were undergoing the fourth one. In addition, three trainers were interviewed.

Data Collection and analysis

Questionnaire

A questionnaire of 19 items distributed over two sections was developed by the researchers. The first section includes twelve open-ended items that cover the major science concepts taught from kindergarten to grade three according to the Lebanese curriculum. Eight items of the questionnaire cover biology concepts, two items for chemistry and another two for physics. The second section comprises seven multiple choice questions about Nature of Science skills. A description of the questionnaire is presented in table 4.

The questionnaire was first developed in English language and completed by ten ECE pre-service teachers that did not participate in the study, for piloting. Based on the results, some items were adjusted. Then, the questionnaire was translated to French and Arabic by science educators.
The table below describes the questionnaire sections along with their related items and the targeted measurement of each.

Table 4. Sections and items and intended measure of the questionnaire

Sections	Items	Measure
Section 1	12 open-ended questions • 8 items biology: o plants' needs, importance and benefits o body systems o organic food groups o the five senses • 2 items chemistry:	Mastery of scientific concepts related to science ECE teaching in Lebanon

	○ State of matter ○ Water cycle • 2 items physics ○ Mass and weight ○ Density	
Section 2	7 multiple choice questions	Nature of Science skills

Participants' answers of the first section, of the twelve open-ended questions were analyzed according to the following criteria:

- "complete": the answer is correct and complete
- "incomplete": the answer is not complete
- "wrong": the answer is wrong, not relevant to the question or no answer

Whereas the answers of the second section were classified as "correct" and "wrong".

Science Lesson Plan

The science lessons prepared by the participants were retrieved from their portfolios and used to measure to what extent the pre-service teachers have developed their pedagogical knowledge to teach science.

The analysis framework was developed by the researchers and adapted from the pre-service competences' framework developed by Chatila, Abou Ali, Naccache & Raad (2019). It included five sections with various items.

The table below presents the framework of ECE science lesson plan analysis.

Table 5. Lesson plan analysis framework

Scale	Items
Learning outcomes	• Specify accurately the learning objectives (outcomes) • Diversify the outcomes according to Bloom's taxonomy (cognitive outcomes) • Diversify the outcomes according to Simpson's taxonomy (psychomotor outcomes) • Diversify the objectives according to Krathwohl's taxonomy (affective outcomes)
Resources	• Choose the appropriate resources • Take into consideration students' prior knowledge
Introduction	• Motivational introduction ○ Exploring object materials ○ Raising questions
Teaching strategies	• Engaging and simple investigation • Choose the appropriate active learning strategies • Choose learning activities appropriate to the learning outcomes • Use variety of appropriate learning tools and technology • Diversify the learning activities by adopting differentiated learning • Diversify the modalities (team/pairs/individual work) • Allocate time appropriately to activities • Relate the concept to daily life Plan appropriate alternative activities
Evaluation	• Prepare activities for reinforcement and evaluation

The computer software SPSS was used to compute response frequencies and percentages for each section. In the analysis, scores were divided into three percentiles and the desired outcome was considered as "non- achieved", "fairly achieved" and "achieved" according to the following criteria.

- The lowest through the 50 percentiles of the score the outcome is considered as "not achieved"

- Between the 50th and the 75th percentile, the outcome is considered as "fairly achieved"
- Above 75 percentiles, the outcome is achieved.

Trainers' Interview

Three ECE pre-service trainers were interviewed about the pre-service trainee proficiency in teaching science. The questions of the interview were in line with the PCK framework suggested for this study.
The following questions were addressed:

1- How do you assess the ECE pre-service teachers' performance in delivering a science lesson in terms of
   a- Content knowledge in science
   b- Pedagogical knowledge in teaching science lesson
2- Do pre-service ECE teachers have any other specific challenges in teaching science?

Results and Discussion

ECE Pre-service Teachers' Mastery of Scientific Content Knowledge

Data analyses of the items of the questionnaire were used to measure the content knowledge of the participant ECE pre-service teachers. The first section, comprised of 11 open-ended questions, was designed to measure the mastery of scientific concepts related to the ECE areas of teaching according to the Lebanese curriculum. Whereas the second section measured the acquisition of Nature of Science skills.

According to data analysis, the total percentage of "complete" answers is 14.13 %, while as for "incomplete" answers is 44.51% and 44.34% for wrong answers. For the "complete" answers, the percentages ranges between 0% to 35.71%, with three items having the percentage 0%. The "incomplete" answers are ranging from 0% to 92.55%, and the "wrong" ones vary between 0% and 100%. The results of the open-ended section are presented in table 6.

Table 6. Distribution of frequencies and percentages of ECE pre-service teachers' mastery of scientific concepts

Open-ended Items	Answers					
	Complete		Incomplete		Wrong	
	Frequencies	Percentage %	Frequencies	Percentage %	Frequencies	Percentage %
1	0	0	52	92.85	4	7.14
2	14	25	36	64.28	6	10.71
3	3	5.35	7	12.50	46	82.14
4	0	0	49	87.50	7	12.50
5	20	35.71	0	0	36	64.28
6	16	28.57	40	71.42	0	0
7	12	21.42	4	7.14	40	71.42
8	2	3.57	50	89.28	4	7.14
9	16	28.57	9	16.07	31	55.35
10	0	0	0	0	56	100
11	10	17.85	25	44.64	21	37.50
12	2	3.57	7	12.50	47	83.92
Total	**95**	**14.13**	**279**	**41.51**	**298**	**44.34**

Regarding the acquisition of the Nature of Science skills, the results show 48.97% of "correct" answers and 51.02% for "wrong" ones. The "correct answers" ranges from 21.42% to 82.14% and the "wrong answers" from 17.85% to 76.78%. The results of the acquisition of Nature of Science skills are presented in table seven.

Table 7. Distribution of frequencies and percentages of ECE pre-service teachers' acquisition of Nature of Science skills

MCQ Items	Answers			
	Correct		Wrong	
	Frequencies	Percentage %	Frequencies	Percentage %
13	46	82.14	10	17.85
14	12	21.42	44	78.57
15	28	50	28	50
16	13	23.21	43	76.78
17	34	60.71	22	39.28
18	21	37.50	35	62.50
19	38	67.85	18	32.14
Total	**192**	**48.97**	**200**	**51.02**

ECE Pre-service Teachers' Mastery of Pedagogical Knowledge

Lesson plan

The analysis of lesson plan was performed on the basis of the framework presented in table 4, and the results are presented for each scale.
Regarding the first scale "the learning outcomes", data show that 35.71 % of ECE pre-service have achieved the outcome of the scale, while as 55.35% have fairly achieved them and 8.92% with no achievement. The results of "the learning outcomes" scale are presented in table 8.

Table 8. Distribution of frequencies and percentages of ECE pre-service teachers 'outcomes of "Learning outcomes" scale

"Learning outcomes" Outcome	Frequencies	Percentage %
Not Achieved	5	8.92
Fairly Achieved	31	55.35
Achieved	20	35.71
Total	56	100

For the second scale of the lesson plan analysis "the resources" scale, data analysis shows that 60% of the participants have achieved the outcomes while 26.78% have fairly achieved them and 12.5% with no achievement. The results of the "resources" scale are presented in table 9.

Table 9. Distribution of frequencies and percentages of ECE pre-service teachers 'outcomes of the "Resources" scale

"Resources" Outcome	Frequencies	Percentage %
Not Achieved	7	12.50
Fairly Achieved	15	26.78
Achieved	34	60.71
Total	56	100

Regarding the "Introduction" scale, 89.28 of the participants have achieved the outcome, whereas 7.14% have fairly achieved and 14.28% with no achievement. The results of the "Introduction" scales are shown in table 10.

Table 10. Distribution of frequencies and percentages of ECE pre-service teachers 'outcomes of the "Introduction" scale

"Introduction" Outcome	Frequencies	Percentage %
Not Achieved	2	14.28
Fairly Achieved	4	7.14
Achieved	50	89.28
Total	56	100

In the "Teaching Strategies" scales, 44.64% of the participants have achieved the outcomes, 41.07% with fairly achievement and the rest 14.28% have not achieved them. The results of the "Teaching strategies" scale are displayed in table 11.

Table 11. Distribution of frequencies and percentages of ECE pre-service teachers 'outcomes of "Teaching strategies" scale

"Teaching Strategies/inquiry" Outcome	**Frequencies**	**Percentage %**
Not Achieved	8	14.28
Fairly Achieved	23	41.07
Achieved	25	44.64
Total	56	100

The last scale of the lesson plan analysis is the "evaluation". Data shows that 48.21% of the participants have achieved the outcomes, 36.28% have fairly achieved them and the rest 12.50 % with no achievement.

Table 12. Distribution of frequencies and percentages of ECE pre-service teachers 'outcomes of the "Evaluation" scale

"Evaluation" Outcome	**Frequencies**	**Percentage %**
Not Achieved	7	12.50
Fairly Achieved	22	39.28
Achieved	27	48.21
Total	56	100

Interview

The interview included two main questions.
The first question is about the content and pedagogical knowledge of the ECE pre-service teachers. The three interviewee trainers agree that the ECE pre-service teachers face difficulties in content knowledge. They hold many scientific misconceptions.

"During class observation, I always detect misconceptions in scientific ideas e.g. in plant they always ignore the role of chlorophyll in photosynthesis, also in senses like the organ of the touch is hand instead of skin! In animal system, they can't relate between two systems in the body especially the digestive and the circulatory system."

"There are a lot of misconceptions, example the vitamins are always considered as minerals not organic. And most importantly they have huge confusion between the concepts of mass and weight"

In addition to misconceptions, the trainers also agree on the lack of mastery of Nature of science skills. The ECE pre-service teachers have difficulties in some skills like formulating a hypothesis, making predictions, and inferences.

"The trainers find it hard to infer from an observation. And also, their analysis are always incomplete."
"The Nature of Science skills are not well developed; many of them still can't write a hypothesis."
"They mostly confuse between prediction and inferences".

Regarding the pedagogical knowledge, the trainers considered that the pre-service teachers have developed to some extent the relevant competences. They can introduce well their lesson, apply active learning and diversify the teaching strategies in class. They also try to apply inquiry in their class.

"They always start the lesson very good; they use motivational technics… but when reaching the explanation part, they start to struggle."

"Our students are developing their strategies; they try always to apply inquiry."
"Some use various active strategies in class, and have the ability to apply active learning. They ask questions, make students to discover the concept and sometimes they relate to everyday life."

However, one trainer mentioned that there is a problem in performing experiments.

"They have fear from experiment, so they avoid it and go for simpler strategies."
Another trainer mentioned the schools are not always providing the right environment for inquiry, e.g. big number of students in classroom and lack of materials.

"Our students are not projecting what they know, because there are limitations in the schools where they perform the practice… young students are not used to cooperative learning, so our pre-service teachers find it hard to apply group work. Also, some schools lack materials for simple experiments."
Another issue, is that active learning and inquiry needs strong classroom management, which make our trainers hesitate to apply it
"They find it risky…they also fear that if the class is not well maintained this may affect their practicum assessment"
In addition, the three trainers mentioned difficulties faced in lesson plan, especially in writing the learning objectives and outcomes. Moreover, the pre-service teachers always fail to diversify their resources especially when it comes for searching references.

"Most of the learning outcomes are not well written."
"They need help in writing the lesson objectives."
"Our students don't diversify their resources... they don't search for new resources; they rely on those provided by us or sometimes they share resources between each others."

One trainer mentioned an issue in delivering the lesson plan, as there are problems in time and classroom management.

"I always notice problem in delivering the lesson plan, especially when it comes to time management. They are weak in classroom management that is why they can't follow their written lesson plan."

Finally, regarding the evaluation, all the trainers agreed that the pre-service ECE teachers need to better develop their evaluation competencies.

"Few of our students are able to perform a good evaluation at the end of the session"
"There is always a lack in the assessment and evaluation"

The second question of the interview was about any challenges the pre-service teacher face in class, other than mentioned above.

The three trainers considered that ECE pre-service teachers lack motivation in teaching science, they are not creative and lack awareness of the importance of teaching and learning science in ECE.

"The trainers are not motivated when teaching science, maybe they don't know the importance of teaching science for young children."
"We notice that they copy the lesson plan from each other, they don't come with new ideas, no creativity. I think this may be due to their weakness in science."
Moreover, the trainers stressed on the psychological side of the trainees, by mentioning
"Some fear applying innovative lesson in class, they fear trying something new!"
"Our students feel it is risky to apply active learning in practice because they lack experience."

Discussion

Data collected from the questionnaire show that ECE pre-service teachers do not master to some extent content knowledge. only14.13 % of the items were answered correctly and completely. while as the percentage of "incomplete" and "wrong" answers was 88.85%, distributed as 44.51% for "incomplete" and 44.34% for "wrong".

In addition, there were three questions where all participants failed to provide "complete" answers. The first question: "State the essential elements that a green plant needs for its growth". None of the participants mentioned the "chlorophyll". This result is in line with the trainers interviewees when they mentioned that ECE

pre-service teachers hold many misconceptions and one of the trainers mentioned the ignorance of the role of chlorophyll.

The second question that was missed by the participants was "What is the importance of plants in our life?" the participants were expected to relate the plants to real-life, however they failed to provide a "complete" answer, as they all focused on the environmental benefit of plants *" giving oxygen*" ignoring economical and societal aspects.

The third question was "Draw the labelled pathway of a piece of cake in your body starting from the mouth". All participants provided "wrong" answer. They failed to connect between digestive and circulatory systems and draw a labelled pathway. This finding is confirmed by the trainer in the interview that mentioned that ECE pre-service teachers find difficulties to connect between body systems.

Regarding the Nature of Science skills, data from the questionnaire show clearly that ECE pre-service teachers lack the acquisition of those skills. Less than half provided "correct" answers 48.97 %. The least answered correctly item is item 16 with 21.42% and was about the steps of scientific investigation, followed by item 18 about "inferences" with 23.21%. This finding is in line with the results from the interview, where the trainers mentioned that ECE pre-service teachers face difficulties with skills, namely formulating a hypothesis, prediction and inferences.

Those findings are in line with Reinoso, Delgado-Iglesias & Fernández (2019) who reported that they detected significant shortcomings in certain content and activities related to scientific methodology.

In addition, El Takach (2018) reported in a study conducted on ECE pre-service teachers at the Lebanese University about their views of science and scientists, that there is an urge to add more science courses in the ECE initial preparation program related to the nature and history of science.

Regarding the pedagogical knowledge of the participants, data collected from their science lessons plans show that outcomes achievement varies between the scales, with a percentage ranging between 35.71% to 89.28%. It can be inferred from this finding, that overall the achievement of the participant is low to fair. To be more specific, in the "learning outcomes" scale only 35.71% of the participants achieved the outcome, while the rest 80% fluctuate between a majority of fairly achievement 55.35% and 8.92% no achievement. This result is enforced by the trainers' interview findings who mentioned that the pre-service ECE teachers face difficulties in the learning objectives and outcomes of the lesson.

The second least achieved scale is "teaching strategies/inquiry" scale. Less than half of the participants, 44.645 %, achieved the outcome. It is obvious that inquiry is causing a big challenge for them, they try to apply inquiry to some extent and they need more tools to do so.

The trainers mentioned in their interview that the pre-service ECE teachers try to apply inquiry, but some of them avoid it due to two main reasons: lack of confidence in applying active learning and inquiry, and school environment restrictions.

Our findings are in line with Dogan and Simsar (2018). The authors investigated in a case study preschool teachers' views on science education. They reported that teachers face problems with the lack of teaching materials, crowded classes and inadequate classroom environment.

Regarding the "resources" scale, 60.71 % of the participants achieved the desired outcome of the scale, and 26.78 % with fairly achievement and the rest 12.50% not achieved. The results are supported by the trainers as they considered that ECE pre-service teachers have limited access to resources.

Data from the "evaluation" scale, show that only 48.21% of pre-service ECE teacher are able to prepare activities for reinforcement and evaluation.While 39.28% are still developing the related competences and the rest failed to do so. The trainers again confirm this finding.

The lesson "introduction" scale is the best achieved by the participant with 89.28% of achievement. The participants are in general able to introduce an engaging science lesson. The trainers confirmed this finding and considered that the ECE pre-service teachers are able to motivate students at the beginning of the lesson.

Data from the interview show also that ECE pre-service teachers do not have motivation towards teaching science, and they lack creativity. This may be due to many factors, some stated by the interviewees like the lack of tools to teach science and awareness of the importance of science education in early years. ECE pre-service teachers feel that they are not well prepared to teach science and lack experience. İn this vein, Johnson (1999) stated that science is neglected in early childhood classes and referred it to the fact that it is perceived as hard and abstract subjects for both students and teachers.

Conclusion

The study findings show that pre-service ECE teachers at the Lebanese university, Faculty of Education, have fairly developed the competencies related to PCK in science education. Overall, the participants present lack in their scientific content knowledge, they hold many scientific common misconceptions and the skills of NOS are not well acquired. The results are in line with El Tackach (2018) findings, who highlights the needs of adding more science courses in ECE initial preparation program at the Lebanese University, Faculty of Education. Similarly, the pedagogical knowledge related competences are not fully developed, and the micro assessment show a various level of achievement between the different axes of pedagogical knowledge, with predominance of fairly achievement level. These weaknesses in both content and pedagogical knowledge have presented a challenge for ECE pre-service teachers when teaching science and a barrier for motivation and creativity. The results are consistent with those reported by Liang (2009) that highlight the need to involve in-depth ECE science education in pre-service ECE teachers' preparation programs.

Recommendations

A reform in the initial preparation program for ECE teachers at the Lebanese University should be considered in terms of course contents, credits and distributions over the three years of the program. More science content courses are advised with innovative strategies for conceptual changes, delivered by science educators. Similarly, more science education courses are needed to empower pre-service teachers with the tools required to teach science in schools.

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Author Information

Hanadi Chatila
Lebanese University, Faculty of Education
Beirut, Lebanon
Contact E-mail:hanadi.chatila@ul.edu.lb

Imane Abou Ali
Lebanese University, Faculty of Education
Beirut, Lebanon

Mariam Raad
Lebanese University, Faculty of Education
Beirut, Lebanon

Eman Shaaban
Lebanese University, Faculty of Education
Beirut / Lebanon

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Challenges of Teachers in the Process of Evaluation and Grading

Natasha ANGELOSKA GALEVSKA
Ss.Cyril & Methodius University

Abstract: One major challenge encountered by teachers is related to the process of grading. Objectivity and accurance in grading is aim of each educator, still there are lot of obstacles in achieving them. The aim of this study is to examine the concerns and dilemmas of educators towards grading and to point out some ways for overcoming them in an optimal way. Data gathering is based on content analyses of relevant literature, research reports, personal accounts and interviews with practitioners. Results show that there is a number of moral controversies related to the policy of grading. Teachers complain about grade devaluation, pressures for higher grades and situations when they are forced to make compromises that sometimes is not in line with their personal code of ethics. Emphasis of pupils on grades has negative influence on the process of learning.Introduction of inclusive practice in Macedonian schools bring aditional dilemmas how to assess children with special education needs who attend regular classes. These children study according to individually developed curriculla, but they receive the same certificates as others and there are not criterias for assessing their achievements. Teachers express need to get instructions and guidelines how to deal with this. Discipline issues, awarding and punishing are also among the common pedagogical and moral dilemmas of teachers.Beside legislative and normative acts that shoud be obeyed, and the code of ethics that should be announced and respected in each school, one efficient way for solving dilemmas in the classroom is group discussion and use of the experience of elder colleagues in previous cases. This can lead to optimal and professional solutions when faced with various challenges on the workplace. Making right decisions affect not only careers of teachers, but affect all the involved sides as well.

Keywords: Teachers, Evaluation, Grading, Inclusive classroom

Introduction

Objectivity and accurance in evaluation and grading of students is aim and major challenge of each teacher and educator. Still there are lot of obstacles in achieving them. There is a number of factors that influence the formation of the summative grade for the student and some of them have nothing to do with the standards and criteria of assessment. In spite of the efforts of teachers to avoid them, subjective factors they do have a significant impact on the assesment and on the final grade of the student. Introduction of inclusive practice in Macedonian schools bring aditional dilemmas in the process of evaluation of children with special education needs who attend regular classes. These children should study according to individually developed curriculla, but they receive the same certificates as others. In the curriculums there are not specific criterias or instructions for teachers how to assess their achievements. Therefore, teachers express strong need to get instructions and guidelines how to deal with this.

The aim of this study is to examine the concerns and dilemmas of educators towards grading and to point out some ways for overcoming them in an optimal way. Focus of the study is on the subjective factors and their influence on grading, through the opinions, beleives and perceptions of teachers.

Evaluation, Assessment and Grading – Definitions

Evaluation as systematic process for gathering data about student achievements is an essential component of teaching. During the process of evaluation teachers seek for the best available indicators on which they can

decide if goals are being met. Any type of assessment and grading in educational context involves decisions on what can be relevant evidences for a particular situation, how to collect evidence, how to interpret it, and how to communicate with the affected users.The grade is not only used to sum up the achievement of student in the period of time, but it is also a tool for information, motivation and support of learning. Through the evaluation and grading teachers track the level of progress and success of their students.

Through analyses of relevant literature we can find many definitions on assessment. Among variety of definitions we present few of them that match in our context:

Asessment is "the systematic collection of information about student learning, using the time, knowledge, expert ise, and resources available, in order to inform decision about how to improve learning." (Walvoord, 2004)

Dwyer (2008) defines assessment of student learning as "process by which we ascertain through data collection if students have learned the skills, content, and habits of mind that will make them successful; if students are not learning, we decide on changes in the curriculum or teaching strategy to improve learning."

William and Thompson (2008) proposed the terms "formative" and "summative" assessment, given the reason to differentiate the role of evaluation. Formative assessment is introduced as an ongoing process of evaluating students' learning, providing feedback to adjust instruction and learning and to improve the curriculum. It is defined as assessment for learning within a unit of study where the outcomes guide instruction without associated rigid quantifiers such as grades. (Andrade & Cizek, 2010). Summative assessment, on the other hand, is bound to administrative decisions and assigning grades to the tests. Summative assessment is intended to summaries student attainment at a particular time, whereas formative assessment is intended to promote further improvement of student attainment. (Crooks, 2001)

Subjective Assessment

Subjective assessment and bias in grading can be either conscious or unconscious (Malouff, 2008). Subjective assessment depends on different factors that can be divided in three main categories:

a) Factors that depends on the student's response to teachers' questioning such as:
   - verbal abilities of the student,
   - ability to perceive and to use perceived data,
   - emotional resistance,
   - clarity and certainty in the given answers
   - other factors related to student behaviour and response that can influence teacher's opinion about student knowledge

b) Factors related to the teacher as a "tool" for measuring. In this category we can list a number of teacher – related factors such as:
   - teacher's tendency to raise or lower the assessment criteria on his own personal perception and thus gain the reputation of a 'strict' or 'mild' teacher,
   - prior experience of teacher with a student. For example, error in grading known as *halo effect* is related to the teacher's tendency to evaluate students on the basis of a previously acquired and constructed opinion of them. As Rasmussen explain "in the classroom, teachers are subject to the halo effect rating error when evaluating their students. For example, a teacher who sees a well-behaved student might tend to assume this student is also bright, diligent, and engaged before that teacher has objectively evaluated the student's capacity in these areas. When these types of halo effects occur, they can affect students' approval ratings in certain areas of functioning and can even affect students' grades." (Salkind & Rasmussen, 2008) Halo effect as a cognitive bias is aproved on the empirical results of many other researchers as well. Some physical characteristic such as attractiveness can also influence the process of grading. (Landy&Sigal, 1974; Abikoff, Courtney, Pelham, Koplewicz, 1993;)
   - similar to the previous factor is the situation when teacher is guided by the opinions of his or her colleagues previously given to that student. For example, some assigned status of student, such as being labeled as gifted or with learning difficulties can lead to bias grading.
   - in many situations teacher builds the evaluation criteria according to the answers given by other students during their oral or written interogation. The same answer of a student can be rated higher in the group of students with poor marks or can be lower among excellent students.
   - other possible cases occur when the teacher equally evaluates all the answers, unable to make difference between the important from the less important or sometimes evaluates everything with an

average grade. Opposite situation is when the teacher goes too deep and makes a great distinction in the student responses with more than five grades;

c) Factors that depend on the interrogation and evaluation technique that are used. Oral interrogation depends on how suggestive or strict the teacher is during the interrogation, when does it happens, how much is teacher involved in the discussion, how much he supports the student answer, what type of questions are used and other factors. The same errors as in oral questioning are possible during written interrogation. However, written questioning excludes empathy between the student and the teacher and gives students the opportunity to answer the same questions.

Assessing Children with SEN

In the last decade, the concept of inclusive education has been promoted and accepted as a new model of organized teaching and learning that implies creating an inclusive culture, building up an inclusive policy and developing inclusive practices in schools. Assessing the educational development of children with special needs is very challenging for the teachers and they often express the need for accurate and precise guidance in applying the assessment practices in the inclusive classrooms. The best way to improve learning for a diverse range of learners is through appropriate, reliable and valid assessment in the classroom. This is especially important issue for Macedonian teachers because inclusive practice is accepted in all schools. (Angeloska-Galevska & Ilić-Pešić, 2018). The problem is that children with special education needs study according to individually developed curriculla, but they receive the same certificates as others and in the curriculums there are not criterias or instructions how to assess their achievements.

When working with special children, teachers are encouraged to implement different practices in order to adjust the pace of instruction to match students' capabilities. Teachers in inclusive classrooms can use formative assessment to plan instruction that maximizes learning. That means that teachers are encouraged to use formative assessments at regular intervals throughout a unit of study and depends on the outcomes of students to make immediate planning decisions regarding pace, readiness and needs of students. (Andrade & Cizek, 2010).

In relation to evaluation and assessment teachers should use more children portfolios because they give rich data about child development and its individual abilities, strengths, constraints, interest, motivation and many other personal features. Portfolio can be a useful mean of the assessment of children if it is organized and filled with data of observation, interviews, rating scales, check lists, photos, children products, evidences of direct assessment and other products of children that teacher and parents can use to track children progress in the dynamic period of the early childhood development. In that way it is important portfolio data to be transferred from preschool institutions to elementary schools. Teachers can use these information also to adjust curriculum and teaching according to children readiness to accomplish the teaching goals.

Method

The research problem was investigated with qualitative research strategy in order to obtain in-depth data about the perceptions of teachers toward grading, their dilemmas and the way of thinking in summing up the grades of students. Through their statements we try to identify what are the factors that influent certain grade, especially subjective aspects beside the objective and standardized ones that are defined in pedagogical legislative.

Data gathering is based on content analyses of relevant literature, research reports, personal accounts and interviews with practitioners**.** Interviews with teachers were done with semi-structured protocols that include relevant topics of the research problem. With some of interviewees we conduct the interview several times, covering the topics that additionally provoked us.

Sample

Sample for content analyses consist of relevant normative acts and documents such as: Laws and ammendmens on primary, secondary and higher education in the last ten years, Guidelines and Rules for assesing issued by the official institutions such as Ministry of Education and Science, State Inspectorate for Education and the Bureau for Development of Education. Subject of analyses were also annual school plans and daily preparation plans of teachers.

Interviews were made with 16 teachers from different arears, urban and rural. Age of the intevieews is between 26 and 41. Seven of them attend postgraduate programs.

Analysing Strategies

In the qualitative analyses we summarize the results using the strategies for qualitative analyses. First, we browse through all the transcripts, and then we re-read one by one carefully, in details. In this process we make marks about our impressions and label the parts according to the concept that we developed before. In this process of coding we mainly focused on their reflections, concepts and differences in the opinions towards grading. In further phase codes were gathered into categories that we previously defined as relevant. Relevancy of categories was determined on the basis of previous readings and discussions. Main categories in the interview are the following:

- Subjective vs. objective criteria in the process of grading
- Grading of pupils with SEN
- Use of traditional and non-traditional forms of assessment
- Pressure for higher grades and other challenges for teachers in the classroom
- External assessment

All these categories are connected to each other and the order of these categories do not mean hierarchy of their importance. On the bases of the primary data, we tried to make conceptualizations and to produce new knowledge about the grading phenomena.

Results

As qualitative results are broad and extensive, in this paper we present only summarized findings related to some of the defined categories. In presenting the results we try to be unbiased and to present them naturally and neutrally as they were told by the interviewees, without our interpretation.

Category 1. Subjective vs. objective criteria in the process of grading

All respondents stressed that they try to be objective; they avoid subjectivity and reduce it to minimum. But in further discussion they admit that sometimes subjective criteria are present, that 'it is difficult to avoid them' and "they influence the process of grading".

The factors that were mentioned as significant for grading beside test results were the following:

- When student is committed, responsible and dedicated he can get higher grade despite lower results in the test. Continuous work at home and regular fulfilling the tasks influence higher grade. Consequently avoiding daily tasks and duties reduce the grade.
- The student's interest in a subject, active participation in some activities bring credits to students and on the other hand, disinterested behavior lead to lower grade despite the test results.
- Active participation of students in school events and classroom activities, demonstration of creativity and own ideas contribute to the good marks and passive ones get lower marks
- Non-discipline students and students with bad behavior sometimes get power marks because they disrupt the normal course of instruction;
- Lack of clarity of response, when student looks nervous or uncertain or has poor verbal abilities can lower the grade
- Emotional immaturity is sometimes factor for lower grades.

Category 2. Grading of pupils with SEN

Teachers who work in inclusive classrooms express strong need to get instructions and guidelines how to evaluate achievements of children with special education needs because these children have same tests as mainstream students although the individualised education plan contains 70% content of the regular one. Most of the teachers do not feel competent to deal with these children and ask for additional trainings and support from professionalists, special educators, logopeds and other specialists.

According to the responses, there are cases when head teachers of inclusive classrooms try to individualize a grading system for a student with a disability, but other teachers lack knowledge of how to do it or do not put individualized plan in practice. Thus, many students with disabilities receive inaccurate and unfair grades that provide little and meaningful information about their achievement.

Some teachers stated that mainly they can make difference when failure of response is a result of laziness or a result of real problem caused by the child impairment. In these cases, similar responses are graded differently.In order to avoid situations of assessing written test with different criteria, sometimes teachers make adaptation of the test or interrogation techniques. They say that very often testing time for children with SEN is extended or questions are adjusted in accordance with the impairment, for example they print the tests for them with larger fonts and space, or give additional instruction how to fulfill the tasks.

Category 3 .Use of traditional and non-traditional forms of assessment

Related to the forms of assessment, most of the teachers confirmed that beside the traditional forms, they also use non-traditional forms of assessment. They practice group work in classroom or they give group projects as a home assignment where students are divided in groups of four or five and with joint effort prepare presentation, reports, tableaux or posters of the explored theme. Non-traditional forms of assessment require students to exhibit skills for applying, analyzing, and synthesizing information that is not included in such a way in traditional tests.

Teachers say that students love group works in classroom because this kind of work and assessing brings more fun and less stress for students. The problem is that usually one or two students of the group take care of the whole task. This can be an example of unfair grading when other pupils earn credits on behalf of abilities and work of some outstanding students.

Category 4. Pressure for higher grades and other challenges for teachers in the classroom

Results show that there is a number of moral controversies related to the policy of grading. Teachers complain about grade devaluation, pressures for higher grades and situations when they are forced to make compromises that sometimes is not in line with their personal code of ethics. Emphasis of pupils on grades has negative influence on the process of learning. Learning for grades and not for knowledge become even more present after introducing of external assessment in Macedonian schools.

Discipline issues, awarding and punishing are also among the common pedagogical and moral dilemmas thet were mentioned by teachers.

Conclusion

All respondents stressed that they try to be objective; they avoid subjective factors in grading and reduce them to minimum. Although these elements are avoided by the teachers, however, they have influenced the formation of the summative grade for the student. These elements have nothing to do with the standards and criteria of assessment, but still they do have a significant impact on the final grade of the student.

Assessment is part of everyday school life and it should be less traumatic for teachers and less painful for students. Using of formative assessment and nontraditional forms of assessment brings teachers quick feedback about their work and about student achievements and guide them to plan the instruction in an optimal way, especially when they work in inclusive classroom with children with special education needs. As much as the students are involved and active in their learning and self assessment, more they will learn.

Beside legislative and normative acts that shoud be obeyed, and the code of ethics that should be announced and respected in each school, one efficient way for solving dilemmas in the classroom is group discussion and use of the experience of elder colleagues in previous cases. This can lead to optimal and professional solutions when faced with various challenges on the workplace. Making right decisions affect not only careers of teachers, but affect all the involved sides as well.

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Author Information

Natasha Angeloska Galevska
Ss. Cyril and Methodius University
Bul. Goce Delchev 9a, 1000 Skopje
Republic of Macedonia
Contact E-mail:natasa*@fzf.ukim.edu.mk*

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A proposed Invention in Science Labs (ISL) Framework for Teaching Science

Mustafa JWAIFELL
Al-Hussein Bin Talal University

Osama M. KRAISHAN
Al-Hussein Bin Talal University

Abstract: The proposed Invention in Science Labs (ISL) framework conceptualizes invention within science labs by four elements representing phases of reaching inventions in a group context: Theoretical thinking: fluency, flexibility, and originality, Solution, Materials and Context. Four phases should lead to a product that can be commercialized, while the whole process monitored through four procedures under the teacher's dwelling the activities: Objectives, Procedures, Discussion, and Evaluation. The study listed the challenges that can face implementing ISL which can be overcome if policy makers have the awareness of using ISL in teaching, while teachers can change their approaches of instruction when they have the opportunity to practice it. Beside of that, Ministry of Education in general can conduct competitions between students and schools to have more inventions thus encouraging using ISL framework. More over the study proposed appropriate solutions for overcoming those challenges.

Keywords: Physics, Science labs, Creativity, Invention, Innovation

Introduction

Little attention has been given for invention within education previously, a study conducted by Jwaifell and Kraishan (2019) which carried out in 2018 about exploring elementary students invention ingenuity in science labs for testing the ISL frame work. The study participants were (50) male and female students of the ninth graders. The study used the mixed approaches of both qualitative and quantitative methodologies to assure the effectiveness of ISL framework. The results were very promising for the use of ISL. This paper describes how the ISL works does and what is consisted of beside the challenges it may face its implementation.

Back ground

Most of researches conducted under the claim of students' acquiring epistemology of disciplines through teaching by creativity without transforming the theoretical ideas into products that can be commercialized, which is the main ISL concern. While researchers tried to form creativity as a concept of invention. Bostrom and Nagasundaram (1998) provided suggestions for future research in creativity factors, where they classify their work in terms of whether it addresses the creative Person, Product and Press as adapted from Fellers and Bostrom (1993):

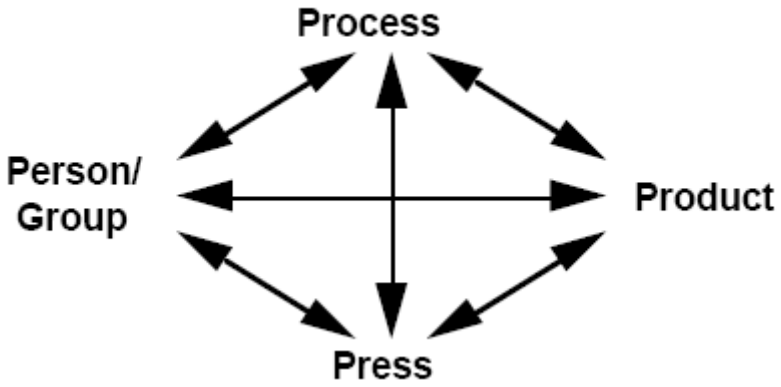

Figure 1. Creativity factors (Bostrom & Nagasundaram, 1998, p391)

Other scholars framed teaching and learning innovation and invention. Schull, Maytychak, and Noel-Storr (2009) described the practices they used in their course on Innovation and Invention which had been taught at Rochester Institute of Technology as Figure 2 describe:

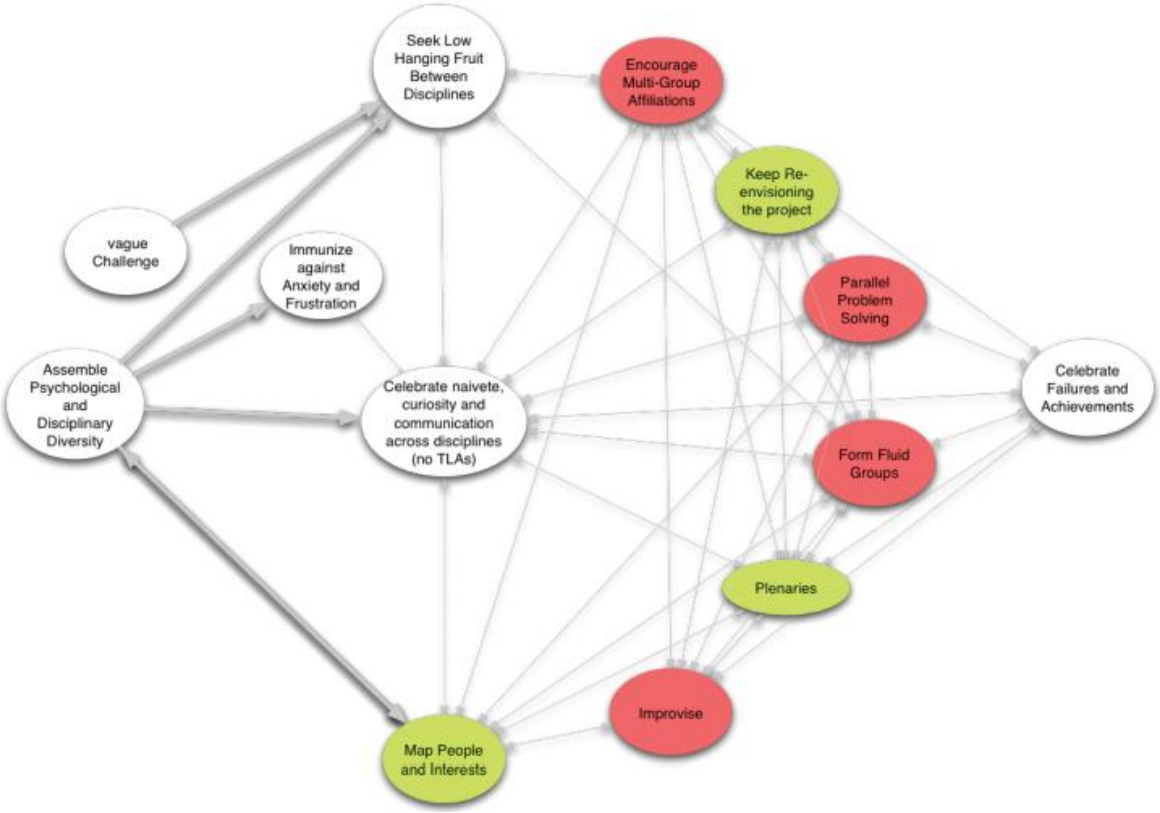

Figure 2. Key practice of a course on Innovation & Invention (Schull et al, 2009. 4)

A framework suggested by Meyer and Lederman (2013) to explore the pedagogy of ingenuity in science classrooms as a guide to analysis of each of the activities the teachers shared on the questionnaire and observed by the researchers. This facilitates the researchers' assessment of whether each activity had the potential to permit fluency, flexibility, and thus potential for responses that are significantly different across a group of students (original) as shown in Figure3:

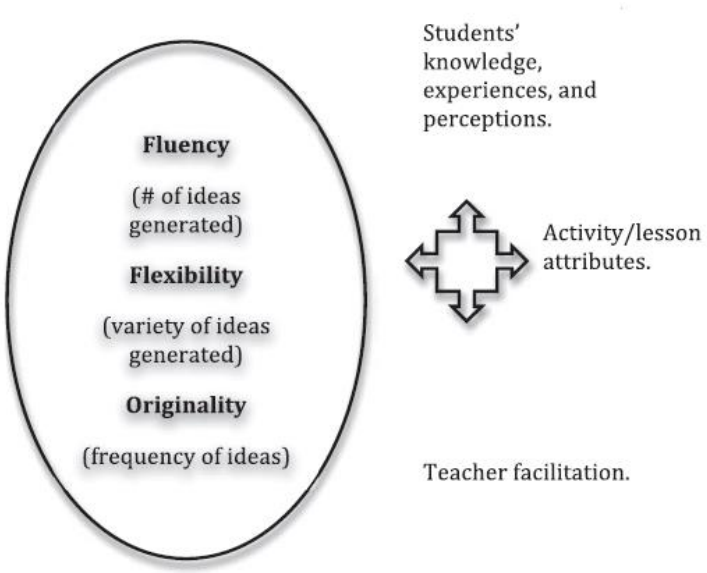

Figure 3. Creative thinking in the science classroom analysis framework (Meyer & Lederman, 2013, p403)

ISL Framework

The proposed ISL framework designed and developed through a pre-experimental research conducted by Jwaifell and Kraishan (2018) where it was followed since 2017 and both of its validity and reliability for its instruments have been assured. The research was reliable on a team work of two male\female teachers and the two researchers. The role of the two teachers understood of the applying ISL, while the researchers analysed the literature related to teaching strategies and methodologies with respect to constructivism theory and creativity approaches in teaching. Figure 4 showing the ISL framework:

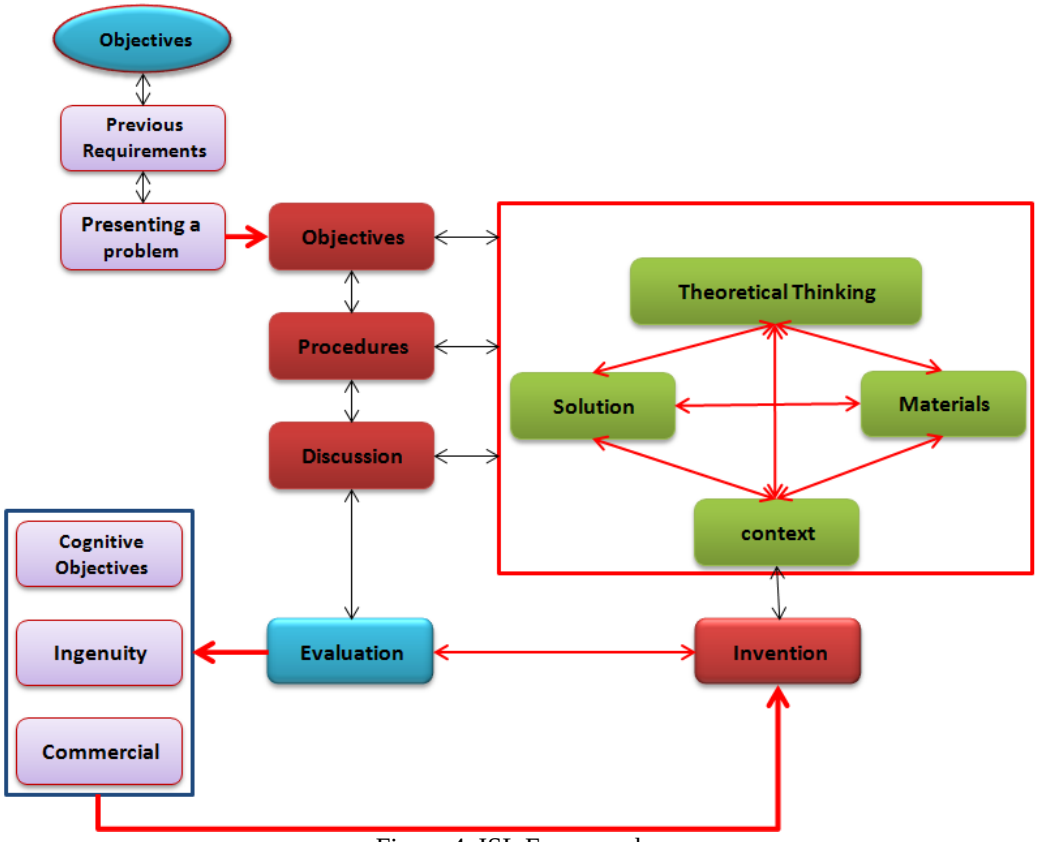

Figure 4. ISL Framework

Teachers with respect to ISL design and plan learning\teaching situations through the following phases:

Phase 1: Stating Objectives

Stating Objectives begins with the common goals will be achieved by students and understanding the environment where the process of Invention will be conducted in; which is in this situation is science laboratories at the school. This phase aims at exploring materials, equipments and media availability, so that outcomes can be reached according to this availability.

The objectives cover cognitive, affective, and psychomotor domains of the subject of the study. While teachers should assure the previous requirements those students should posses to accomplish the outcomes, it will be essential to choose the suitable problem with relevant to exploring materials, equipments and media availability that should be solved by an invention.

For example:

- Objective: connecting of a simple electrical circuit.
- Materials etc: welding device, wires, lump, battery …etc.
- Presenting a problem: a doorbell for a deaf person.
- ISL design and plan learning\teaching situations its phases.

Phase 2: Procedures

Dividing students into groups and assigning tasks for each individual of the team. The teacher in this phase reforming students' previous knowledge and shape it by giving scaffoldings for students' acquisition of subject matter objectives.

Phase 3: Discussion

Discussion phase conducted through all learning\teaching situations. Teachers will discuss all relevant needs to understand the task devoted for the outcome of that should be accomplish by the students. Teachers will change their moves within ISL approach to facilitate learning and explore students' way of thinking for reaching the best solution of the problem presented to each team.

The students will gain subject matter through thinking theoretical thinking of the problem and what they will assume of solutions based on the knowledge they need to understand the relationship between what they are going to solve and the concepts that they have to understand. Theoretical thinking also will include solutions of the problem that should be discussed with the teacher and other students through brain storming and elimination of improper solutions. The context of applying those solutions as a product will be supervised by the teacher with the relation of the product evaluation card. Here an example of a problem that needs a solution:

- Problem: Help a blind/deaf person to know if someone at the door of his home?
- Tools/Materials available: Electrical kill key, Electrical lamb, Remote control toy car, Wristwatch, Bill hanged inside a room.
- Describe the above tools and materials functions?
- Discuss the relationship between these tools?
- What is the relationship between these tools and the addressed Problem?
- Can those tools be helpful to solve the problem?
- Address solutions to help the blind/deaf person by using these tools and materials?
- What is the most suitable solution?
- What are the implementation procedures?
- Suggest how this product can be developed?
- Suggest how this product can be developed commercially?

Phase 4: Invention

The whole team will use every skill they have according to each individual of the team to make the solution they proposed as a product that work properly according to the evaluation card.

Phase 5: Evaluation: the evaluation phase will measure students' achievements of subject matter they were learned and evaluating the product they invented by an evaluation card which contains the following standards:

Table 1. Product evolution card

Invention Ingenuity	**Score (1-10)**
Consistency with religion	
Applicability	
Novelty	
Community needs	
Efficiency	
Power saving	
Easiness of use	
Cost of materials	
Safety	
Total (cut Score=63)	

The production card consisted of 9 items: Safety, Cost of Materials, Easiness of use, Power saving, Efficiency, Community needs, Novelty, Applicability, and consistency with religion hence people do not change the perceived connection between religion and science, even if they were in a scientific course which integrated activities explicitly addressing the nature of science (Aflalo, 2018).

Challenges of ISL Implementation

The implementation of the proposed ISL may face some challenges derived out of Jwaifell and Kraishan (2018) study. The most challenge was what the researchers faced in the pre-experimental study, which is cost of materials that students need to accomplish the product. Over all challenges can be summarized in four categories:

1. Cost: the previous study of Jwaifell and Kraishan (2018) showed the cost of each product reached in average (52 US$) which can be considered in a poor country like Jordan is very costly. To overcome this kind of challenge it would be very helpful if the materials that used can be reused again in different situations.
2. Teachers' readiness: teachers are a very understanding of those new methodologies of teaching, but at the same time they need more training in dealing with ISL and the equipments needed for its implementation. This challenge can be overcome by more training courses and virtual cources will be least costly. While teachers' readiness for new methodologies and integrating technologies are high Jwaifell, Abu-Omar, & Al-Tarawneh. (2018).
3. Policy makers awareness: in countries such as Jordan, policy makers can realy make the deffirence and assure changes if they were aware of the outcomes and befiets of using ISL as a learning and teaching framework which lead to quality assurance. This challenge can be overcome by media and community pressure.

Conclusion

Challenges can be overcome if policy makers have the awareness of using ISL in teaching, while teachers can change their approaches of instruction when they have the opportunity to practice it, while students can be more active and enjoy learning. Beside of that, Ministry of Education in general can conduct competitions between students and schools to have more inventions thus encouraging using ISL framework.

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Author Information

Mustafa Jwaifell
Al-Hussein Bin Talal University
Ma'an, Jordan
Contact E-mail: jwaifell@hotmail.com

Osama M. Kraishan
Al-Hussein Bin Talal University
Ma'an, Jordan

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The Attitudes of Turkish Men towards Family Planning: An Example of Workers in a Railway Factory

Senay PEHLIVAN
Alaaddin Keykubat University

Ayfer TEZEL
Ankara University

Ilknur M. GONENC
Ankara University

Abstract: The aim of this study was to determine the attitudes of Turkish men towards family planning (FP). The research was conducted descriptively and cross-sectionally with a sample of 233 people working in a railway factory in Ankara. The data collection form and Family Planning Attitude Scale (FPAS) were used to collect the data. The mean age of the participants was 43.53 ± 7.86, and 58.4% were high school graduates. The highest score average possible in the FPAS was 170, whereas in this study, it was found to be 137.59 ± 20.20. The men scored 61.00 ± 10.61 in the "Attitude of Society towards FP" sub-dimensions; 44.61 ± 8.20 in the "Attitude towards FP methods" sub-dimension; and 31.97 ± 6.90 in the "Attitude towards Birth" sub-dimension of the FPAS. As a result of the research, it was seen that age, education, family structure and social security affect the attitude towards FP.

Keywords: Family planning, Men, Thought, Attitude, Nursing

Introduction

The Neo-Malthusian approach, which was formed as a result of the reshaping of Malthus's population approach, which claimed that rapid population growth was an obstacle to development, was used to control the rapid population growth experienced in less developed and developing countries especially after the Second World War. This approach was reflected in the activities of international organizations, and in the 1960s, under the influence of international organizations and various foundations and associations adopting the Neo-Malthusian approach, population control and family planning programs were implemented in many less developed and developing countries of the world. These population policies have ignored the individual needs of women and men, and the conditions in which they live. In order to keep the population under control, practices that attempt to keep the reproductive capacity of women under control have been encountered, and the reproductive rights of women have been violated. However, it is understood that there has been a positive change and transformation in the approach of international organizations over time. At the final population conference held within the United Nations, the 1994 International Conference on Population and Development (ICPD), which is considered the most important in terms of women's rights and gender equality, adopted an Action Programme that embraces equality as one of its principles, and declared that both men and women have reproductive rights throughout their lifecycle. This Action Plan was achieved under the influence of women's rights and women's health advocates, and is in direct opposition to the population policy concepts that prevailed in previous periods. Turkey has made moderate progress in implementing the ICPD Action Programme, which it has signed and pledged to implement; however, this progress is insufficient in terms of ensuring gender equality and empowering women (Karaca Bozkurt, 2011). The purpose of family planning services are the prevention of unwanted pregnancies, and consequently maternal and infant deaths, providing assistance and counseling services to each family for having any number of children at any time, and increasing the level of mother and child health (Kaya et al. 2008). It is reported that there are approximately 300 million couples in the world who

do not want children but do not use contraceptive methods (Gilic et al. 2009). In cases where contraceptive methods are not used adequately, various health and social problems may arise (Akin et al. 2006). In women with unwanted pregnancy, the rate of prenatal care is lower, and infant and maternal mortality is higher (Osmani et al. 2012).

In Turkey FP is inadequate today. According to 2013 TNSA data, if unwanted pregnancies could be prevented, the total fertility rate would be 1.9, but due to the need for unmet family planning (FP) methods, the total fertility rate is 2.26 per woman (this rate is only 0.16 higher than the population regeneration rate of 2.10). This rate, which is not statistically different from the 2.16 obtained in the TDHS in 2008, shows that periodic fertility has not decreased in the last five years, but has stagnated (TDHS 2013). Women still cannot have the number of children they want in Turkey. As our culture is influenced by traditional, conservative and strict rules in Turkey woman's individuality is prevented (Orsal & Kubilay, 2007). For this reason, FP is still seen as the role of women and men avoid taking responsibility. Behaviors are affected by factors such as norms, habits, learning processes, the environment and attitudes. Accordingly, it is important to determine the attitudes of men towards FP and to take responsibility in our society. This is why this research was conducted to determine the attitudes of men towards FP.

Method

Materials and Method

The research was conducted descriptively and cross-sectionally with 233 people working in a railway factory in Ankara. The universe of the study consisted of all employees working in the railways factory in Ankara. The reason for choosing this factory as the place of research was because almost all of the employees are men. The sample of the study consisted of 233 males, who were volunteer participants, who did not have any communication obstacles, and accepted to participate in the study.

The necessary permit was obtained from the relevant institution and ethical approval was obtained from the Research Assessment Authority and Ethics Committee of a University (Institutional Review Board Date 2012 September 30 and Institutional Review Board Number: 431-1132132). The study was conducted in accordance with 'The Code of Ethics' of the World Medical Association (Declaration of Helsinki). The purpose of the research was explained to all men included in the study group. Participation was on a voluntary basis. The participants were assured that all personal information would be kept confidential and written informed consent was obtained from each participant. The pilot study was performed with 10 men who did not participate the study. After the pilot study, necessary corrections and revisions were made to the data collection forms and it was found that the forms took 20-25 minutes on average to complete. The study was conducted between 07 January 2013 – 29 June 2013.

The Data Collection Form and Family Planning Attitude Scale (FPAS) were used to collect the data. The Data collection form consisted of two types of questions; one type had the descriptive characteristics of the participants, and the other type had the thoughts of men. The Family Planning Attitude Scale was developed by Örsal and Kublay in 2006. The scale is a likert type and consists of 34 items. Each expression in the scale is scored from 1 to 5. "Completely Agree" is 1 point, "Agree" is 2 points, "Undecided" is 3 points, "Disagree" is 4 points, and "Completely Disagree" is 5 points. There were no expressions that needed to be coded in reverse. The scale can score at least 34 points and a maximum of 170 points. As the scale scores increased, the FP attitude increased positively. The scale has three sub-dimensions: *"Society's Attitude towards Family Planning", "Attitude on* Family Planning Methods" and "Attitude towards Birth". The number of items constituting the *"Society's Attitude of Family Planning"* among the sub-dimensions of the scale is 15 (questions 1-15) and at least 15 and a maximum of 75 points can be obtained from this subscale. The number of items constituting the *"Attitude on Family Planning Methods"*, which is one of the sub-dimensions of the scale, is 11 (questions 16-26). A minimum of 11 points and a maximum of 55 points can be obtained from this sub-dimension. The number of items in the *"Attitude towards Birth"* subscale of the scale is 8 (questions 27-34) and a minimum of 8 and a maximum of 40 points can be obtained from this subscale. Internal consistency and homogeneity coefficients determined by alpha correlations of the scale were found to be 0.90 for the total FPAS (Orsal & Kubilay 2007).

In the study, the Cronbach's Alpha internal consistency reliability of the scale was 0.84 for the "Society's Attitude towards Family Planning" subscale, 0.87 for the "Attitude on Family Planning Methods" subscale, 0.81 for the "Attitude towards Birth" subscale, and the total FPAS internal consistency reliability coefficient was

0.90. In order to determine the comprehensibility and usability of the questionnaire, 10 men working in the same factory and fulfilling the criteria to participate in the research were pre-applied and after the necessary modifications were made, the questionnaire was finalized. The pre-applied group was not included in the study. Data collection forms were given by the researchers to the men on their breaks during working hours and they were asked to complete the forms. It took the males about 20 minutes to complete the data collection form.

The statistical analysis of the data was performed with a statistical package program. The statistical significance level was accepted to be $p<.05$. Number, Mean, Standard Deviation, Median, Minimum and Maximum were used for descriptive statistics related to the continuous data. In the evaluation of the data, variance analysis and regression analysis were used.

The mean age of the participants was 43.53 ± 7.86, 55.8% of the participants were 45 years old or older, 91.8% were married, the mean age of marriage was 23.92±4.59, 58.4% were high school graduates, 43.3% of their spouses were primary school graduates, and 70% lived in the city center for the longest period. 80.7% live in a nuclear family, 64.4% have equal income, 89.3% of participants are and 96.1% have social security.

Results and Discussion

It was determined that 70.4% of the men used a family planning method and 22.7% of the longest used method of family planning was withdrawal. According to the TDHS 2013 data, 74% of women use FP and the most commonly used traditional method was withdrawal (26%). The TDHS data are consistent with the research results. Withdrawal is the most common traditional method in Turkish society (Table 1). In the study conducted by Gilic et al. in 2009, the rate of withdrawal was 59.6%. In a study conducted by Şentürk Erenel et al. in 2011, shows that withdrawal is used at a rate of 26.7%. In another study conducted in 2014, the rate of withdrawal and other traditional methods was 41.2% (Gur Caliskan et al. 2014). As a result of the research, which shows a change in the use of traditional methods over the years, it is thought that the use of modern methods has increased (Santas & Celik 2018), but not at the desired level. Withdrawal results in reduced pleasure, low back pain and irritability in more than half (62.6%) of men (Ozara Koç, 2009) suggests that this traditional method is actually uncomfortable for men.

The outcomes in this study showed that men (42.9%) stated the chosen family planning method should be a method that the woman would use. To the question of who should decide to use an FP method, 62.2% of the men stated that they and their spouses should decide together. 31.8% of the men stated that using and providing a family planning method is the duty of the woman. To the question of "men's tubes can be tied after having enough children" stated that were disagree (Table 1). Almost half of the men think that the use of an FP method is the duty of the woman, but the spouses should decide together on the method to be used. This result suggests that the thoughts and actions of men are not very compatible with FP. As a result of the study, it was found that FP methods are still seen as the duty of women by men. It is seen that 79.4% of men do not look at tubing positively. The results of Ozara Koç (2009) revealed that women wanted an increase for FP methods for men, even though they state that the use of an FP method is an equal duty of both spouses, however the results of the research show that men do not agree. The results of the study can be considered as an indication that the gender egalitarian approach is still not applicable. On the other hand, in the research carried out by Guldal and his colleagues in Izmir, found that 22.8% of males said "it's the woman who should be protected", while 17.7% said "it's the male who should be protected", and 58.2% said "there is no difference" (Guldal et al. 2001). Examining the study of Sayan Cevirmen and colleagues, it was determined that the rate of participants stating that the responsibility had to belong only to the female (25.3%) is slightly higher than the ones saying that the responsibility should belong to the male (20.2 %). In the same study the rate of protection by vasectomy was found to be the lowest among the males, 0.6%). On the other hand, tubal ligation was preferred by 4.6% of women (Sayan Cevirmen et al. 2010). The findings of Cevirmen et al. show that men view the responsibility of FP belongs more to women.

The most accurate way to obtain information about the attitudes of individuals is to examine their behavior. However, individuals do not always turn their attitudes into behavior. Even if some attitudes turn into behaviors, individuals can still hide their real attitudes (Orsal 2006). The results of the research suggest that individuals hide their true attitudes. As their attitudes are close to the desired level (Table 3), there are differences in their thoughts (Table 1).

Table 1. Men's thoughts on FP (n: 233)

Expressions	Agree n(%)	Disagree n(%)
The chosen family planning method should be the method used by the woman.	100(42.9)	133(57.1)
The joint decision of the spouses is important in deciding on family planning methods.	145(62.2)	88(37.8)
Using the family planning method is the duty of the woman.	74(31.8)	159(68.2)
It is the duty of the woman to provide the family planning method.	80(34.3)	153(65.7)
If the married individual does not have children, he / she should not use a family planning method.	121(51.9)	112(48.1)
It is not appropriate to use a family planning method.	26(11.2)	207(88.8)
Family planning methods negatively affect sexual intercourse.	35(15.0)	198(85.0)
Family planning methods lead to infertility.	22(9.4)	211(90.6)
Family planning methods adversely affect health	33(14.2)	200(85.8)
The protection of the selected family planning method against STDs is not important.	36(15.5)	197(84.5)
After having enough children, women's tubes can be connected.	69(29.6)	164(70.4)
Men's tubes can be connected after having enough children	48(20.6)	185(79.4)
The withdrawal method is a reliable method.	105(45.1)	128(54.9)
The withdrawal method adversely affects men's health.	37(15.9)	196(84.1)
Only married women should use family planning methods.	118(50.6)	115(49.4)
Only married men should use family planning methods.	115(49.4)	118(50.6)
Infertile couples should not use the family planning method.	101(43.3)	132(56.7)
The family planning method used affects the sex of the baby.	13(5.6)	220(94.6)
Women should obtain information from female staff about family planning methods.	128(54.9)	105(45.1)
Men should receive information from male staff about family planning methods.	120(51.5)	113(48.5)
Abortion can be used as a family planning method.	43(18.5)	190(81.5)
It is the most natural right of spouses to have an abortion when an unwanted pregnancy occurs.	71(30.5)	162(69.5)
If my partner does not want pregnancy, I support having an abortion	63(27.0)	170(73.0)
It is a man who has to decide whether a pregnancy ends with abortion.	29(12.4)	204(87.6)

Table 2. Comparison of the mean FPAS scores by the descriptive characteristics of the males (n: 233)

Descriptive Characteristics Age (Year)	n	%	FPAS X±SS	Statistical Analysis
29 and under	12	5.2	142.08±12.74	
30-34	22	9.4	146.36±18.70	
35-39	24	10.3	143.16±13.93	
40-44	45	19.3	137.80±17.85	F= 0.937 p= 0.613
45 and above	130	55.8	134.59±22.14	
Education				
	51		133.60±22.23	F= 0.988

Primary education		21.9		p= 0.511
Secondary education	25	10.7	137.96±21.53	
High school	136	58.4	138.58±19.65	
University	21	9.0	140.42±20.20	
Family structure				
Nuclear Family	188	80.7	138.84±19.89	
Extended Family	37	15.9	130.59±22.02	F= 0.820
Broken Family	8	3.4	140.50±12.67	p= 0.824
Age of Marriage (Years) (n: 224)				
24 and under	137	58.8	138.74±19.40	
25-29	60	25.8	136.21±22.91	
30-34	21	9.0	136.38±18.93	F= 1.427
35 and above	6	2.6	132.83±20.30	p= 0.424
Economic Status				
Income less than expenses	60	25.8	134.68±20.95	
Income equal to expenses	150	64.4	139.26±19.69	F= 1.405
Income is more than expenses	23	9.9	134.26±21.15	p= 0.042
Longest Place of Residence				
Province	163	70.0	133.45±26.23	
District	19	8.2	126.94±22.50	F= 1.427
Village	51	21.9	118.77±25.80	p= 0.035

Table 2 shows the FPAS mean scores according to the descriptive characteristics of males. There was a statistically significant difference between the men's educational level, family structure, age of marriage, economic status, longest living place and mean FPAS score ($p < .05$). Gozukara et al. found similar outcomes (Gozukara et al. 2014). In the research of Günay et al., it was found that the FP knowledge level was affected by educational status and where they live. The level of knowledge of FP increases with education (Gunay et al., Yılmaz et al., Gozukara et al. 2015, Gilic et al. 2009, Katırcı 2008). This finding is similar to the results of the research. The fact that social security and income increases positively affected FP and the difference was statistically significant (Table 2) shows that these individuals increased their access to health services.

Table 3. Distribution of the mean scores of the males from the sub-dimensions and total mean scores of the FPAS, together with the lowest and the highest values of FPAS (n: 233)

Scale Sub-dimensions and Total Scale Scores	FPAS X±SS	FPAS Min-Max	FPAS Min-Max
Society's attitude towards FP	61.00± 10.61	23 - 75	15-75
Attitude on FP Methods	44.61±8.20	11 - 55	11-55
Attitude Towards Birth	31.97±6.90	8 - 40	8-40
Total Scale Score	137.59± 20.20	56 - 170	34-170

When the distribution of the mean scores of the males from the sub-dimensions of the FPAS was examined (Table 3); it was found that they received 61.00 ± 10.61 points from the "Society's attitude towards FP", 44.61 ± 8.20 points on the "Attitude on FP Methods" and 31.97 ± 6.90 points on the "Attitude towards Birth" sub-dimension. Similar results were found by Akin (Akin et al.2006). The results showed that men's FPAS total score was 137.59± 20.20. Another study found that women's FPAS total score was 120.11± 13.8 (Ayaz & Yaman Efe 2009), 124.20± 27.34 (Gozukara et al. 2015). In the research conducted by Cayan (2009) found that the women's average FPAS score was 130.28±13.81. In Tezel et al.'s (2015) study, it was found to be 130.72±26.10. The same research found that women scored 59.13±12.25 in the "Society's attitude towards FP" sub-dimension; 41.41±9.46 in the "Attitude on Family Planning Methods" sub-dimension; and 30.18±7.24 in the "Attitude towards Birth" sub-dimension of the FPAS. This study shows that the mean FPAS of males was found to be higher than women. Ciftcioglu and Karatas (2019) showed that the FPAS of males was found to be higher than women. Although the FPAS means of men were high, Ozara Koc (2009) found the rate of women who stated that they could not use modern methods was because they did not allow their husbands to use modern methods. This result suggests that although male attitudes are positive, other factors are effective in using methods. As a matter of fact, Gilic et al. (2009) stated that nearly half of the women (44.4%) did not plan their birth and Sentürk Erenel et al. (2011), in the same study, revealed that women's knowledge, attitudes and behaviors were not at the desired level (Gilic et al. 2009).

Table 4. Results of Regression Analysis of Variables affecting the use of FP

Independent Variables	Unstandardized Coefficients		Standardized Coefficients	Sig.	95.0% Confidence Interval for B	
	B	Standard Error	Beta		Lower Bound	Upper Bound
Age	-.264	.090	-.196	.004	-.441	-.087
Mariage Status	.438	1.744	.018	.802	-2.998	3.875
Education Level	1.337	.742	.117	.073	-.126	2.800
Family Structure	-3.252	1.537	-.152	.035	-6.281	-.223
Social Security	-8.821	3.455	-.160	.011	-15,630	-2,013

As a result of the univariate analysis, the variables which are statistically significant in linear regression analysis, only age, educational background, family structure and social security affect the attitude towards family planning, which is the sub-dimension of FPAS as an independent risk factor. In other words, it was found that the male participants were young and the family planning attitude was positive. As education level increases, attitudes towards FPAS family planning change positively. Family planning attitudes of the extended family was found to be negative. The presence of social security also affected the attitude positively (Table 4). Calıskan et al. (2014) found that being young and having higher education meant a preference for modern FP methods ($p < .05$). In their analysis of TDHS data in 2018, Santas & Celik found that education level, living in urban areas, health insurance, welfare level and spouse's education level affected the use of modern methods of women. In the study of Cayan (2009), a positive relationship was found between family planning and being a university graduate, discussing family planning issues with his / her spouse, and a perception of a high level of age and income. Conversely, Cayan also found that there was a negative relationship between family planning and having a primary school education, having lived most of their lives in a village and using the traditional method of FP. The results of Cayan's research are similar to those of the present study (Cayan 2009).

Conclusion

It was determined that 70.4% of the men used a method of family planning and 22.7% of the family planning method used for the longest period was the FP method of withdrawal. The males' FPAS scores were at a moderate level. The score was affected by the male participants being young and the nuclear family structure FP towards attitude being positive. It was found that as education level increases, attitudes towards FPAS family planning change positively. The Family planning attitude of the extended family was found to be negative. The presence of social security also affected the attitude positively. Although the attitudes of men are positive, they reveal that they still do not intend to take responsibility for the AP.

Recommendations

As a result of the research, it is suggested that counseling should be given to encouraging men to take equal responsibility with women on family planning methods by the nurses, is required. At the same time, it is suggested that conducting more detailed research investigating why men prefer to use the withdrawal method instead of modern FP methods. Although they have a positive attitude towards FP methods, it is also recommended to conduct research to find out why these attitudes do not turn into behavior.

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Author Information

Senay Pehlivan
Alanya Alaaddin Keykubat University, Turkey
Kestel Konya Cimento Street, Alanya,
Antalya / Turkey
Contact E-mail: senay.pehlivan@alanya.edu.tr

Ayfer Tezel
Ankara University, Turkey
Aktas Plevne Street, Altindag,
Ankara / Turkey

Ilknur M. Gonenc
Ankara University, Turkey
Aktas Plevne Street, Altindag,
Ankara / Turkey

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Wood is Present for all Humanity with Its Unique Existence

Ilker USTA
Hacettepe University

Abstract: Wood, which is the single most renewable natural material known to humans in due course of the sustainable forestry efforts, and that provides numerous benefits for all people since the beginning of recorded history with its anatomical structure, chemical composition, physical properties and mechanical properties, has the characteristics and features, all of which are construed as marvelous or miraculous in some way, in terms of meeting the needs and requirements arising in everyday life. Wood also stands out as an entity that has a positive effect on people's emotions, thoughts, attitudes and behaviors throughout history. Because wood is also known for providing communication, which is an exchange of information between two or more people belonging to different cultures, and/or among generations in the same culture, that is at the heart of human interaction, almost everyone agrees that wood is important and valuable as a material and an entity in the context of the development of civilization and humanity. In this article, therefore, depictions are made about the internality of wood, which is present for all humanity with its unique existence. This textual depictions are prepared with a woodlover point of view to exemplify the versatility and functionality of wood, which has been in use worldwide for thousands of years with a broad range of products or applications either alone or in combination with other materials in terms of the various purposes to live a perfectly happy and comfortable life.

Keywords: Wood, Intercultural interaction, Woodlover approach, Material properties of wood, Humanity

Introduction

It is certain that wood is a material with a deep-rooted history that is used in the same or very similar way in all cultures from past to present. Part of that is because wood is available in large quantities from sustainable forests, and it is also because wood is easily processable in a variety of different forms in order to produce something for a particular purpose. Although many researches have shown that wood is an important natural material and a valuable entity in terms of its distinctive properties, numerous issues still need to be addressed on the broader concept of the flexibility and usability of wood, with a need for providing more assessments of its versatility and functionality accompanied by innovation and creativity, which are still sorely lacking in order to make wood more approachable for solving a problem as alone or as a complementary material along with other components. Therefore, in this article explanatory descriptions are made about how wood has internality in terms of its characteristics and features as a material that provides countless benefits to people and as an entity that positively affects people. In this perspective, wood is depicted in the context of its great contribution to the development and spread of civilization and the advancement of humanity.

The Unique Existence of Wood

In a more general context, the eventual existency and uniqueness of wood can be considered with its tangible and intangible properties on the basis of its characteristics and features that make life easier and more convenient in many aspects. At this point, it is certain that the material properties of wood (based upon its anatomical structure, chemical composition, physical properties, and mechanical properties) are the subject of many researches as a vast subject which is studied from a very wide perspective. For that reason, the study of wood as a natural and an organic material and many of the issues faced in the professional activities related to wood have been treated with all the appropriate details in various specialized texts and reference works (e.g., Tiemann, 1944· Esau, 1953· Armstrong, 1955· LIFE Magazine, 1959· Stamm, 1964· Kollmann & Cote, 1968·

- Selection and peer-review under responsibility of the Organizing Committee of the Conference

Berkel, 1970· Siau, 1971· Skaar, 1972· Nicholas, 1973· Hoadley, 1980· Panshin & de Zeeuw, 1980· Zobel & van Bujitenen, 1980· Bodig & Jayne, 1982· Wilson & White, 1986· Bozkurt & Göker, 1987· Barnett, 1988· Fengel & Wegener, 1989· Tsoumis, 1991· Bozkurt, 1992· Eaton & Hale, 1993· Sjöström, 1993· Dinwoodie, 2000· Rice, Kozak, Meitner, & Cohen, 2006· Forest Products Laboratory, 2010· Shmulsky & Jones, 2011). And, of course, the studies, which focus on wood, have revealed that there is no doubt that wood, as a natural and organic material, has an almost limitless internality that provides great benefits to all people in the world. For example, as one of these studies aiming to shed light on the place of wood in our lives and its role in the development of civilization, the importance of wood as a material and its value as an entity has been explained extensively in a diverse themes in various publications by Usta in national or international journals or congresses between 2014 and 2018 in view of its properties that make life easier and definitely better in many ways for various reasons. As the characteristics and features available in wood have always been considered a core subject of many studies performed with either general or more specific severity and priority criteria in the field of wood science and technology and other related areas, the unique existence of wood can be clearly stated and explained from different angles and points of view by a high number of thematic titles. Accordingly, wood has been depicted by Usta (2014, 2015, 2016, 2017, 2018) in accordance with the studies of the different and common aspects of wood as a material and an entity, and the possible assumptions and intellectual approaches regarding the provision of individualized support for both learning and teaching wood as well as building social awareness have consistently been fictionalised throughout almost all his depictions. In fact, his writings about wood might be quite impressive, because this writings are steeped with a sense of identifying the acceptable views and describing absolute reality on the basis of examining a particular set of issues that what way can the studies of wood contribute to our understanding of communication, interaction, culture, and civilization.

It is a long established fact that wood is an irreplaceable material and a magical entity in the development of civilization and the advancement of humanity, because it is a renewable natural material obtained from trees as a reflection of nature with the means of the sustainability efforts, and it is also an extraordinary tool in intercultural interaction throughout all stages of societal development forming the continuous advancement of humanity. Although it has certain names in every language with respect to cultural differences and lifestyles, wood is a universal material and has served all people throughout history with an almost limitless variety and has provided tremendous benefits to everyone. Surely wood has always been an indispensable material and a remarkable entity in the history of civilization regarding with its superior characteristics and fabulous features that are naturally occurring on the basis of its anatomical structure and chemical composition, and physical properties and mechanical properties. At this point, it can be clearly said that wood is present for all humanity with its unique existence due to its versatility and functionality in the sense of flexibility and usefulness since the beginning of mankind. In this context, because wood is a wondrous material to meet the different needs and requirements of people and is an outstanding entity of the world that affects people's feelings and thoughts, it is one of the most widespread and potentially generative resources on earth that can be adapted in several applications and turned into various types of products to facilitate mundane activities of daily life.

Characteristics and Features of Wood

The most fascinating truth is that wood is a versatile and functional material that can be used in many different ways for a variety of purposes based solely upon its characteristics and features that each of them has a separate definition from the other. This concept and the terms "characteristics" and "features" have been described in detail previously by scientists. Although the characteristics and features of wood, as two distinct phenomena that could be featured by a variety of contexts, are a technical issue in the field of wood science and technology evaluated by numerical values based on experimental findings, they are generally explicable in terms of understanding of wood by everyone. To put it briefly, these two phenomena have completely different meanings: a) the characteristic is the key distinguishing trait of wood, and can vary within and between tree species, and hence this means that anatomical structure and chemical composition of wood are subjected to identical formations with the characteristics of trees which provide us wood as a natural and organic material, and b) the feature on the other hand is the most closely related transformation that occurs depending on the typical characteristics of wood, and thus both the physical and mechanical properties of wood are the features represented dependently on the characteristics in terms of the anatomical structure and chemical composition of wood. In a wide sense, the characteristics of wood concerning the anatomical structure and chemical composition are souls of all features in wood with regard to the physical properties and mechanical properties.

Wood is a natural material harvested from trees grown in the sustainable forests, and it is an organic material with having hygroscopic behaviour and also heterogeneous and anisotropic attributes that allow us to widely acknowledge that it is a living asset with a genuine instinctive effort. In this circumstance, wood, which is a

natural and organic material, is perhaps the most obvious example of fibrous and porous materials that have expressed botanically as a function of its cellular nature. In this context, according to the microscopic observations and the findings of the experimental studies which are previously described what it refers to be technical and vocational means in literature, wood has the fibrous and porous structure anatomically consisting with the three-layered cell wall (which is constructed with the microfibrils oriented at various angles to the longitudinal direction) and the lumen, and the cells are composed of cellulose, hemicellulose, lignin, and a small amount of extractives (that are extraneous materials containing several types of inclusions deposited in wood in due course of growing a tree). Besides, the anatomical structure of wood is shaped by the growth rate of the tree from which wood is taken, which varies from species to species throughout in either softwoods (needle-leaf trees, or conifers) or hardwoods (broad-leaf trees, or broadleaves), emerges with the growth ring formation based upon the growth ring width and also the proportions of earlywood (springwood) and latewood (summerwood) per unit length within annual growth rings. Likewise, the chemical composition of wood is also based on the structural organization of cell wall, and therefore it appears a reflection of the cell structure of wood. In that sense, the chemical composition of wood varies from one species to another, but it mainly consists of carbon, oxygen, hydrogen, nitrogen, and other elements (in terms of the components assimilated by the tree from which wood is obtained according to the conditions in the growing environment) by weight.

As we may surmise from the paragraph above, wood has many different features in terms of the physical and mechanical properties, each of which can be evaluated separately. In this frame, the physical properties of wood are those that influence its capacity of utilization as a raw material for making products for different purposes in a wide range of needs and requirements. The prominent topics adjacent to the features with a lot of specialist terminology related to the physical properties of wood could be listed predominantly as follows: a) density (used here synonymously with spesific gravity), value of unit weight (also known as the green weight), porosity (the certain amount of void volume), b) hygroscopicity, absorbability in accordance with adsorption and desorption, moisture content, fibre saturation point, swelling and shrinkage, c) diffusion, surface tension and capillarity, drying, permeability, amenability to preservative treatment, d) specific heat, e) thermal properties on the basis of thermal conductivity, thermal diffusivity, thermal expansion, and thermal insulation, f) electrical properties in terms of electrical resistivity and electrical conductivity, g) acoustical properties based on the sound conduction, sound absorption, and sound dampening, h) adhesion properties as related to gluability and surface finishing. Wood of course, is composed of cells, has the mechanical properties that are measures of its resistance to the action of the exterior forces which tend to make a deformation at a given rate. The ones that are the most important mechanical properties of wood well known for a wide variety of applications are as follows: a) elasticity, strength in bending, modulus of elasticity (MOE), modulus of rupture (MOR), b) strength in tension, strength in compression, c) strength in shear, d) torsional strength, e) cleavage, f) nail and screw holding power, g) hardness, toughness, h) wear resistance.

In considering the capillary system of wood consisting of the cell walls and the cell lumina, it is clearly seen that the cell structue influences both physical and mechanical properties of wood, and this leads us to the understanding that the features are depended on the characteristics. On the other hand, both of the physical and mechanical properties have direct or indirect effects on the use of wood for various purposes referring to density and moisture relations that affect the choice of wood for manufacturing of goods and items ordered within the general or special reasons, whether or not material is procured from either coniferous or broadleaved trees. In both cases, since wood is a fibrous and porous material, the physical and mechanical properties of wood are primarily shaped by specific gravity (or usually referred to as density) which is the net amount of wood per unit volume (that is to say the actual quantity of wood available in the cell wall in the unit volume), and are defined by the amount of moisture retained within the cell cavities of wood and also in intermicellar and intermicrofibrillar spaces in the cell wall. In the light of these explanations, considering the conspicuous differences in the qualities and attributes of wood material, physical properties and mechanical properties are mainly correlated with density and moisture content. In view of the moisture content, which can be thought of as the amount of water within the all possible cell voids of wood, the presence of excessive or of deficient moisture in wood can adversely affects the internal consistency and dimensional stability of wood material and thus its quality and usability. Therefore, understanding the correct moisture content of wood as well as maintaining it by accurately providing the aceptable level of moisture using different methods of drying prior to use, is absolutely essential to ensure the material quality of wood in terms of both physical and mechanical properties.

Tangible and Intangible Assets of Wood

It is pretty obvious to us that wood, which is the most beautiful and creative material in the world because of its unlimited availability providing a vast array of unsurpassed offerings for the production of products in many

different ways in different contexts for different purposes, is by far the most famous material around the world since the ancient times with its positive and motivational qualities. Correspondingly, it is no doubt that we can clearly visualize a wide variety of such offerings of wood with an impressive array of products available in many categories that are ideally suited to meet the needs and requirements of people in almost all parts of the world. It should further be noted that we can envisage the part of the activities of organic lifestyle that rests upon the reasonableness and part of the contemporary experiences of the mere fact of living a more natural life combining a reasonably diverse set of potential applications of wood that has existed for centuries in other cultures, and other customary conditions consisting solely of environmentally friendly materials that can be recycled relatively easily without any loss of utility. By far the most important concept on this depiction is understanding the availability of wood as a natural material and a valuable entity. At this point, it may be able to say that the most inspirational and powerful things in life to live a passionate and purposeful life is that the consciousness, which is an awareness or perception of something, is the only reality. In this respect, because wood is the most applicable material in a wide variety of applications by means of a broad range of products in the context of different purposes, it is worth acknowledging that the only reality is wood.

It is evidently true that wood, as a natural material and a valuable entity, has tangible and intangible assets in a form that these are evaluated as the most impressive and attractive properties of wood at first glance along with its characteristics and features in some situations. In this case, tangible attributes of wood are those properties capable of being handled or touched and may be evaluated by the senses, whereas intangible properties of wood may be evidenced by its intrinsic value according to the possibilities of satisfying expectations and the range of individual or social benefits from actively engaging with multiple point of views. Indeed, wood has the various perceptible attributes that can be easily perceived by the senses or grasped by the mind to be capable of being handled or touched or felt based on the appearance and weight as well as the usage functions of wood such as colour, luster, odour, and texture. Besides, wood, which is a good-natured and affable entity showing friendly warmth, is a natural material that appeals to the senses and emotions. Accordingly, wood is valuable material that directly or indirectly affects people's attitudes and behaviors and feelings and thoughts in a positive way and allows people to feel good at all times. It is true, therefore, that in the context of the tangible and intangible assets of wood based on the whole range of its characteristics and features, in terms of the process of socialization as well as the functioning or flourishing civilization, wood provides a wide range of interactions and relationships between societies in different cultures, and also among individuals within the same culture.

Conclusion

Wood is a material that has played a major role in the development of civilization and the advancement of humanity by using widely in order to meet the needs and fulfill the requirements with its superior material properties, and has witnessed the flow of history from the beginning of time to the present.

In this context, in this article, the unique existence of wood is depicted based on the fact that wood is an important material and valuable entity that has provided countless benefits for humanity throughout history with its both typical properties and specific assets either tangible or intangible. Obviously, wood is such an important and valuable natural material that it is the most prominent representative of sustainability because of its renewability, and also it is a symbolic figure of creativity and innovation since it is used in many different ways for almost limitless purposes. It is absolutely true that wood has always been by our side with its natural warmth and versatility since the beginning of history and did not leave us alone in fulfilling the needs and requirements of life, and is never ordinary with its many advantages and numerous benefits for everyone. However, although wood is always standing beside us, we may deem its contributions to us to be insignificant. But most importantly, if we could change the way we see it, we can see the ways to benefit from wood more efficiently and effectively. In other words, at this point it is up to us for widening the use of wood in different ways by thinking in a certain way to find out reasonable solutions for our needs and requirements present in every area of our lives. Typically, wood has always offers us an utterly bewildering array of possibilities and opportunities for our choices, and so we love wood with a deep passion and the full array of feelings and thoughts. It is quite clear that as the challenges that we face everyday should be solved in an acceptable way, wood leads us to overcome obstacles in our life by providing us many useful everyday items. In this situation, we should find out the most suitable options to ensure the implementation of wood using with the whole range of experiences and knowledge as well as consistency between the various activities that are linked by the mundane tasks of daily life. For this, we need to think broadly and consider other people's thoughts about wood with great care and sincerity. At this point, given the great contribution of wood to the development and spread of civilization as an intercultural interaction tool, the common or similar views of people of different cultures about wood are confirmation of the universality and uniqueness of wood. Certainly, the living conditions in which we aware

explain in part why people from different cultures are more predictive for diverse lifestyles in terms of using wood to make a wide variety of desired goods and services for fulfilling the needs and requirements in relation to the mundane daily activities. In these circumstances, it is perfectly true that wood deserves to be applauded at least once in our lives thanks to its naturality and renewability, and its versatility and functionality.

This article contains original depictions of Professor Ilker Usta with the emphasis of "Wood is Present for all Humanity with its Unique Existence" that have been made within the course "Importance of Wood in Intercultural Interaction", which is a new elective course for students of Hacettepe University (Ankara, Turkey) designed in 2013 when updating the curriculum of Wood Products Industrial Engineering due to the scope of the Bologna Process and launched under the Elective Courses Coordination Unit within the responsibility of the School of Vocational Technology, in terms of raising awareness about wood by introducing its importance in the development of civilization as well as its role in improving the quality of life to the university students studying in programs apart from the field of wood science and technology. In this context, the containments forming for these depictions written in terms of the woodlover point of view are internalized with professional and/or technical knowledge, and although the sources that are taken into consideration for fulfillment the particular theoretical explanations to strengthen wood awareness or for writing the general descriptions to introduce wood efficiently are shown in the reference list, comprehensive knowledge about wood can be elaborated in greater detail elsewhere in the literature.

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Author Information

Ilker Usta
Hacettepe University
School of Vocational Technology
Department of Wood Products Industrial Engineering
06532 Beytepe Campus
Ankara / Turkey
Contact E-mail: *iusta@hacettepe.edu.tr*

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Opinions of Academicians on Teaching Sociology Subjects in Social Studies Course

Ozkan AKMAN
Gaziantep University

Abstract: We live in an age of social changes where technological developments reach the highest levels thanks to the level of knowledge achieved. The direction of these changes, in other words, will be the most dynamic and openest part of the society. In spite of this importance that should be given to youth in terms of the future of our society, problems such as unemployment and inflation, especially caused by the inadequacy of the education system in general and the social structure in general, cause the young population to be worried about their future. It would be too optimistic to expect a mass of people who pursue their individual concerns about the future to take action by considering the general interests of society. Sociology starts with life science course in primary schools and continues with social studies course. Sociology is one of the main disciplines of the social studies course which includes many disciplines. The purpose of this research; The aim of this course is to examine the views of academicians about teaching sociology subjects in social studies course. The study group consisted of 4 academicians working in 4 different universities. This research was prepared by using semi-structured interview technique which is one of the qualitative research methods. The data of the study consisted of six open-ended questions with semi-structured views of academics. The analysis of the data was presented by shortening the answers given by the working group. According to the results obtained, social studies course is related to many disciplines, but it is obtained that sociology subjects are given less importance than history and geography course. In our country, suggestions have been made such as giving more place in sociology teaching of sociology due to refugee problem and social events.

Keywords: Sociology, Social studies, Social events

Introduction

In order to explain the social foundations of education, it is necessary to examine some basic concepts about sociology which is the science of society. If so, it is useful to start by first answering the question of what is Sociology. Sociology is the scientific examination of the relations of people with each other. The word Sociology consists of the combination of the words "Socius" and "logos". Of these Latin words, Socius means community, and logos means word, information bundle. For this reason, most of the social scientists, this branch of the "social science" is also called (Aslan, 2001).

Since the beginning of the history of humanity, people have been living in a collective and social way. The collective lives of people continue today as in the past. There is no doubt that the same situation will continue in the future. Sociology is the branch of science that deals with society and social relations (Doğanay, 2008). Sociology in the West, in the turbulent process that emerged with the French and Industrial Revolution in the 18th and 19th centuries, that is, in the chaotic environment where industrialization, rapid population growth of urbanization, increasing immigration and mass labor movements are experienced intensively, the problems emerged in order to find solutions to them (Yavuzer, 2015).

The social events in France, England, Germany and Europe prepared the ground for the birth of the science of sociology and spread over time to other places. Today, sociology and sociology education have become important in many places around the world. Along with the industrial revolution, there have been important changes and developments in the countries where this revolution took place. These changes and developments soon affected the Ottoman Empire. Sociology has been a source of hope for the emancipation from the chaotic

environment that has occurred due to the changes and developments in both Turkey and Europe (Keçe & Merey, 2011). Today, both are also experiencing a very rapid change in Turkey in the world. This change and development is affecting life more and more every day. The rapid change and development in technology, especially in communication and transportation, brings convenience in many areas and raises new problems in many areas. Sociology and sociology education is gaining more and more importance both in our country and in the world in parallel with the changes and developments experienced today as in the years of its emergence. In order to keep up with these changes and developments, in order to follow and control the developments and changes, sociology education is carried out in secondary education in high school and higher education in both undergraduate and graduate and doctorate level. Compared with the old sociology getting more important every day in Turkey and widespread (Yavuz, 2015).

What is Social Studies? When asked the first answer given; Ders History, Geography and Citizenship birlikte. If we take into account that one unit of history and one unit of geography are covered in social studies courses until 2005, it is not surprising to say these definitions (Doğanay, 2008). In order to explain that social studies are not only about history, geography and citizenship, it is important to recognize the basics of social studies and the disciplines that constitute social studies. Social studies have many purposes. Many disciplines are also used to achieve this goal. This process requires interdisciplinary cooperation and interdisciplinary approach. Because social events concern many disciplines. If a historian looks at an event from his point of view, philosopher from his point of view, theologian from his point of view, psychologist from his point of view, a healthy analysis and determination cannot be made (Doğanay, 2008). Therefore, it is necessary to make an evaluation by looking at the whole picture with a more general and holistic approach. In this context, it is necessary to know the disciplines that make up social studies and to understand their place in social studies (Keçe & Merey, 2011). The importance of interdisciplinary approach is emphasized in the social studies program which has been prepared in our country in November 2003 and has been implemented since 2005 academic year. In this context, it is thought that social studies gains are in line with the data and interdisciplinary understanding of the disciplines constituting social sciences (Keçe & Merey, 2011).

Sociology is a science that examines the social realities that exist in our social lives, the groups formed by people, the behaviors of groups, social institutions and how the social environment affects our thoughts, feelings and behaviors (İçli, 2005). Sociology is one of the most important sub-disciplines of social studies because it directly examines society and its problems. In the social studies course, the student can become a person who is at peace with the society by taking the data of the structure and characteristics of the society and internalizing them (Keçe & Merey, 2011).

Social studies first appeared in the United States in the early 19th century as a concept. In those years, the word social was one of the popular words, and it was an adjective almost at the beginning of many reforms. For example, social development, social productivity, social reality, social research, social control, social education and so on. (Doganay, 2008). At the end of the eighteenth century, reformist educators started to develop a new education program for a newly developing urbanized industrial era (Çetin, 2003). One of the main reasons for these developments was to provide the necessary environment for the Americanization of immigrants coming from various parts of the world. The history lesson in the school programs provided chronological information about the past, disconnected from current events and problems. After the publication of the Social Studies in Secondary Education report by the National Education Association in 1916, the term social studies was frequently used. The concept of social studies, which is highly influenced by the ideas of John Dewey and James Harvey Robinson, one of the leading representatives of the progressive philosophical movement, assumed the function of citizenship education for a democratic society (Doğanay, 2008).

Edgar B. Wesley, one of the leading leaders of the social studies movement, defined social studies as basit the simplified form of social sciences for pedagogical purposes 19 in 1937 (Doğanay, 2008). The pedagogical objectives in Wesley's definition highlighted the needs of society and students. While history has always maintained its place among the simplified social sciences, political science, geography, economics, sociology, anthropology and psychology have taken their place in the program at different times (Çetin, 2003). Although Wesley's definition expresses a disciplinary approach to social knowledge, pedagogical aims have enabled this knowledge to be integrated into the needs of society and students (Doğanay, 2008).

When the objectives related to this knowledge, skill, value and social participation to be gained by the students are examined, it can be said that almost all of these aims are related to cultural elements and it is necessary to benefit from cultural elements in social studies course (Ergün, 1994).

According to Sozer (2008), social studies constitute an important part of the basic and general information about the lives, relationships, culture and place of people in a society. Social studies integrate the knowledge of the basic cultural elements into the information by selecting and kneading them from the findings obtained from the studies in many fields with an interdisciplinary approach. Deveci (2009) states that each society tries to develop existing culture by introducing its own culture to the young members of the society. In this study, it is aimed to examine the sociology subjects in the social studies course in line with the opinions of academicians with the literature. For this purpose, the following sub-problems were sought:

- What do you think about the appropriateness of social studies course achievements to social science disciplines and interdisciplinary understanding?
- What are the topics directly related to the social studies course?
- Does the social studies course contribute to social change?
- What are the contributions of Social Studies to Socialization?

Method

In this section, the design of the research consists of working group, data collection tools and data analysis.

Research Design:
This research was obtained by preparing semi-structured interview form which is one of the qualitative research methods.

Working Group:
This research consists of 4 academicians working in social studies education department in 4 different education faculties.

Data Collection Tools*:*
The data of the study consisted of 4 semi-structured open-ended questions given to the study group.

Data Analysis:
The analysis of the research data is presented by shortening the opinions of the academicians in the study group. Comments were made in line with their opinions. The views of academics are coded as A1, A2 ..... A4.

Results

Findings and comments for the First Sub Problem:

What do you think about the appropriateness of Social Studies Course Achievements to Social Science Disciplines and Interdisciplinary Understanding? Questions to;

A1: When the achievements of social studies lessons are examined, it is seen that the majority of them are related to psychology, but there are also data on the discipline of history and the acquisition of scientific thinking processes. For example, the achievement of ar puts the main events in life in chronological order ınd is within the scope of history discipline. In addition, the analysis of the information in the official identity documents that it possesses inferences about its personal identity shows that it is aimed at improving the scientific thinking skills of the student, unlike the social science disciplines...

A2: Although it is seen that the gains reflect primarily the data of the discipline of history, there are also gains in the fields of anthropology, sociology, citizenship and Kemalism. It is an example that the acquisition of disiplin recognizes the elements reflecting the national culture of the family and the environment ait belongs to the discipline of anthropology...

A3: In addition to the fact that the gains are directly related to the geography, it is seen that the gains generated from the historical data are also included. By making use of legends, epics, stories, folk songs and poems, he makes inferences about the geographical characteristics of the place he lives in....

A4: Although it is directly related to science and technological developments, there are also data on the disciplines of geography, history and sociology. For example, taking into consideration the changes made by

technological products in our lives and our environment, it compares the past and the present, and when the gains are examined, data on sociology, history and scientific technological developments are presented here...

Findings and comments for the second sub-problem:

What are the topics directly related to the social studies course? Questions to;

A1: They stated the subjects of Social Studies course that can be directly related to the society and the applications they have made in teaching these subjects. Since 2005, the Social Studies course has been established by the Board of Education. groups, institutions, social organizations; culture and heritage; power, governance and society; people, places and environments; science, technology and society; global connections; economy and social life; our country and population; communication and human relations; It is stated as the adventure of democracy.

A2: It is seen that the subjects expressed by the Social Studies teachers within the context of the issues that can be directly related to the society are in line with the issues related to sociology in the program. This situation can be interpreted as classroom teachers are aware of the issues that can be related to society.

A3: It is seen that the subjects that can be directly related to the society are generally the same in all socio-economic levels, but the practices in teaching these subjects differ according to the socio-economic level where the school is located.

A4: Applications that cannot be done in schools at socio-economic level include group invitations, internet softwares, internet research, studies with families and trips. The reasons why these practices cannot be included can be explained by the inadequacy of the financial resources of the school, the lack of interest of the families, the low level of education of the families and the low economic level of the families.

Findings and comments for the third sub-problem:

Does the social studies course contribute to social change? Questions to;

A1: Opinions about the social change dimension of the social studies course in schools at all socio-economic levels: by teaching the rules of etiquette; gaining knowledge and skills; teaching the administrative structure and history of the country; contributing to values education; It contributes to social change by raising sensitive citizens towards the country and the world...

A2: Traffic rules; economic thinking; conscious consumerism; harms the use of harmful substances; Social Studies course has an impact on social change by teaching the functioning of official institutions and their role within institutions and through children teaching their families what they have learned at school....

A3: Social Studies course contributes to social change by teaching how to become a conscious consumer....

A4: I think that Social Studies course is not effective enough on social change because of the contradictions between what is learned in Social Studies course and the characteristics of large family structure ", sağlama Providing social participation and inadequate implementation of what is learned"....

Findings and comments for the fourth sub-problem:

What are the contributions of Social Studies to Socialization? Questions to;

A1: Regarding the socialization dimension of the Social Studies course, in schools at all socio-economic levels: Learning about their rights and responsibilities; To gain cultural values adopted in society; He has theoretical and practical areas such as communicating with the elderly through oral history studies...

A2: Contributes to the socialization dimension by serving the learning of rights and responsibilities...

A3: Learning about their rights and responsibilities, gaining cultural values adopted in the lower-middle-upper society, communicating with the elderly through lower-middle-upper oral history studies, communicating with peers through lower-middle-upper collaborative studies, and carrying out studies with middle-upper families. contributions are .....

A4: The course which has the primary effect on the socialization of the individual is the social studies course .....

Conclusion and Suggestions

In line with the views of academicians, although it is emphasized that the subjects are discussed in a multidimensional way related to history, geography, citizenship, economics, psychology, sociology, anthropology, law and education, it is seen that most of the program consists of knowledge of history, geography and citizenship on the basis of one disciplinary understanding. It can be said that they have sufficient information about osy concepts and issues related to sociology Sosyal in Social Studies course. In the Social Studies course, it was observed that the activities performed in the processing of the subjects directly related to the society were generally at the level of knowledge in the schools located at the lower socio-economic level; It was concluded that sufficient cooperation with society, institutions and non-governmental organizations could not be achieved. It can be said that the effect of Social Studies course on social change is inadequate in lower socioeconomic level schools. When the views of social studies teachers on the "socialization" dimension of the Social Studies course are examined, it is possible to communicate with their peers in collaborative studies; their opinions about carrying out studies with families were expressed only in the schools at the middle and upper socio-economic levels, but not in the schools at the lower socioeconomic level. In the light of these results;

- First of all, the gains in the social studies curriculum should be structured in accordance with the disciplinary understanding in general and the number of the gains prepared in this way should be increased.
- Studies can be conducted in which the sociological dimension of the Social Studies course is evaluated based on the views of different stakeholders such as students and families.
- Due to the refugee problem and social events in our country, sociology needs to be more involved in teaching social studies.

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Author Information

Ozkan Akman
Gaziantep University
Gaziantep University Nizip of Education Faculty
Gaziantep / Turkey
Contact E-mail: *akmanozkan@hotmail.com*

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Contribution of Artvin Bilim ve Robotikle Renkleniyor Project to Middle School Students' Science Opinion

Sibel ACISLI
Çoruh University

Hatice KUMANDAS OZTURK
Çoruh University

Abstract: This study aims to reveal the opinions of middle school students regarding science after attending "Artvin Bilim ve Robotikle Renkleniyor" project including variety of science activities related with robotic, science and nature under the scope of TÜBİTAK 4004 Nature and Science School program. Data of the current study was collected via a personal information form and a survey from a total of 30 6th and 7th grade students in six middle schools in Artvin province who participated in the project. In this study, a two-question survey developed by Akay (2013) was used to reveal the students' opinion regarding science. Qualitative data of the study were analyzed by using content analysis method and quantitative data were analyzed by giving frequency and percentages. 19 of the students are female and 11 are male. 14 of these students are in 6th grade and 16 of them are in 7th grade. At the end of the project, students were asked to define science and the students were asked what would you like to invent if you were a scientist. Moreover, researchers tried to determine how the students' attitudes towards science changed after the project. When the respond of the students were examined, it is seen that most of the students define science as the work of producing new things, discovering and explaining the universe. In addition, the students stated that they want to build a time machine that facilitates transportation if they were a scientist. Furthermore, the number of students who want to discover a flying car and teleportation tool is higher than others. In general, it is seen that most of the student want to discover transport and technology related products. Most of the student state that their science interest has increased after the Project. Moreover, the number of students who realize the importance of science and increase their curiosity and desire to learn is also high. So, it can be said that the project has increased students' positive perceptions towards science.

Keywords: Science school (camp), Science, Middle school student, Active learning

Introduction

Quality science teaching is evaluated as a key point of world's future in terms of the future of the nations considering the fact that scientific knowledge increase incrementally, technological innovations advance at a great pace, and the effects of science and technology are felt in every field of life (Yalçın and Şişman, 2018). Becoming a society of the 21st century is through raising scientifically literate individuals who can respond to the increasing values and adapt to the science age (Doğanay, 2002). Since we are living in an age which is named information age due to the rapidity of accessing information, societies continuing their existence today are called information society (Yankayış, Güven and Türkoğuz, 2014). Certain innovations are required due to reasons such as the rapid changes in the information world, increasing education standards, increasing classroom sizes, and the fact that technology advances faster than education (Balcı, 2007). The individuals in the developing world are required to produce information and technology instead of taking information and using when necessary and to be interrogative instead of acceptive (Aydoğmuş, 2008). TÜBİTAK (The Scientific and Technological Research Council of Turkey) which desires a vast majority of target group, ranging from students to public employees, to interact with science, implemented a program named 4004 - Nature Education and Science Schools and the projects supported within this context provide significant opportunities in terms of

eliminating the insufficiencies of formal training programs on nature-environment and procuring nature-friendly individuals to the society (Avcı et al., 2015).

When the science school projects in our country are examined, Marulcu, Saylan, and Güven (2014) determined that most of the primary-school students participated in the "Little Scientists Science School" project supported by TÜBİTAK found it entertaining and the conducted activities contributed students to associate the subjects they learn in courses with daily life. Yıldırım, Atila, and Doğar (2016) determined that primary-school students participated in the "Little Scientists Explore" project carried out by TÜBİTAK found the activities conducted in the project more entertaining and favorable than the activities conducted in their schools and students acquired numerous knowledge in these activities. Tekbıyık et al. (2013) reported that the attitudes of primary school students, who participated in a summer science camp based on active learning, towards science increased significantly after the camp. In the study of Akay (2013), it was determined that the perspectives of middle-school students participated in the "Learning by Doing Summer Science School" project carried out by TÜBİTAK towards science and scientific knowledge increased positively as a result of learning different scientific activities by doing and with active learning. In the study of Buluş Kırıkkaya, Bozkurt and İmalalı conducted on 2010, it was determined that students, who participated in the "Evaluation of the Little Scientists' Science School" project supported by TÜBİTAK, were quite satisfied since they were learning through entertainment and participated in the long-lasting activities without getting bored. According to the study of Konur et al. (2011) conducted on the evaluation of science camp, it was stated that science camp influenced students to develop positive attitudes towards the science course and the scientific activities carried out in the camp and scientific environment had significant roles in reaching this conclusion.

It is considered that determining the opinions of children towards science, revealing their ideas towards science as a result of activities they participate in science schools/camps and making necessary regulations for applying these teaching-learning processes in schools can be a significant foundation both for the society and the future generations (Akay, 2013). In this context, this study was conducted in order to examine the opinions of 6^{th} and 7^{th} grade students towards science after they perform different active learning and learning by doing activities in the learning fields of robotics, nature, and science in the "Artvin Bilim ve Robotikle Renkleniyor" (Artvin is Enlivened with Science and Robotics) project which was based on robotics activities and supported by TÜBİTAK within 4004-Nature Education and Science Schools projects. Within this scope, the direction and degree of the effect of activities in the project to the participants were researched. In this context, the participants were asked "What do you think science is?" and "If you were a scientist, what would you like to invent?" and the data obtained from the participants were analyzed.

Artvin Bilim ve Robotikle Renkleniyor project was carried out between the dates of 1-7 July 2019. 30 students participated in the project of which the total application duration was 7 days. 19 of the students were female and 11 of them were male. 14 of these students were in 6^{th} grade and 16 of them were in 7^{th} grade. The survey model was used in the study. Personal information form was used in order to collect data on the personal information of the students and a two-question questionnaire developed by Akay (2013) was used in order to reveal the opinions of students towards the concept of science. Quantitative data were collected with personal information form and quantitative data was collected with the questionnaire. Quantitative data was analyzed with the content analysis method and qualitative data was analyzed by giving frequency and percentages. At the end of the project, the students were asked to define science and the question of what would you like to invent if you were a scientist. Furthermore, it was also aimed to determine the perspectives of students participated in the project towards science after the project. A questionnaire developed by Akay (2013) was used in order to reveal the opinions of students towards the concept of science. Quantitative data was analyzed with the content analysis method and qualitative data was analyzed by giving frequency and percentages.

Table 1. Opinions of participants towards science

	f
The profession of producing, inventing, exploring new things	9
Everything that changes humans and life	3
Set of knowledge that explains the universe	7
Way of reaching information based on observation and experiment	6
Way of fulfilling desires and needs	2
Performing useful works for humanity	4
The profession of explaining the unknown by using consistent information	2

When Table 1 is examined, it was observed that the most stated definition about science by the students was; it is a profession of producing, inventing, exploring new things (f=9). The second most stated definition about science was; it is the set of knowledge that explains the universe (f=7). The third most stated definition about science by the students was; it is a way of reaching information based on observation and experiment (f=6). On the other hand, the least stated definition about science by the students was; the profession of explaining the unknown by using consistent information (f=2).

Table 2. The things that students want to invent

		f
Technological tools	Artificial planet	1
	A machine that examines animals	1
	A mind-reading machine	3
	Construction robots	1
	Precision telescope	1
	A machine that corrects errors or mistakes	1
Vehicles that facilitate transportation	Flying car	4
	Teleportation machine	6
	A vehicle that can travel everywhere in space	3
	Time machine	9
Inventions aimed at protecting the environment and nature	A gas that would prevent ozone layer depletion	1
	A machine that regulates, changes climates in accordance with the needs	1
Inventions on health protection	A patient's bed that determines microbes	1
	A vaccination that prevents Alzheimer's disease.	1
	A vaccination that cures cancer	2
Inventions aimed at other purposes	Everything that would be beneficial for humankind.	1
	A handicap-accessible vending machine	1

When Table 2 is examined, five categories were determined from the answers of students. These categories were created as a result of the evaluations of the specialists. These are; technological tools, vehicles that facilitate transportation, inventions aimed at protecting the environment and nature, inventions on health protection, inventions aimed at other purposes Under the technological tools category, the things that students wanted to invent were respectively; a mind-reading machine (f=3), artificial planet (f=1), a machine that examines animals (f=1), construction robots (f=1), precise telescope (f=1), and a machine that corrects errors or mistakes (f=1). Under the vehicles that facilitate transportation category, the things that students wanted to invent were respectively; time machine (f=9), teleportation machine (f=6), a flying car (f=4), and a vehicle that can travel everywhere in space (f=3). Under the inventions aimed at protecting the environment and nature category, the things that students wanted to invent were respectively; the machine that regulates, changes climates in accordance with the needs (f=1), and a gas that would prevent ozone layer depletion (f=1). Under the inventions on health protection, the things that students wanted to invent were respectively; a vaccination that cures cancer (f=2), a vaccination that prevents Alzheimer's disease (f=1), and a patient's bed that determines microbes (f=1). Under the inventions on health protection, the things that students wanted to invent were respectively; a handicap-accessible vending machine (f=1) everything that would be beneficial for humankind (f=1).

Table 3. The perspectives of participants towards science

		f
The contribution of the project to the perspective towards science	The increase of interest in science after the project	10
	Recognizing the importance of science	5
	Increase in the sense of wonder towards the unknown	4
	Increase in the desire to learn new information	4
	Recognizing the entertaining aspect of science	4
	Increase in the interest towards robotics coding	2
	Acknowledging that it is not difficult and impossible to do science	3
	Elimination of prejudice towards science	2

When the contribution of the project to the perspective of students towards science in Table 3 is examined, it was observed that the statements of students were respectively; the increase of interest in science after the project (f=10) recognizing the importance of science (f=5) increase in the sense of wonder towards the unknown (f=4) increase in the desire to learn new information (f=4) recognizing the entertaining aspect of science (f=4), acknowledging that it is not difficult and impossible to do science (f=3), increase in the interest towards robotics coding (f=2), and elimination of prejudice towards science (f=2).

According to the analysis of data obtained from the present study in which the opinions of 6^{th} and 7^{th} towards science after performing different active learning and learning by doing activities in the learning fields of robotics, nature and science, it was determined that most of the students' interest in science increased. While it was observed that students defined science as inventing new things, exploring, and the profession of explaining the universe, there were a number of students who realized the importance of science and whose sense of wonder and eagerness to learn have increased. When the opinions of students towards science are examined, it was determined that all of the students made positive statements about science. It can be observed that the present study complies with the studies in which a positive contribution was observed towards science and scientific knowledge by middle-school students (Akay 2013; Tekbıyık et al. 2013). When the answers of the participants to "If you were a scientist, what would you like to invent?" question is examined, it was determined that most of the students wanted to invent a time machine. When the obtained results are examined, it can be stated that the activities students performed affected their desire to invent construction robots, artificial planet, precise telescope, a gas that would prevent ozone layer depletion, and a vehicle that can transport everywhere in space. Furthermore, the number of students who wanted to invent a flying car and teleportation machine was higher than other students. Overall, it can be observed that the things students want to invent were products about transportation and technology. From this point of view, it can be interpreted that this project increased the positive perceptions of students towards science.

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Author Information

Sibel Acisli
Artvin Çoruh University,
Faculty of Education, Department of Mathematics and Science Education, Science Education
Artvin/Turkey
Contact E-mail: sacisli26@hotmail.com

Hatice Kumandas Ozturk
Artvin Çoruh University,
Faculty of Education, Department of Educational Sciences, Measurement and Evaluation in Education
Artvin/Turkey

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Harnessing Creativity and Nurturing University Students' Innovation for Entrepreneurial Breakthrough

Ketsia Lorraine MOTLHABANE
North West University

Abstract: The paper review the extent to which university entrepreneurial programs can harness students' creativity and nurture innovation for entrepreneurial breakthrough; while earning degree credit, a focus group at North West University (NWU), South African (SA). Alarming youth unemployment rates demand an alternative education approach. Exploratory inquiry evaluated students' creativity and innovation projects to fill the market gap, using existing resources for income generation. Follow up in-depth Interactive Qualitative Analysed SWOT and key entrepreneurial breakthrough constructs. Students reiterated trust issues, vulnerability and betrayal risk as reason for suppressed Innovations mindful that entrepreneurial practical was insignificant to their degree attainment. Risk tolerant and hands-on students however, seized project opportunities resulting in thriving entrepreneurial businesses. The study sampled thirty (30) undergraduate students from NWU, rural campus, and needing entrepreneurship course to graduate and may not be generalised to non-entrepreneurial student. Project outcome showcase successful entrepreneurial breakthrough with stakeholder support to motivate students and increase youth employment. It highlight the necessity to embed practical in entrepreneurial curriculum, nurturing students' creativity and innovations to forming value-adding stakeholder partnerships for entrepreneurial breakthrough.Technology and global competition place the youth and universities as key entrepreneurial role-players needing stakeholders support and mentoring including legal recourse avenues safeguarding creativity and innovation of those who are vulnerable from potential abuse.

Keywords: Entrepreneurial programs, Creativity and innovation, University students, Youth unemployment

Introductıon

Entrepreneurial programs are gaining popularity with tertiary institutions, the private sector and government initiatives in South Africa. The thrust is meant to increase employment opportunities in an era where South Africa (SA) is grappling with high unemployment rates, particularly among the youth. More often than not these entrepreneurship programmes focus not only on earning credits for degree and certification, but students are expected to master the curriculum content, apply theories learnt in class (Hamzah, Yahya, Sarip and Mohd Adnan, 2016) and obtain high grades. Indeed a number of students excel in the subject matter and some even exceed the expectations. What happens then post-graduation? What market do they fit in to sell their skills and apply their creativity to make a living? This is a critical question entangled with curriculum and accreditation.

McMurray, Dutton, McQuaid, and Richard, (2016) question the relevance of university qualifications and whether academic programmes are developed with a full understanding of employer requirements to benchmark the business studies and entrepreneurship qualification. The argument is that relevant programme designs could better prepare graduates to meet potential employers' requirements, together with the crucial wider educational university degree objectives. According to Larsson, Wennberg, Wiklund, and Wright, (2017), the average Swedish student population have 63 % of their entrepreneur graduates starting their own businesses locally in their graduation region, while 37 % start businesses elsewhere. In economies with limited private-sector wage jobs creation, entrepreneurship-support interventions, coupled with business environment that is receptive to innovation, could be promising policy options for the creation of more attractive skilled jobs, (Premand, Brodmann, Almeida, Grun and Barouni, 2016; KritiKoS, 2014). The Malaysian government provides micro-credit to support the development of youth skills and competencies (Abdullah, Osman, and Rahim, 2009).

Singapore would be SA's ideal support model, yet SA's graduates are looking more to the government to provide jobs. To date, the government holds regular 'job summit' creation targets and even invite the private sector to employ the youth in return for incentives (Steinman and van Rooij, 2012; Mubangizi and Mkhize, 2013). Mmesi (2015) however doubts the government's ability to significantly change the unemployment rates because of its common economic inefficiencies and managerial ineffectiveness with respect to job creation.

Indeed SA is in dire need of entrepreneurial studies to guide interventions to stimulate economic activity, development and reduce unemployment (Malebana and Swanepoel, 2015). In presenting a mandatory Internship Report, Yasin, (2018) reiterates how his business could have improved had he gained earlier experience of three (3) years before starting his company. The challenge is in the inclusion of the necessary metrics to ensure value adding interventions to initiatives and outcomes.

This study uses the example of a large SA university, University of South Africa (Unisa), which prides itself of the explicit purpose of 'producing graduates of noble character, mastering science and technology with health vision, professional, having entrepreneurial spirit, and becoming a driving force in the nations' life advancement' (Zuhdi, 2018, p134). A study undertaken at the same university found more than half (54%) of the sampled alumni felt they lacked the practical knowledge required to implement their theoretical components of entrepreneurial education acquired in their degree (Premand, Brodmann, Almeida, Grun and Barouni, 2016). These challenges are apparently common with many other universities' alumni within and outside the country.

Literature Review

Entrepreneurship in practice for other field

Entrepreneurship programmes are also evolving (Etemad, 2018) where different professions are motivated to learn the skills to incorporate and practise their profession as independent business ventures. The extent to which university entrepreneurial programmes can harness creativity and nurture university students' innovation for entrepreneurial breakthrough; in addition to earning degree attainment credit need to be understood in one South African university. This paper is a development from a Mafikeng campus assessment of the credit bearing courses offered in an entrepreneurship programme.

With this incorporation of skills attained in a credit-bearing module, professionals learn to infuse procedures and models that enable a change in entrepreneurial and innovation landscape (Chen, 2018). The thrust is designed to assist their profession to grow and succeed as business ventures. The legal professionals practice their professional independence in the practicing law by providing the legal profession with its strength, character, and integrity (Green, 2013). New developments even allow other professionals to invest in legal firms providing capital access that allows employee development and creative use of technology for better market service while contributing as economic growth activity drivers (McMorrow, 2015, Brescia, 2016; Kim-Soon, Ahmad and Ibrahim, 2016).

The same applies to commercialization of audit and accounting firms where independence forms the essence of audit work (Song, Wu, Liu, 2016; Richardson, 2017; Broberg, Umans, Skog and Theodorsson, 2018). Information Technology (IT) governance mechanisms work to align a firm's value adding capabilities with strategic objectives for organizational performance (Wu, Straub and Liang, 2015; Luftman, Lyytinen and Zvi, 2017, p2). The artists and musicians employ a variety of entrepreneurial skills in creating their own career paths (Clawson, 2019; Usherwood, 2015), perhaps following in the footsteps of the tried and tested business independence to overcome their predecessors' historical plight. In the process, they narrow the hurdles and set up successful enterprises. Evidently many other professions indicate the market in which they will utilize their skills whereas the entrepreneurial students from commerce and administration specialization seem to lack the existing market to practice their skills.

Purpose

The paper reviews the extent to which one university's entrepreneurial programmes can manage to harness creativity and university students' creativity and innovation for entrepreneurial breakthrough. Ordinarily university entrepreneurial programmes emphasise earning good marks for mastering the course content for degree credit. The purpose of this study was to add an entrepreneurial project to a second year semester course at North-West University (NWU) Mafikeng campus. This course is not prescribed in the curriculum. The

proposed project required students to be creative, innovative and resourceful in identifying a market gap that they could fill as business start-up for income generation. Embracing Yaacob, Shaupi and Shuaib (2016), the entrepreneurial prototype is to make students developers of new ideas, through creativity and innovativeness and harnessing available resources to reap business profit. The project was an opportunity for students to be specific about the market, how to reach it, identify the potential risk factors and design strategies to overcome them. In a real-life business start-up, the students on the project had to identify existing useful resources of their own, from families or friends while being mentored by the lecturer through the process, mindful of the financial constraints and the reality of inadequate capital market access.

Universities are well placed to facilitate entrepreneurial breakthrough that has become a necessity for the young in their bid to assist the country rid itself of the scourge of youth and graduate unemployment. According to Bushuyev, Murzabekova, Murzabekova, and Khusainova, (2017) the success of projects and programmes depends on:

(i) the competence of organisations in managing these projects and programmes;
(ii) (ii) "Entrepreneurial spirit (energy)" formed by the leadership of the organisation leads to successful completion of the breakthrough projects.

Bot, (2012) sees entrepreneurial breakthrough in new innovations, paradigm shifts, new products or solutions, and adapting to a very strong and competitive market.

Bushuyev et al. (2017) assimilate entrepreneurial breakthrough to 'entrepreneurial energy', requiring a clear understanding of visible and invisible activity of the project actions and key stakeholder roles. These entail using key resources, including knowledge, technology, and creative leadership to establish project progress. In addition to creativity and risk taking, Kozubíková, Belás, Bilan, and Bartoš, (2015) regard independence as foundational to becoming an entrepreneur. While productivity, sufficient finance access and managerial ability to assume inherent risk are key success factors (Levratto, and Serverin, 2015); it is critical that they be effected systematically and in a disciplined manner (Bot, 2012).

The need for change in direction

Historical platforms for entrepreneurial students from commerce and administrative studies are narrowing and students find it difficult to find environments to experiment their skills and practice what they have learnt in entrepreneurial studies. The family businesses were best absorbers and safe havens of the business entrepreneurial students (Larsson, Wennberg, Wiklund and Wright, 2017). However lately, the family businesses face various challenges emanating from global competitiveness as well as technological demands.

Segal, Borgia and Schoenfeld, (2005) believe in entrepreneurship so much that they believe it offers a personal challenge that many individuals would prefer over being an employee working for someone. The opposite may be true, unless there is a shift in the current job seekers' mind-set and attitude, together with access to developmental support structure. Consequently it is highly unlikely for people to resign from a secure regular income earning job to pursue a non-guaranteed income from entrepreneurship.

The reality of South Africa's unemployment

With soaring unemployment rates in SA, especially among the youth who account for more than half its population means the country's education system needs to be overhauled drastically. The soaring unemployment rates and lack of job opportunities for the youth have reached disturbing levels. Ironically, these unemployed youths still expect the SA government to be the major graduate employer, which is unrealistic. Countries with high unemployment rate suffer from skills mismatch that exist in various areas, including entrepreneurial and managerial skills together with liquidity constraints (Anyanwu, 2013; Magruder, 2012). Okoye (2017); Ayoade and Agwu, (2016) share the same sentiment, seeing Nigerian educational institutions as churning out thousands of graduates yearly to pursue few paid government jobs.

Certainly small businesses have contributed significantly to the world economies and countries with high economic growth have vibrant entrepreneurial activities (Olawale and Garwe, 2010; Fraser, Bhaumik and Wright, 2015). How ideal it would be if the youth was capacitated and skilled, relevantly enough to pursue prospective entrepreneurial opportunities to become job creators rather than job seekers. Already SA youth,

aged 15–34 years, are among the most vulnerable in the labour market with unemployment rate reaching 63,4% in the 1st quarter of 2019, while graduates within the same age group, recorded 31.0%. The rates show an increase from 19.5% in 2018. The country's overall unemployment rate increased from 27.6% first quarter to 29% in second quarter of 2019, making it the highest increase in quarter two of the year since 2013 (David Harrison2019; STATSSA: 2019). 3,5 million people in the country have stopped looking for jobs (STATSSA: 2019) meaning that the unemployment rate is at crisis level.

Design– The study used exploratory inquiry, reviewing students' creative and innovative ideas in a second semester entrepreneurial course group project which could generate income. The sample was 30 students over a period of three years 2016-2018. The project required students to develop convincing, creative and innovative ideas with potential entrepreneurial business breakthrough. The project required identifying the market gap, the product to sell, how to reach the market, potential risk factors involved and strategies to overcoming them. Follow up in-depth Interactive Qualitative Analysis interrogated the drive for successful projects as well as causes and effects for substandard submissions, contrary to the project guidelines. Continued mentoring and nurturing was offered for a period beyond the semester.

Findings: Students reiterated trust issues, exposure to betrayal and risk as reason for suppressed creativity and innovation, mindful that the entrepreneurial practical was insignificant to their degree attainment. Vulnerability to betrayal and no recourse for stolen ideas seemed high on students' agenda. This was submitted as reason enough to supress the project participation. The end result was submitting substandard work, disregarding the opportunity to be mentored and nurtured. Although students were unwavering about the right to protect their interests, the laziness and disregard to what could contribute positively to their financial wellbeing, more so during post-graduation period, was discussed. This was in no way undermining the legitimacy of the students' concern and fear especially that referral recourse avenues could not be identified, in case such betrayal occurred.

The quality of prospective projects indicated the effort put into them. During the discussions and follow up in-depth Interactive Qualitative Analysis, these students still acknowledged that betrayal of their trust was not a myth but a reality. The students are not naïve about this reality as deceitful people are commonplace. They however believed that:

- the game of life was taking a chance with what may be worthwhile in their future
- the risk of exposing their creativity and innovation was worth taking rather than losing mentoring and nurturing opportunities which may not exist in the future
- risk tolerant students were willing to fold their sleeves and work to explore the project potential in their spare time
- rather seize the market opportunities and generate the much needed funds

During the continued discussions students learned the virtue of showing commitment and own fund generation as value adding convince potential funders to sponsor their project. A good project may serve as collateral in influencing the relaxation of the common funding barriers.

Success stories and thriving (breakthrough) in entrepreneurial businesses.

Lantic Design: Using home resource to blend African Print material to redesign the youth attire: T-shirts, shirts, jeans, dresses etc. The African redesigned clothes is allowing the youth to reclaim their rich heritage as well as making designer clothes affordable to the student market.

Biga Design: Redesigning and blending the rich Setswana cultural utensils into all kinds of material using acrylic and painting. The prints are on clothing and portraits to showcase and educate the young about household utensils, clothes and music instruments for different occasions and other forms of communication presented in artistic prints.

Beauty and health: Artistic designs on hair braids, style and nurture nail and massage services offered to university community (students and staff). The service is provided at an affordable price, easily accessible, time negotiated (including after hours) and place. The dream is to find a dedicated place with minimal rent or cheap premises, easily accessible to client to offer one stop service including massage parlour.

Master Cook: students wanted to offer cooking and baking services for families, government departments and business occasions and functions. Students face the dilemma of accessible resources (machines, stoves, ovens,

microwave etc.) being kilometres away, at their homes, whereas the identified potential market composed of university community and different government Provincial departments located in Mafikeng, the Capital City of North West Province. Their desire is to be able to have access to these resources locally, to blend their university education with their passion.

One stop shop: Direct marketing and selling company ready to use products to client. Bringing regular company product broachers for clients to peruse, select and pay in advance for their product choice ranging from beauty, household and personal care products. Products are delivered in bulk to the seller or agent who then sort orders accordingly and then conveniently delivers to the buyer.

Conclusion and Recommendations

All students' needs are opportunities and space to apply complement the skills acquired at the university and the necessary mentors who are willing to take baby steps with them to realize their entrepreneurial breakthrough while earning a living. Workshops, training and presentations are all important but their value is limited to lecture halls, training and seminar centres and conferences they are offered in.

Indeed students may have their reservations and fears but the worst frustration is post-graduation, having spent a minimum of three years at the university, all of a sudden they have to spend time at home and start another unfamiliar life they have outgrown over their university years, which for the majority is away from home. Waiting for opportunities or something to occupy their time is very traumatic because after high school many travel to faraway places to pursue their university education, hoping to start their career soon after. Some have expressed their hopelessness and the trauma being confined to their home, where they observe their unemployed predecessor graduates, who are idling and facing a bleak future with degree less attractive to employers. Others question the value of education, being obedient to the system and commitment to their studies if all it's worth is joining the hopeless and forgotten unemployed masses.

Rather let students have formal structures and systems with people who go out of their way to support and buy their not so perfect products and services, enabling practice that will allow them room to perfect their skills over time in order to become gurus in their deliverables. Only if the government and business community can join families and friends to buy their products and services without abuse or exploitation it can bring home to the hopeless.

There is need for seed fund to aid students or interest free loans for students who have already shown commitment and have started something even if it generates a fraction of the required income. Hopefully the start-ups will convince those in authority and potential investors to top-up what is already being raised. Also dedicated spaces are a must to allow students to develop, function and experiment their acquired knowledge as well as having places that are easily accessible and convenient to practice their skills.

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Author Information

Ketsia Lorraine Motlhabane
North West University (South Africa)
P.O. Box 4359 Mmabatho 2735
Contact E-mail: motlhabanelorraine@gmail.com