International Journal on New Trends in Education and Their Implications (IJONTE)

July 2017

Volume: 8
Issue: 3

ISSN 1309-6249

http://ijonte.org

International Journal on New Trends in Education and Their Implications
July 2017 Volume: 8 Issue: 3 ISSN 1309-6249

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International Journal on New Trends in Education and Their Implications (IJONTE) is currently indexed, abstracted and listed starting with the first issue in:

International Journal on New Trends in Education and Their Implications
July 2017 Volume: 8 Issue: 3 ISSN 1309-6249

International Journal on New Trends in Education and Their Implications
July 2017 Volume: 8 Issue: 3 ISSN 1309-6249

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International Journal on New Trends in Education and Their Implications
July 2017 Volume: 8 Issue: 3 ISSN 1309-6249

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ARTICLES

International Journal on New Trends in Education and Their Implications
July 2017 Volume: 8 Issue: 3 Article: 01 ISSN 1309-6249

MOBILE LEARNING AND MOOCs

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Abstract
Massive Open Online Courses (MOOCs) designed upon the idea of free, open and world-wide knowledge sharing, have been an out-spread response to global educational needs of distant learners since 2008. In this connection, MOOCs have a pivotal importance for not only providing educational equality for millions, but being a unique opportunity for supporting students at a distance as well. Also within the ascent of mobile learning in education field in the last decade, MOOCs have got a new dimension; that is learning any time at any place. Keeping these views in mind, the focal aim of this paper is to provide a general overview on the emergence of MOOCs, the different types of MOOCs, the dimensions of these MOOC types, their typologies as well as to provide a specific examination on e/m learning integration in the context of formal, non-formal and informal learning.

Keywords: Massive Open Online Courses (MOOCs), MOOC types, MOOC typologies, mobile learning, MobiMOOCs.

MOOCs AT A GLANCE

A MOOC or Massive Open Online Course is open online course model which delivers learning contents prepared by prominent institutions to every distant learner across the globe with no geographical, social or economic restrictions. The courses have no limits on attendance as well. Massive Open Online Courses (MOOCs), can be named as a mass education, have different types such as cMOOC, xMOOC, Hybrid MOOC, MobiMOOC, and EduMOOC. Loosely borrowing from the original concept of the MOOC (now labelled cMOOCs) developed by Downes and Siemens, three new major MOOC technology platforms (now labelled xMOOCs) launched in 2012, namely edX, Coursera and Udacity (Yuan, Powell & Olivier, 2014). xMOOCs were primarily based on interactive media, such as lectures, videos and text that followed a behaviorist pedagogical approach (Conole, 2013). To Yuan, Powell and Olivier (2014), these courses are all developed by elite universities to publish their courses online, for anyone interested in learning for free. Additionally, these free courses provide a gorgeous opportunity to close the biggest educational gap between the elite and the needy as indicated by Thomas Friedman from The New York Times (Evans & McIntyre 2016). Table 1 given below, shows the two different forms of MOOCs in terms of massive, open, online and course:

Table 1: MOOC Typologies

xMOOCs		cMOOCs
Scalability of provision	**Massive**	Community and connections
Open access - Restricted license	**Open**	Open access & licence
Individual learning in single platform	**Online**	Networked learning across multiple platforms and services
Acquire a curriculum of knowledge & skills	**Course**	Develop shared practices, knowledge and understanding

Yuan, Powell and Olivier (2014)

Based upon the above mentioned efforts to start crowdsourcing push towards MOOCs, different world institutions have recently focused on MOOC and mobile learning (m-learning) integration.

MOOCs DELIVERED VIA MOBILE LEARNING

The emerging advances in mobile learning (m-learning) have a great effect on distance education all around the world. In many emerging regions of the world, learning societies learn and share information on the move that results with fully mobile human lives. In this regard, it might be observed that m-learning as the immediate descendant of e-learning (Laouris & Eteokleous, 2005) has become "just in time, just enough and just for me" model of flexible learning (Peters, 2009). As aptly described, m-learning with its flexible form facilitates active learning. MOOCs, in this sense may be considered as the strongest learning milieu that allows students to be part of a mobile system. In this connection, there has been a visible tendency towards m-learning within the studies related to MOOCs such as (mobimooc.wikispaces.com), (http://facultyecommons.com/category/moocs-innovations/), (https://mosomelt.wordpress.com/) (Pegrum, 2016). As also indicated by Koutropoulos et. al. (2012), MOOCs suggest possibilities for research in many areas, including learner motivation, engagement, social presence and instructor presence. According to the writers mentioned above, initial periods of a MOOC should be analyzed in terms of learners who are lurkers, who are active participants, and the ones who drop out the courses completely.

Various case study research samples on the design and implementation of MobiMOOCs have also been carried out. For example, a six-week MOOC format course starting from 2 April to 14 May 2011 on mobile learning was organized by Ingatia de Waard (de Waard at al. 2011). This conducted MobiMOOC course may be a good reference in order to comprehend the idea of using Open Educational Resources (OER) in terms of participants, discussion threads, tweets hashtags and so on.

MOOCs WORKING WITH MOBILE LEARNING

Mobile learning is fundamentally about increasing learners' capability to physically move their own learning environment with them (Ogata and Yano, 2004) in order to facilitate distance learning on individual and collaborative basis. Today many higher education institutions embrace mobile learning initiatives that provide an opportunity for students to be part of that cross-border higher education. In the last few years, mobile learning has been increasingly used to support learning experiences both in formal and informal contexts (Ahmed & Parsons, 2013; Jones, Scanlon, & Clough, 2013). In addition to those experiences, several attempts on integrating MOOCs and mobile learning have been observed since 2011. As indicated by Chen, Barnett, & Stephens (2013) MOOCs are built on the characteristics of massiveness, openness, and a connectivist philosophy. In this regard, it is probable to say that MobiMOOCs would help mass and open education and be formed within a connectivist frame. In the year of 2016, a MOOC may be regarded as a non-formal learning opportunity by which learners feel free to complete activities in relation with their own interests rather than formally structured course materials (Littlejohn, Hood, Milligan & Mustain, 2016).

THE SIGNIFICANCE OF MOOCS WITH MOBILE LEARNING

MOOCs have started to become widespread so thanks to emergence of phenomenal network and the theory of Connectivism, proposed by George Siemens as a new learning theory for a digital age (Siemens, 2004). It was then arranged and managed by Stephen Downes and George Siemens by means of University of Manitoba, Canada. In spite of the limited advertisement, 2000 people from all over the world registered for the course. It presented a unique chance to discover how online learners learn in large open networks, which offer connectivity, extensive diversity and sharing information.

MOOCs are innovative way of teaching and learning (Meyer & Zhu, 2013). As a new type of asynchronous online learning, it provides unique benefits for learners and providers, flexibly for higher education institutions, commercial organizations, and faculties. While some critics declare concerns about the high "dropout" rate among students who participate in MOOCs, this may not be the exact frame of reference. MOOCs are principally used for informal learning, which calls for flexibility and highly modularized content so that students can pick and choose what is most pertinent to their needs. In the future, MOOCs will need to offer learners more choices for how to join.

Traditional educational institutions will need to deem what part they want to play in the MOOC space and how they can serve their on-campus learners as well as the broader universe of potential learners. As both traditional and contemporary institution, Anadolu University, currently provides MOOCs that are free of charge. This mega university, whose vision is supporting lifelong learning, has been providing open courses to learners across the world since 2015 under the platform called AKADEMA (http://akadema.anadolu.edu.tr/). The platform started providing 7 courses in 2015, 26 courses in 2016 and finally reached 51 courses in 2017. These courses are conducted on a unifying milieu called Anadolum eKampüs (https://ekampus.anadolu.edu.tr/). The participants are awarded with certificates as long as they complete the programs they enrolled.

A corresponding movement to MOOCs and one, which could act as a promoter to how thriving MOOCs are incorporated, is mobile learning. "Recent, large-scale deployment of mobile devices for learning have initially shown positive results" (Hargis & Cavanaugh, 2014; Hargis, Cavanaugh, Kamali, & Soto, 2013a; Hargis, Cavanaugh, Kamali, & Soto, 2013b). Nevertheless, discussions of MOOCs are still incongruent, disintegrated, and distributed among different outlets. As indicated by Daniel (2012) and Clow (2013) systematic and extensive published research on MOOCs was still unavailable but most recent studies show the opposite. While some studies are of the pros, some others are of the cons. Below you can find the major concerns of MOOCs.

1. Class size
Enrolling a course with thousands of participants has its innate challenges. Firstly, providing social presence to the participants is almost impossible. In addition, access to the lecturers is very limited which means lack of interaction. Students are learning based on videos/documents that are posted for the class.

2. Dropout/ withdrawal
"It is acknowledged that MOOCs have high withdraw/dropout rates" (Koutropoulos & Hogue, 2012). The size of MOOCs is often seen as strength, but it creates difficulties. The students that are generally in the demographic to take MOOCs are often the ones that need face-to-face instruction the most. These same students end up never finalizing a course. For instance, MTx's Circuits and Electronics had 154,763 students enrolled – only 5% completed the course.

3. Quality Concerns
Due to the fact that the MOOC industry is pretty new, quality standards are not well formed professionally in place that all of them have to meet worldwide standards, which can be at both the lesson level and the course level. Many MOOCs rely heavily upon unreliable peer grading and unconstructive feedback. While there are first-rate modules available from MOOCs, most programs do not offer the progression of building block classes that traditional universities offer. Establishing quality control is critical to enhance the characteristic of MOOCs.

4. Non-Accreditation
Another subtle downside of MOOCs is they often lack accreditation. This means students will not receive any academic credit for finalizing a course or program. Universities and colleges generally do not recognize certificates of completion obtained by students.

Although there are various pros and cons of MOOCs, we should bear in mind that they offer remarkable courses without tuition for people all around the world which enable lifelong learning.

TRENDS AND FUTURE OF MOOCS WITH MOBILE LEARNING

To see where the MOOCs with mobile technologies are going, first we should look at where we are now in online world. To Downes (2005), where we are now is where we were prior to e-learning. During online practices, the traditional theories of distance learning such as Moore's transactional distance have been adopted. As a result, the dominant learning technology employed today is the learning management system (LMS) such as Blackboard, Moodle, and Canvas.

For Garrison (2000), on the other hand, in the following phases of the 21st century, which is also called as the post-industrial era of distance education, transactional issues (i.e. teaching and learning) will predominate over structural issues (i.e. geographical distance). In this respect, we will witness the rapidly rise of mobile learning as a domain. Mobile learning not only provides opportunities to create, but also to connect (Downes, 2005). Since nowadays, mobile access has become the main way to access to the Web, mobile MOOC can be considered as a very reasonable way to address a larger audience all around the world. When the MOOCs' informal nature, and the fact that they are not restricted by time and place are considered, it can be seen that their principles closely overlap with the principles of mobile learning (Explore a New Learning Frontier: MOOCs), so from 2011 onwards, mobiMOOCs, opening up the MOOC format for mobile devices, have been newly in use. In this case, MOOC is employed as the pedagogical format and mobile learning as the emerging technology (deWaard et al., 2011). So, MOOCs can be regarded as an educational approach that is supported by current technologies. Considering the implications of MOOCs with Mobile learning on teaching and learning practices (See the next section), in the near future, it seems that MOOCs with mobile learning will be employed more commonly. Thanks to further research on this novel practice, the benefits (i.e. intrinsic motivation), and challenges (i.e. socioeconomic and ethnic breakdowns) of MOOCs with mobile learning will be taken under control and contributing dynamics will be mapped. Furthermore, more online learning communities will be framed on MOOCs with mobile learning, considering the high student retention rate in these particular environments.

All in all, in the near future, MOOCs will be redesigned within the context of mobile learning to maximize self-organizing, self-referencing, and knowledge-producing capabilities of them (deWaard et al., 2011).

IMPLICATIONS OF MOOCS WITH MOBILE LEARNING FOR TEACHING AND LEARNING

In line with the paradigm shift in 21st century distance education from structural issues (i.e. geographical distance) to transactional issues (i.e. teaching and learning) as Garrison (2000) suggested, the emerging phenomena of MOOCs with mobile learning has resulted in a transformative educational paradigm (deWaard et al., 2011). It means that there have been a lot of implications of MOOCs with mobile learning on transactional issues, that is teaching and learning.

First, in MOOCs with mobile learning (e.g. https://www.mooc-list.com/), learners share their experiences with others by means of Web 2.0 tools, assist each other to expand their understandings of the topic, as well as provide and receive feedback from each other. Therefore, it can be said that MOOCs with mobile learning can be used as a way to stimulate collaboration, communication, and interaction among learners in teaching and learning practices (deWaard et al., 2011).

Second, MOOCs with mobile learning employs two important technologies: Mobile technology and social networking technologies (Web 2.0 tools) in teaching and learning practices. There are two benefits of using these particular technologies: a) learners already use these technologies in their daily lives, so they are familiar with their structure, and b) learners can access teaching and learning environments at any place any time convenient for them.

Third, MOOCs with mobile learning enhances dialogue among learners. The more dialogue means, the more dynamic interaction among learners, and a good degree of interaction among learners result in collaboration (Rodriguez, 2013). So, in a broader sense, it can be said that MOOCs with mobile learning is a good way to create online collaborative learning communities, which is the most desired environment in distance education.

In general, MOOCs with mobile learning is an example of an open and adaptive system, so it will play a crucial role in post-industrial era of distance education when the present teaching and learning practices have to be redesigned to respond the specific needs and realities of this new era (deWaard et al., 2011).

IJONTE's Note: This article was presented at 8th International Conference on New Trends in Education - ICONTE, 18- 20 May, 2017, Antalya-Turkey and was selected for publication for Volume 8 Number 3 of IJONTE 2017 by ICONTE Scientific Committee.

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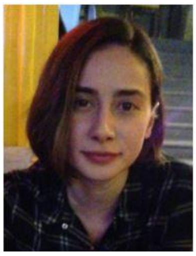

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REFERENCES

Ahmed, S., & Parsons, D. (2013). Abductive science inquiry using mobile devices in the classroom. *Computers & Education, 63*, 62–72.

Chen, X., Barnett, D. R., & Stephens, C. (2013). Fad or future: The advantages and challenges of massive open online courses (MOOCs). Paper presented at the Research-to-Practice Conference in Adult and Higher Education, Lindenwood University, St. Charles, Missouri. Retrieved from http://www.lindenwood.edu/r2p/docs/ChenBarnettStephens.pdf

Clow, D. (2013). MOOCs and the funnel of participation. In *Proceedings of the Third International Conference on Learning Analytics and Knowledge* (pp. 185-189). ACM, New York.

Conole, G. (2013). MOOCs as disruptive technologies: strategies for enhancing the learner experience and quality of MOOCs. *RED - Revista de Educación a Distancia, 39*. Retrieved from http://www.um.es/ead/red/39/conole.pdf

de Waard, I., Koutropoulos A., Keskin N. Ö., Abajian S. C., Hogue R. J., Rodriguez O. C., & Gallagher M. S. (2011). Exploring the MOOC format as a pedagogical approach for mLearning. *10th World Conference on Mobile and Contextual Learning.* Retrieved from http://mlearn.bnu.edu.cn/source/ten_outstanding_papers/Exploring%20the%20MOOC%20format%20as%20a%20pedagogical%20approach%20for%20mLearning.pdf

Daniel, J. (2012). Making sense of MOOCs: Musing in a maze of myth, paradox and possibility. *Journal of Interactive Media in Education*, *3*.

Explore a New Learning Frontier: MOOCs. *Learning Solutions Magazine*. Retrieved from http://www.learningsolutionsmag.com/articles/721/explore-a-new-learning-frontier-moocs/page2

Garrison, R. (2000). Theoretical challenges for distance education in the 21st century: A shift from structural to transactional issues. *The International Review of Research in Open and Distributed Learning, 1*(1), http://www.irrodl.org/index.php/irrodl/search/search

Evans, S., & McIntyre, K. (2016). MOOCs in the humanities: Can they reach underprivileged students? *Convergence*, *22*(3), 313-323.

Hargis, J., & Cavanaugh, C. (2014). A one-year federal mobile learning initiative review. *Encyclopedia of Information Science and Technology* (Third edition). USA.

Hargis, J., Cavanaugh, C., Kamali, T., & Soto, M. (2013a). Measuring the difficult to measure: iPad mobile learning. *International Journal of Mobile and Blended Learning, 3*(2), 60-77.

Hargis, J., Cavanaugh, C., Kamali, T., & Soto, M. (2013b). A federal higher education iPad mobile learning initiative: Triangulation of data to determine early effectiveness. Journal of Innovation in Higher Education, 39(1).

Jones, A. C., Scanlon, E., & Clough, G. (2013). Mobile learning: Two case studies of supporting inquiry learning in informal and semiformal settings. *Computers & Education, 61*, 21–32.

Koutropoulos, A., Gallagher, M., Abajian, S., de Waard, I., Hogue, R., Keskin, N. & Rodriguez, O. (2012). Emotive Vocabulary in MOOCs: Context & Participant Retention. European *Journal of Open, Distance, and E-Learning, 2012*(I), May 10, 2012. Retrieved from http://www.eurodl.org/?article=507

Koutropoulos, A., & Hogue, R. J. (2012). How to succeed in a MOOC-Massive online open course. *eLearning Guild, October 08, 2012*. Retrieved from http://www.cedma-europe.org/newsletter%20articles/eLearning%20Guild/How%20to%20Succeed%20in%20a%20MOOC%20-%20Massive%20Online%20Open%20Course%20(Oct%2012).pdf

Laouris, Y., & Eteokleous, N. (2005). We need an educationally relevant definition of mobile learning. Proceedings of mLearn, 2005, Retrieved from
http://www.mlearn.org.za/CD/papers/Laouris%20%26%20Eteokleous.pdf

Littlejohn, A., Hood, N., Milligan, C., & Mustain, P. (2016). Learning in MOOCs: Motivations and self-regulated learning in MOOCs. *The Internet and Higher Education*, *29*, 40-48.

Meyer, J. P., & Zhu, S. (2013). Fair and equitable measurement of student learning in MOOCs: An introduction to item response theory, scale linking, and score equating. *Research & Practice in Assessment, 8*(1), 26-39.

Ogata, H., & Yano, Y. (2004). Context-Aware Support for Computer-Supported Ubiquitous Learning. *Wireless and Mobile Technologies in Education, 2004. Proceedings. The 2nd IEEE International Workshop on Wireless and Mobile Technologies in Education* (WMTE'04). (Pp. 27 – 34). Retrieved from http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=1281330http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=1281330

Pegrum, M. (2016). Future Directions in Mobile Learning. In *Mobile Learning Design* (pp. 413-431). Springer Singapore.

Peters, K. (2009). M-learning: Positioning educators for a mobile connected future. In M. Ally (Ed.), *Mobile learning: Transforming the delivery of education and training* (p.116).

Rodriguez, C. O. (2013). Two distinct course formats in the delivery of Connectivist MOOCs. *Turkish Online Journal of Distance Education, 14*(2).

Siemens, G. (2004). Connectivism: A learning theory for the digital age. Retrieved from http://www.elearnspace.org/Articles/connectivism.htm
http://i.glokalde.com/pdf/issues/1/Article2.pdf

Yuan, L. Powell, S. & Olivier, B. (2014). Beyond MOOCs: Sustainable Online Learning in Institutions. CETIS, Retrieved from http://publications.cetis.ac.uk/wp-content/uploads/2014/01/Beyond-MOOCs-Sustainable-Online-Learning-in-Institutions.pdf

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International Journal on New Trends in Education and Their Implications
July 2017 Volume: 8 Issue: 3 Article: 02 ISSN 1309-6249

COMPARISON OF STUDENT ENGAGEMENT FROM TWO DIFFERENT UNIVERSITIES IN TURKEY IN TERMS OF TECHNOLOGY INTEGRATION AND CAMPUS CLIMATE

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Abstract

Student engagement was defined as "quality and quantity of students' psychological, cognitive, emotional and behavioural reactions to the learning process as well as to in-class/out-of-class academic and social activities to achieve successful learning outcomes". In this study, the purpose was to compare the engagement levels of students from two universities which had different campus structures, climates and cultures with respect to campus, level of technology integration and campus climates. The research data were collected from students attending Yüzüncü Yıl University and Hakkâri University in the Spring Term of the academic year of 2016-2017. As the quantitative data collection tools, "Demographic Information Form", "Student Engagement Scale", "Student Perception Scale Regarding Faculty Member's Competency in Technology Integration" and "Campus Climate Checklist" were used. The findings obtained in the study revealed that Çölemerik Vocational School students at Hakkâri University had higher scores of sense of belonging and campus engagement that the education faculty students at Hakkâri University. The education faculty students at Hakkâri University had higher scores of cognitive engagement, emotional engagement and class engagement when compared the education faculty students at Yüzüncü Yıl University. The education faculty students at Yüzüncü Yıl University had higher levels of sense of belonging and higher scores regarding campus engagement and campus climate when compared to the education faculty students at Hakkâri University.

Keywords: Engagement, student, university, campus, class, technology integration.

INTRODUCTION

Today, students have different life styles, habits, ways of using the technology and methods of reaching the information when compared to those from the previous generation. It is important to understand these students and to establish healthy communication with them. Making students' education lives more effective and productive is also important for the development of such skills as problem solving, analytical thinking, analyzing one's learning, putting one's knowledge into effect and using technology effectively. Especially in the period of undergraduate education, which is fairly important since it shapes university students' future lives, it is necessary to examine their engagement with the campus, with their courses as well as with their learning.

The Turkish Language Association defines the concept of engagement as "dependence, attachment, feeling of sympathy for someone with love and respect, showing interest and loyalty" (Turkish Language Association, 2017). As for student engagement, it was defined by Günüç (2013) as "*quality and quantity of students' psychological, cognitive, emotional and behavioural reactions to the learning process as well as to in-class/out-of-class academic and social activities to achieve successful learning outcomes".* Student engagement covers a number of concepts like academic achievement, campus climate, student satisfaction, recreation activities and retention, and it is closely related to these concepts (Günüç, 2016a). In addition, in international literature, several other definitions have been provided for student engagement such as active participation in the learning process, responsibility and focusing on the learning process, attention in the learning process and the quality of the time spent and of the effort made by the student in relation to the educational activities to contribute to the outcomes (Newmann, Wehlage & Lamborn, 1992; Marks, 2000; Kuh & Hu, 2001; Kuh, 2009).

In studies reported in related literature on student engagement, it is seen that the concept was examined in several dimensions. Student engagement has three dimensions: cognitive, emotional and behavioral (Jimerson, Campos & Greif, 2003; Fredricks, Blumenfeld & Paris, 2004; Günüç, 2013). Cognitive engagement, which is related to students' approaches to their own learning, includes making investment in learning, valuing what they learn in class, objectives of learning, self-control and planning (Günüç, 2016a). Frederick and colleagues (2004) state that students with high levels of cognitive engagement have more flexible problem solving skills, make investment in their own learning, determine their own needs and develop various strategies against intellectual difficulties. Cognitive engagement refers to the situation related to students' intellectual processes. As for emotional engagement, it depends on psychological engagement and involves emotional reactions including interests and values regarding students' attitudes towards their classmates, teachers, lessons and their class (Fredricks et al. 2004). Emotional engagement occurs as positive emotions like students' interest in class and their happiness or as negative emotions like students' boredom and anxiety. Behavioral engagement, which constitutes another dimension of student engagement and which includes students' participation in academic and social activities at school, is more easily observable and measurable when compared to other types of engagements. Behavioral engagement includes students' attendance in classes and their efforts to participate in academic, social and in-class and out-of-class activities. Behavioral engagement, which is related to campus and class activities, requires student participation (Günüç, 2016a).

In student engagement, how students think (cognitive), how they feel (emotional) and how they behave (behavioral) are examined separately or collectively (Fredricks et al. 2004). In addition to these three dimensions, Günüç (2013) added the dimensions of sense of belonging and valuing and considered student engagement to be a five-dimension concept. The concepts of valuing and sense of belonging are also related to emotional and behavioral engagements. Students will be in peace and happy in an environment which they feel they belong to and where they feel they are valued, and they will thus be more willing to take part in the activities.

All university students could be said to have engagement even at lowest level. However, what is important is to increase their engagement and to maintain their engagement throughout their education lives. In this respect, Günüç (2016a) developed the Theory of Campus-Class-Technology to understand, explain and increase student engagement. In other words, according to the researcher, it was not satisfactory just to consider the cognitive, emotional and behavioral engagements as in related literature. Therefore, the researcher also pointed out that campus engagement was influential on students' achievement and on their learning as well. Within the scope of campus engagement, campus climate and facilities including the physical conditions of the campus, campus activities, peace and safety in campus, group activities and team works are considered to be among important factors that increase student engagement. In class engagement, the focus is on such factors as students' love for faculty members, their mutual communication, respect and interest, faculty members' professional competencies, students' participation in class, projects and cooperative learning activities, and physical conditions of classrooms. The dimension of technology, another factor of the theory, includes factors such as technological sub-structure of classrooms and of the faculty, support structures for technological malfunctions, introduction of technological innovations, technological competency and technology integration and use of social networks in education. All these factors are considered to be important for students to increase their engagement and to maintain their engagement throughout their education lives.

Student engagement is likely to be influenced by a number of variables in the teaching and learning process. In this study, the purpose was to compare the engagement levels of students from two universities which had different campus structures, climates and cultures with respect to campus, level of technology integration and campus climates.

METHOD

Research Model

In the study, two universities were compared in terms of certain variables, and the current situation was described and examined. In relation to the main purpose of the study, the academic units of Hakkâri_University (HU) and the education faculties of HU and Yüzüncü Yıl University (YYU) were compared. For this reason, in the study, the survey model, one of quantitative research methods, was used.

Research Sample

The research data were collected from students attending YYU and HU in the Spring Term of the academic year of 2016-2017.

Table 1: Distributions of Frequencies and Percentages Regarding the Participants

University	Variable	Frequency	%
Hakkâri University			
Gender	Female	129	52,9
	Male	115	47,1
Unit	ÇVS	165	67,6
	Fac. of Edu.	79	32,4
Total		244	100
Yüzüncü Yil University			
Gender	Female	96	54,2
	Male	81	45,8
Unit	Education Faculty	177	100
Total		177	100
Total		**421**	**100**

As can be seen in Table 1, 244 students from HU and 177 students from YYU (421 in total) participated in the study. Of all the participants, 225 of them were female, and 196 of them were male. Table 1 presents the frequency and percentage distributions of the participants regarding their gender, university and academic unit.

Data Collection Tools

In the study, as the quantitative data collection tools, "Demographic Information Form", "Student Engagement Scale", "Student Perception Scale Regarding Faculty Member's Competency in Technology Integration" and "Campus Climate Checklist" were used.

Demographic Information Form: This form was used to collect data regarding the variables of the students' gender, university and academic unit.

Student Engagement Scale: In the study, the "Student Engagement Scale" developed by Günüç and Kuzu (2014) was used. As can be seen in Figure 1, the scale was made up of 41 items and two components with a six-factor structure. The factor structure of student engagement was determined by Günüç and Kuzu (2014) as presented in Figure 1. For this reason, this structure was taken into account while conducting the related analyses.

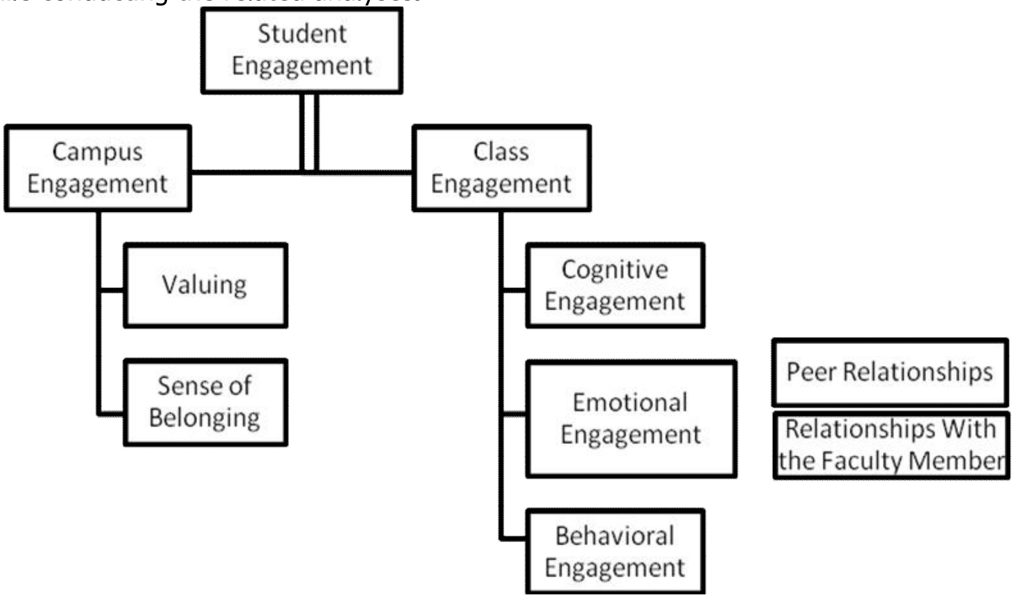

Figure 1: Factor Structure of the Student Engagement Scale

The scale included 5-point items graded as "I completely disagree", "I disagree", "I am neutral", "I agree" and "I completely agree". Total variance explained in relation to the six factors of the scale was found to be 59%. The Cronbach's Alpha (α) internal consistency coefficient for the whole scale was calculated as .957 according to the exploratory factor analysis and as .929 according to the confirmatory factor analysis. Table 2 demonstrates the Cronbach's Alpha internal consistency coefficient for the scale and for its sub-factors regarding the two universities included in the present study.

Table 2: Reliability Values Calculated for the Student Engagmeent Scale and Its Sub-factors

Univ.	Total Scale (Stu. Eng.)	Valuing	Sense of Belonging	Cognitive Eng.	Peer Relationships (Emo. Eng.-1)	Relationships With the Faculty Member (Emo. Eng.-2)	Behavioral Engagement
HU	.943	.761	.932	.885	.842	.920	.864
YYU	.936	.849	.872	.887	.909	.907	.861

The scale was made up of two main components (campus engagmeent and class engagement) and six factors. Campus engagement included the factors of valuing and sense of belonging, while the component of class engagement included cognitive engagement, peer relationships (emotional engagement-1), relationships with faculty member (emotional engagement-2) and behavioral engagement. A higher score to be received from the scale refers to a high level of student engagmeent, which means the student has high levels of campus engagement and class engagement. On the other hand, a low score to be produced by the scale demonstrates that the student has a low level of student engagement; in other words, the student has a low level of campus engagement and class engagement, which is likely to lead to disengagement.

Student Perception Scale Regarding Faculty Member's Efficacy in Technology Integration (SPSFETI): The scale was developed by Artun and Günüç (2016) for university students, and the scale included 5-point items graded as "Never", "Rarely", "Sometimes", "Usually" and "Always". Total variance explained in relation to the six factors of the scale was found to be 49%. The Cronbach's Alpha internal consistency coefficient of the structured confirmed with CFA was calculated as .940. A higher score to be received from the scale demonstrates that the preservice teacher perceives the faculty member's competency in technology integration to be high. In the present study, the Cronbach's Alpha internal consistency coefficients were calculated as .948 for the participants from YYU and as .972 for those from HU.

Campus Climate Checklist: This checklist was prepared by Günüç (2016b). The main indicators regarding a good-quality included Campus (physical features of the campus and physical features of the faculty), Life in Campus (accommodation/dormitory services, health services, counseling services, security services, technology services, library), Social Facilities (shopping, sports facilities), Entertainment Activities (sports activities, cultural activities, entertainment activities) and Student Clubs/Communities, and based on these indicators, a 21-item questionnaire was developed. This form can be filled out by each student individually, and it reveals students' perceptions regarding the campus climate/facilities. In addition, the questionnaire included 3-point items graded by the students as "I have no idea", "Inefficient" and "efficient". The researcher, who developed the questionnaire, explained the reason for including the category of "I have no idea" in the form saying that some of the students would be likely to be unaware of the campus facilities or may not have used these facilities.

Data Collection and Analysis

The research data were collected on pencil-and-paper basis with the measurement tools applied to the students attending Colemerik Vocational School (ÇVS) and Education Faculty of HU as well as to those attending Education Faculty of YYU. The data collected were computerized and checked using the package software of SPSS to determine any related deficiencies or wrong entries in the data, and the participants with such deficient or wrong data were not included in the analysis process. For the analysis of the data, descriptive statistics such as mean scores, standard deviations, percentages and frequencies were used. In order to compare the groups, independent samples t-test was used.

FINDINGS

Initially, for the purpose of comparing the two universities, the researchers described the campuses where the campus and academic units were found. For this reason, two researchers observed the universities and evaluated the campuses where the academic units were found with respect to certain indicators, which made it possible to interpret the data collected with quantitative data collection methods. In line with the basic purpose of the study, the analyses included comparisons between the units of HU and between the education faculties of HU and YYU. Similarly, the descriptions regarding the university campuses were done as well.

Describing the Campuses of Hakkâri University

The units in ÇVS and Education Faculty of HU are in different campuses. When the facilities and structures of the campus where the two units are found were compared, it was seen that ÇVS was located in a place a bit farther from the city center than the location of the Education Faculty, yet the former had a small-scale campus with its own dining hall, sitting benches, green areas, security, public housing and cafeteria. The ÇVS building was made up of two blocks, and the classrooms and the administrators' offices were on different floors. In addition, there were conference halls and application laboratories belonging to the departments. On the other hand, the education faculty was located only on one floor of a building found in the city center of Hakkâri. The classrooms were on the same floor with the administrative units, and the other floors of the building accommodated other faculties. The building did not have any garden, and its main entrance door directly opened to an avenue. The number of the classrooms and other facilities were a bit limited when compared to ÇVS.
The campus of HU was still under construction at the time of the study, and the two units were found in a place different from the central units of the Rectorship, Head of Student Affairs, Head of Health,

Sports and Culture and Public Dormitory. When the facilities provided by the two units were evaluated in general, ÇVS had slightly better facilities compared to the education faculty.

Describing the Campuses of Education faculties of HU and YYU

As the campus of HU was under construction at the time of the study, the units were giving education either in the buildings belonging to the university or in those rented. Since the construction of the campus was not completed, the buildings and the units were in different areas. The number of the public and private dormitories where the students accommodated was quite limited. There were not enough places where the students would have found the opportunity to communicate, spend their free time or socialize. Considering the technological sub-structures of the current buildings, it could be stated that they were all inefficient. On the other hand, YYU had its own campus with a wider variety of facilities. The campus of YYU, which is located near Lake Van, has the necessary environments for students to socialize, green areas, central laboratories, central cafeterias and dining halls, central libraries, hospitals for health services and the necessary technological sub-structure and related tools. Students have the opportunities to spend their time safely in the campus. In brief, it was seen that the two universities were different from each other in terms of their facilities and that HU provided its students with fairly limited facilities while YYU had a large and better-looking campus with its education faculty located in the campus.

Findings Regarding Student Engagement, Technology Integration (SPSFETI) and Campus Climate

In the study, comparisons were made between ÇVS and Education Faculty of HU and between the education faculties of HU and YYU with respect to student engagement, student engagement components/factors, technology integration and campus climate, and the results obtained are presented in Table 3 and Table 4.

Table 3: Comparison of HU Units in Terms of Certain Variables (T-Test Findings)

Variable	Department	N	$\bar{x}$	S	Sd	t	p
SPSFETI	ÇVS	165	74.98	26.42	242	1.77	.077
	Fac. of Edu.	79	69.00	20.19			
Valuing Faktor	ÇVS	165	11.64	2.85	242	.237	.813
	Fac. of Edu.	79	11.55	2.75			
Sence of Belonging Factor	ÇVS	165	23.78	8.61	242	4.757	.000
	Fac. of Edu.	79	18.13	8.78			
Cognitive Engagement Factor	ÇVS	165	39.01	7.44	242	.711	.478
	Fac. of Edu.	79	38.29	7.34			
Peer Relationships (Emotional Eng. -1) Factor	ÇVS	165	22.57	5.68	242	.517	.606
	Fac. of Edu.	79	22.18	4.94			
Relationships With the Faculty Member (Emotional Eng.-2) Factor	ÇVS	165	35.98	9.87	242	.264	.792
	Fac. of Edu.	79	36.32	8.45			
Behavioral Engagement Factor	ÇVS	165	16.06	3.73	242	.683	.495
	Fac. of Edu.	79	15.72	3.38			
Campus Engagement Component	ÇVS	165	35.43	10.01	242	4.308	.000
	Fac. of Edu.	79	29.69	9.09			
Class Engagement Component	ÇVS	165	113.63	22.29	242	.376	.707
	Fac. of Edu.	79	112.53	19.55			
Student Engagement	ÇVS	165	149.06	27.93	242	1.875	.062
	Fac. of Edu.	79	142.22	23.74			

When Table 3 was examined, it was seen that the results of the comparison analyses revealed a significant difference between the education faculty and ÇVS of HU in terms of the variables of sense of belonging ([t(242)=4.75; p<.05]) and campus engagement ([t(242)=4.30; p<.05]). Although no significant difference was found between the total scores of student engagement and SPSFETI, there was a difference with respect to the two variables in favor of ÇVS.

These findings demonstrated that the ÇVS students at HU had higher scores regarding the factor of sense of belonging when compared to the education faculties and that the ÇVS students at HU had higher scores regarding campus engagement than the education faculty students. Based on these findings, it could be stated that ÇVS was better when compared to the education faculty with respect to technology integration and campus facilities.

Table 4: Comparison of HU and YYU in Terms of Certain Variables (T-Test Findings)

Variable	**Unit**	**N**	$\bar{x}$	**S**	**Sd**	**t**	**p**
SPSFETI	HU	79	71.60	21.25	237	.126	.900
	YYU	160	71.91	17.99			
Valuing Faktor	HU	79	11.58	2.81	237	.320	.750
	YYU	160	11.70	3.02			
Sence of Belonging Factor	HU	79	19,48	9.40	237	3.463	.001
	YYU	160	23.08	6.92			
Cognitive Engagement Factor	HU	79	38.39	7.59	237	2.406	.017
	YYU	160	36.05	7.32			
Peer Relationships (Emotional Eng. -1) Factor	HU	79	22.16	5.12	237	.051	.959
	YYU	160	22.12	6.31			
Relationships With the Faculty Member (Emotional Eng.-2) Factor	HU	79	36.15	8.60	237	5.273	.000
	YYU	160	30.12	8.63			
Behavioral Engagement Factor	HU	79	15.63	3.49	237	.552	.582
	YYU	160	15.87	3.22			
Campus Engagement Component	HU	79	31.06	10.04	237	3.036	.003
	YYU	160	34.78	8.91			
Class Engagement Component	HU	79	111.78	21.44	237	2.917	.004
	YYU	160	104.21	18.74			
Student Engagement	HU	79	142.84	26.17	237	1.148	.252
	YYU	160	139.00	25.12			
Campus Climate	HU	79	21.32	7.35	237	2.175	.031
	YYU	160	23.23	6.23			

When Table 4 was examined, it was seen via the results of the comparison analyses that there was a significant difference between the education faculties of both universities in terms of the variables of sense of belonging ([t(237)=3.46; p<.05]), cognitive engagement ([t(237)=2.40; p<.05]), relationships with the faculty member (emotional engagement-2) ([t(237)=5.27; p<.05]), campus engagement ([t(237)=3.03; p<.05]), class engagement ([t(237)=2.91; p<.05]) and campus climate ([t(237)=2.17; p<.05]). These findings revealed that the education faculty students at HU had higher scores regarding student engagement, relationships with faculty member (emotional engagement-2) and class engagement when compared to the education faculty students at YYU. On the other hand, the education faculty students at YYU had higher scores regarding sense of belonging, campus engagement and campus climate when compared to the education faculty students at HU. In other words, the education faculty students at HU had higher scores of class engagement, while the education faculty students at YYU had higher scores of campus engagement and campus climate. All these findings were consistent with the campus descriptions regarding the units and universities. In another saying, the facilities and structures related to the campus are important for student engagement.

DISCUSSION AND CONCLUSION

The present study aimed to describe student engagement at the universities located in the cities of Van and Hakkâri and to compare certain campus-related variables. In this respect, not only the ÇVS and Education Faculty units at HU but also the units of the Education Faculty of HU and the Education Faculty of YYU were compared in terms of certain variables related to the campus, student engagement and technology integration.

The findings obtained in the study revealed that the ÇVS students at HU had higher scores of sense of belonging and campus engagement than the education faculty students at HU. One reason for this could be the fact that ÇVS had its own campus and that the education faculty did not. Therefore, the ÇVS students could be said to have a higher score of sense of belonging due to the facilities they were provided with in the campus.

Another finding was that the education faculty students at HU had higher scores of cognitive engagement, emotional engagement (the factor of relations with the faculty member) and class engagement when compared the education faculty students at YYU. The students at HU had better relationships and communication with each other and with their faculty members probably because HU was smaller than YYU as well as because the former had fewer students in number. For instance, some classes included 7-8 students, which made the lessons more productive and interactive. In addition, since the education faculty at HU used only one floor of its building, the students and the faculty members shared the same environment at out-of-class times. Accordingly, this situation could be said to create a warmer atmosphere which allowed the faculty members and the students to know one another better and which increased the students' levels of class engagement. The factors leading to an increase in engagement include the faculty members' support to their students, cooperation and interaction, interest in the environment and establishment of positive friendship relations between the students (Brewster & Bowen, 2004; Shin, Daly & Vera, 2007; Badge, Saunders & Cann, 2012; Günüç, 2016a). In this respect, the findings obtained in the study are supported by the related literature.

In addition, it was found in the study that the education faculty students at YYU had higher scores of sense of belonging and higher scores regarding campus engagement and campus climate when compared to the education faculty students at HU. The reason for this finding could be the fact that YYU had more facilities and its own campus and that it provided its students with environments where they could spend their free time. In addition, this result could also be based on the fact that HU did not have a big/wide campus; that the students were not exposed to any campus climate; and that the students were not provided with any facilities to spend their free time or to do any activities. Consequently, the limited campus facilities of HU decreased the students' scores of campus engagement, and the relationships established with peers and with the faculty member in a warmer atmosphere increased the students' scores of class engagement. In contrast, there was a contrary situation at YYU. However, the research data collected did not make it possible to explain the students' low levels of class engagement at YYU. This result might have occurred due to administration, faculty members and several other factors. In order to clarify this situation, interviews could be held with students in future studies.

One limitation to the present study could be the research sample. In the study, a limited number of students were reached due to time and cost issues. Moreover, the study included only the students from the ÇVS and education faculty at HU and from the education faculty at YYU. In future studies, similar comparisons could be made between students from other universities and units. In this respect, the variables in question may reveal different results at different class grades and in different units of the same university. Another limitation to the study could be the research method applied in the study. In the present study, the quantitative research method was used. Therefore, it was not possible to determine the students' views in detail about the campus and the class, and several difficulties were experienced in relation to the interpretation of the findings.

There are a number of variables influential on student engagement. It is impossible to say that campus facilities, relations with the faculty member technology integration and technological sub-structure are the only variables influential on increasing engagement. In future studies, all these variables could be taken into account as a whole, and the influence of other variables on student engagement could be examined. University administrators should make more efforts to make campus climates better. As can be seen via the results obtained in the present study, there are many factors influential on student engagement. However, it will make important contributions to increasing student engagement if the focus is not just on the factors related to the campus or class as well as if the two factors are evaluated simultaneously with a holistic approach.

IJONTE's Note 1: This study was carried out with the support of the TUBITAK 3001 (Number: 115K070).

IJONTE's Note 2: This article was presented at 8th International Conference on New Trends in Education - ICONTE, 18- 20 May, 2017, Antalya-Turkey and was selected for publication for Volume 8 Number 3 of IJONTE 2017 by ICONTE Scientific Committee.

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REFERENCES

Artun, H. & Günüç, S. (2016). Öğretim Elemanlarının Teknoloji Entegrasyonu Yeterliliğine Yönelik Öğrenci Algısı Ölçeği: Geçerlilik ve Güvenirlilik Çalışması. *Yüzüncü Yıl Üniversitesi Eğitim Fakültesi Dergisi*, 8, 1-1.

Badge, J., Saunders, N. & Cann, A. (2012). Beyond marks: new tools to visualise student engagement via social Networks. *Research in Learning Technology*, *20*.

Brewster, A. B., & Bowen, G. L. (2004). Teacher support and the school engagement of Latino middle and high school students at risk of school failure. *Child and Adolescent Social Work Journal, 21*(1), 47-67.

Fredricks, J. A., Blumenfeld, P. C. & Paris, A. H. (2004). School engagement: potential of the concept, state of the evidence. *Review of Educational Research, 74,* 1, 59–109.

Günüç, S. (2016a). *Üniversitelerde Öğrenci Bağlılığı.* Ankara: Nobel Bilimsel Eserler.

Günüç, S.(2016b). Kampüs İklimini Belirlemeye Yönelik Bir Ölçme Aracının Geliştirilmesi. *International Multidisciplinary Eurasian Congress,* Odessa, UKRANIA, 11-13 July 2016. pp.1-1.

Günüç, S. & Kuzu, A. (2014). Student Engagement Scale: Development, Reliability and Validity*. Assessment and Evaluation in Higher Education,* 40(4), 587-610.

Jimerson, S. R., Campos, E., & Greif, J. L. (2003). Toward an understanding of definitions and measures of school engagement and related terms. *The California School Psychologist, 8,* 7-27.

Kuh, G. D., & Hu, S. (2001). The relationships between computer and information technology use, student learning, and other college experiences. *Journal of College Student Development, 42,* 217–232.

Kuh, G. D. (2009). The national survey of student engagement: Conceptual and empirical foundations. *New Directions for Institutional Research*, 141, 5-20.

Marks, H.M. (2000). Student engagement in instructional activity: Patterns in the elementray, middle, and high school years. *Amarican Educational Research Journal*, 37, 153-184.

Newmann, F. M., Wehlage, G. G. & Lamborn, S. D. (1992). The significance and sources of student engagement. In F. M. Newmann (Ed.). Student engagement and achievement in American schools (p.11-39). New York: Teachers College Press.

Shin, R., Daly, B., & Vera, E. (2007). The relationships of peer norms, ethnic identity, and peer support to school engagement in urban youth. *Professional School Counseling, 10*(4), 379-388.

Turkish Language Association. (2017). *Güncel Türkçe Sözlük (Current Turkish Dictionary).* (Retrieved on 09.04.2017), (http://www.tdk.gov.tr/).

International Journal on New Trends in Education and Their Implications
July 2017 Volume: 8 Issue: 3 Article: 03 ISSN 1309-6249

THE EFFECT OF TWO APPROACHES TO DEVELOPING REASONING SKILLS OF PRESERVICE SCIENCE TEACHERS

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Abstract
The aim of this study is to determine the effect of the Prediction Observation Explanation (POE) Method and the Cognitive Acceleration through Science Education (CASE) Project based activities on reasoning skills of preservice science teachers. A pretest-posttest quasi-experimental research, without a control group, design was used. The study group consisted of 93 students studying in their 2nd year of a Science Education program in the fall semester (2014-2015) at Gazi University. A "Scientific Reasoning Skills Test" (SRST) was implemented as the pretest to determine pre-scientific reasoning skills. Then, the students in the two classes were randomly divided into four groups and two of them were selected as the Implementation Group 1 (IG_1)(n_1 = 47)tocomplete 12 POE Method based activities. The other two groups labelled Implementation Group 2 (IG_2), (n2= 46) completed 12 activities developed for the CASE Project. SRST was implemented to all groups as the posttest. A statistically significant difference was observed in the scientific reasoning skills as a result of different activities that the IG_1 and IG_2 groups completed. It was seen that POE Method based activities were more effective than CASE Project based activities in developing scientific reasoning skills. In addition, scientific reasoning skills of males were more developed than females.

Keywords: Cognitive acceleration through science education, prediction observation explanation method, scientific reasoning.

INTRODUCTION

Today, with rapid developments and changes in science and technology, the knowledge and skills gained by individuals need to be one of the most important goals. Regardless of individual differences, it is necessary to help students have the skillsto approach events with an inquiring and searching mind at an early age. Scientific teaching needs to emphasize research and inquiry, critical thinking, having a sense of wonder about the world in which we live in and about our environment, identifying problems, the ability to propose solutions to problems andalso the ability to solve such problems In addition, the need for individuals who have improved decision-making and lifelong learning skills is clearly expressed (Ministry of National Education of Turkey National Board of Education, 2012). It has been claimedthat these skills can be developed within students using a teaching approach that enables mentally, physically and sensorially effective participation of students (Ozer, 2009). Moreover; ithas been seen that individuals with scientific reasoning and thinking skills can be more successful in achieving their goals and coping with difficulties (Yuksel, 2015).

To solve problems met in their daily life, individuals should possess reasoning skills which can enable the ability to seek the information they need and provide them with new information through deduction (MONE, 2000). There is a need for qualified individuals in changing life situations to be able to make suitable observations, detect problems, pose a query, test the hypothesis, generate alternative hypotheses, make appropriate decisions, generate new ideas and solve problems. This is expected to refer to individuals who have developed reasoning and thinking skills. In practice, it is not possible to face individuals with all problem situations they may encounter. But from now on, individuals who not only acquire knowledge but also can reason by making use of acquired knowledge and solve the problems by using scientific methods are able to be successful in a rapidly developing and changing world (Coban, 2010).

Many theories are put forward trying to explain how individuals may have knowledge, skill and sensorial structure, which are mentioned above, or how learning can occurs and the putting forward of new ones can continue. Some of the theories, which mostly affect education in its general meaning and science education in particular, are those put forward by Jean Piaget, Jerome Bruner, Robert Gagne and David Ausubel (Ozmen, 2004). The studies by Piaget in the field of cognitive development have a profound impact on the education system in many countries and continues to impress. According to Piaget, knowledge is not passively received by individuals. Knowledge is configured actively in the mind after the individual's own experiences and interaction with the social environment and processes of testing hypotheses mentally or making logical reasoning. Piaget, arguing that the child's cognitive development takes place by biological maturation (growth), and is shown through evaluating individuals' cognitive development in four stages, claims that each individual lives through these processes (stages) at similar ages (Ozmen, 2004).

Criticisms related to Piaget's theory of cognitive development are classification of the stages regarded as intellectual development are made based on the age and context dependence of the items available in the assessment instrument used to measure reasoning skills seirously affecting the level of success (Yazgan, Bilgin and Kılıc, 2015).

Responding to these criticisms, Lawson et al. (2000) carefully reviewed the formal operational stage again, based on individuals' mental abilities possessed at this stage (Lawson, Clark, Cramer-Meldrum, Falconer, Sequist and Kwon, 2000; Lawson, 2004). Lawson et al. (2000), divided the formal operational stage into four subgroups and reinterpreted this stage according to the mental skills and hypothesis testing skills which individuals should have.

Lawson et al. (2000) argued that the most prominent and remarkable difference among individuals at the formal operational stage was the type using the logical inference process in the form of "if.....and.....then.....therefore" or the process of hypothesis testing in different situations. According to the new classification, individuals could be grouped as; Level 0: who could not test the hypothesis even on observable events, Low Level 1: who could test the hypothesis on observable events in some cases, but not in others, High Level 1: who could test the hypothesis on observable events in a consistent manner, and Level 2: who could test the hypothesis even on unobservable events. To take into account the hypothesis testing skills in the new grouping, Lawson et al. modified the logical thinking test. Based on the modified test scores, individuals were divided into four categories that reflected their ability to test the alternative hypothesis.

Today, it is well known that knowledge is constructed in the mind of individuals depending on preliminary information, cognitive skills, environmental and cultural factors, and efficiency of student-centered education. Therefore, to determine whether the students have reasoning and hypothesis testing skills they should have, at the formal operational stage in science education, one of the preconditions for an efficient education (Lawson, 1985). It is stated that the interruptions in the development of cognitive skills at formal and concrete operational stages and the inadequacy of reasoning skills of students make giving scientific meanings to the concepts, problem solving and understanding the nature of science difficult (Lawson, 2004). Determining the level of reasoning skills anticipated at the during formal operational stage and at what efficiency they are used is important for cognitive development and concept teaching (Ates, 2002). In addition, many studies conducted in Turkey show that middle school, high school and university students' scientific reasoning and hypothesis testing skill levels are inadaquate (Ates, 2002; Ozcan and Oluk, 2007; Demirbas and Ertugrul, 2012).

In previous studies, it is reported that the inadequacy of reasoning skills at the formal operational stage may be one of the reasons for student failure in science and mathematics (Lawson, 1985). It has been shown that British students who completed the activities developed for the Cognitive Acceleration through Science Education (CASE) project during one year develop scientific reasoning skills, in addition to this their science, maths, foreign language and social sciences course successes increasing (Adey and Shayer, 1994). As seen in the result of this research, knowledge and skills that are expected to be at concrete and formal operational stages may be improved with appropriate methods and have a positive effect on success in many courses. However, the CASE Project based activities do not include the alternative hypothesis generation and testing skills of formal operational stage, redefiened by Lawson et al. (2000) and some of reasoning skills required instructional methods developed based on conceptual change approaches to learn them. In this study, it is aimed to develop scientific reasoning skills of students including hypothesis generation and testing skills with the help of Prediction Observation Explanation (POE) Method based activities.

This research sets out to;

i) identify pre-scientific reasoning skills of the students who undertook POE Method and CASE Project based activities.
ii) compare the pre-scientific reasoning skills in terms of gender.
iii) compare IG_1 and IG_2 groups according to scientific reasoning skills posttest mean scores.
iv) compare pre and post scientific reasoning skills of students who completed POE Method and CASE Project based activities.
v) compare post scientific reasoning skills of female and male students who completed POE Method and CASE Project based activities according to the mean scores.
vi) determine a possible teaching method-gender interaction in terms of post scientific reasoning skills of groups.

METHOD

This study is conducted using a pretest-posttest, quasi-experimental design without a control group. The difference between this design and pretest-posttest experimental design with a control group is that groups aren't fully formed randomly and there is no control group in this design. A symbolic view of the research design is presented in Table 1.

Table 1: Symbolic View of the Research Design

Groups	Pretest	Implementation	Posttest
IG_1	O_1	X_1	O_2
IG_2	O_3	X_2	O_4

IG_1:POE Group, **IG_2:**CASE Group, **X_1:** POE Based Activities, **X_2:**CASE Based Activities,**O_1, O_3:** Pretest Points, **O_2, O_4:** Posttest Points

Study Group

The sample of the study was selected from students who were studying in a Science Education Program with the idea of contributing to professional development of preservice science teachers at the Gazi University Gazi Faculty of Education. For this study; students studying in two classes in the fall semester of the 2014-2015 academic year were divided into two groups so that there are two groups per class. One of the groups in each class was randomly assigned to the IG_1 and the other one to the IG_2. The distribution of students in IG_1 and IG_2 groups according to gender is shown in Table 2.

Table 2: The Distribution of Students in IG_1 and IG_2 Groups According to Gender

Groups	**Female**		**Male**		**Total**	
	f	**%**	**f**	**%**	**f**	**%**
IG_1	40	43	7	7.5	47	50.5
IG_2	40	43	6	6.5	46	49.5

As seen in Table 2, the number of students in IG_1 group is 47 (40 female and 7 male), the number of students in IG_2 group is 46 (40 female and 6 male). Based on this data, it is possible to say that the number of students in IG_1 and IG_2 groups and their distribution according to gender is equivalent. However, the number of males is far less than females. This situation can be a disadvantage of studying with present groups and a limitation of the research.

Procedure

First, the pilot implementation of materials developed for this study was held with different students who participated in this research. In the pilot implementation; POE Method based activities were implemented in a group consisting of 25 students and CASE Project based activities were implemented in the other group consisting of 27 students. A pilot implementation was first undertaken. The aim of the pilot study was to identify problems encountered during the implementation of the developed and adapted activities and to avoid encountering similar problems in actual implementation by taking the necessary precautions.

Second, the actual implementation of the research was held with the 93 students who were studying in the fall semester of 2014-2015 academic year. The Scientific Reasoning Skills Test (SRST) was implemented as a pretest in both groups.

In the research, variables such as ambient conditions of implementation classes, the equal number of activities to develop the same reasoning skills and lesson time, etc. were made to be the same for IG_1 and IG_2 before the experimental procedure. Students of IG_1 group were taught with activities developed. POE Method based using worksheets two hours per week for 12 weeks during a semester. With regard to of students IG_2 group, they were taught with CASE Project based activities adapted to Turkish two hours per week for 12 weeks during a semester.

Taking into consideration the subdimensions of scientific reasoning skills, a lesson plan including POE Method and CASE Project based activities was prepared two hours per week for 12 weeks. Instructions for weekly lessons both in IG_1 and IG_2 groups were set forth in detail in these plans. In this way, the subject of 12 weekly lesson for IG_1 and IG_2 groups was determined with 12 weekly lesson plans.

Students in IG_1 group was trained to reason via the POE method other than in the time allocated for the activities. They were provided information for implementation of the methods and the lower steps. A similar application was made to students in IG_2 group with CASE Project based activities. The necessary information on CASE Project based activities was given to them.

Implementation lasted for 12 weeks. In the activities, both IG_1 group and IG_2 group students studied in groups of 4-5 people. Finally SRST was implemented as the posttest in both groups. Students in both groups were also asked for feedback about the subject of the lesson for two hours each week.

Development of POE Activities

The ability to gain knowledge and skills about science effectively to students is directly related to the quality of conceptual teaching to be applied in science courses (Ates and Bahar, 2002).This method which is used to reveal knowledge of students about a particular subject and to provide them with a conceptual change in teachinghas been developed by White and Gunstone (1992). It is referred to in the literature as POE (Prediction-Observation-Explanation) Method.

With the POE Method, students are faced with real problem situations rather than theoretical problems. Thanks to this, students are actively involved in the solution of the problem situation (White and Gunstone, 1992, p. 56). POE-based learning allows students to use scientific process skills and allows them to work as scientists using scientific methods. This learning approach is very suitable for science lessons, which enables students to relate new knowledge to previous knowledge and to construct and express their knowledge in a meaningful way. It permits students to take responsibility when they work on their own or as a group, to express themselves and to develop their self-confidence. In addition, this method helps learners develop positive attitudes toward science courses because they are constantly active, responsible for their own learning, and able to apply what they learn in everyday life (Bilen, 2009).

In total, 12 POE based activities were prepared and used in this research to improve scientific reasoning skills of students. One such activity is shown in Annex 1. The first step in the activity worksheets were used for the prediction process. For this, pictures to attract students' attention were given and students were asked through an open-ended question to explain their predictions about the events in the activities with their reasons.

This approach was used because CASE Project based activities does not include the alternative hypothesis generation and testing skills of formal operational stage reviewed by Lawson et al. (2000). According to research it was seen that misunderstanding in the minds of the students affect their predictions about the events (Liew and Treagust, 1998). Thanks to prediction process by looking at their predictions students' misconceptions and ways of thinking are identified in detail. In summary, prior knowledge of the students is provided and their curiosity is increased in prediction process. Prediction process is the one at which students desire to know and learn and at this process it is expected to gain research and inquiry skills by reasoning.

Observation, the second process, aims at the development of students' reasoning skills by gaining critical thinking, identifying problems and solving skills. In this process, implementations in which students are expected to develop their scientific reasoning skills by making observations about pictures and questions are given. In each POE activities, there was an activity in the observation process for students to understand the answers of questions asked in the prediction process better. Care was taken for the event in the activities to be easily observed by the students and to make contradictions in their minds (White and Gunstone, 1992). With these contradictions, detailed information about students' understanding was reached. Activity guidelines were expressed to the students in the form of instructions step by step. The way to do the activity was shown with pictures or shapes.

In the third and final process that is the process of explanation students were enabled to use the reasoning skills by the development of their decision-making skills. In this process students were asked to make explanations in order to eliminate the contradictions that occur between their predictions and observations, in other words, to reach a conclusion in line with the activities carried out and answers of the questions and to express this result. According to the intensity of topics, sometimes more than one relevant activity were given.

Adaptation Process of CASE Based Activities

CASE, based largely on the work of Piaget and Vygotsky, is a teaching approach which arose from the research about cognitive development. It aims to develop children's thinking ability by enhancing them with higher-order thinking skills that are called "formal operations" by Piaget. It makes this by developing children's science understanding which may sometimes be difficult for most of them. CASE Project is a project carried out in the United Kingdom between the years 1984-1987 on selected samples representing a large portion of the school population of a country. CASE, which is now widely used in schools of the United Kingdom and is experimented in different countries, is an intervention program in the existing curriculum and it is originally for children between the ages of 11 and 14. A course curriculum consisting of various activities in order to develop scientific reasoning skills of the students are applied to the students (Adey, 1999).

The following steps were taken for the adoption of CASE Project based activities:
1. The acquisition of CASE activities (receiving of permission)
2. Validated Turkish adaptation of CASE activities
3. Choice of parallel activity from CASE activities to POE Method based activities
4. Pilot implementation
5. Regulation of CASE activities
6. Actual implementation

A pilot study was carried out with 25 students studying in 2nd year at Gazi University Gazi Faculty of Education Science Education Program in 2013-2014 academic year spring semester. Written answers given to CASE Project based activities by students were collected and interviews were conducted with students after the activities finished. At the end of the implementation, the points difficult to understand in the materials and worksheets were revealed and incomprehensible ones were corrected. After the elimination of missings in the CASE Project based activities used in the study, the opinion of three experts was asked again and the actual implementation was started. One such activity is shown in Annex 2.

Data Collection Instruments
Scientific Reasoning Skills Test (SRST)
SRST was adapted and compiled by researcher. Because multiple choice tests are shown inadequate to elicit students' conceptual structures, misconceptions, and conceptual knowledge (Griffard, 2001). It was decided to measure scientific reasoning skills with semi-open-ended tests rather than multiple-choice tests. Since there is no open-ended Turkish-adapted test concerning Lawson's (1995) reinterpreting of the stage theory, a new test was developed. Therefore, the Scientific Reasoning Skills Test to measure scientific reasoning skills in more detail wasredeveloped for this study.

As a result of feedback from experts, a pool of 28 questions was obtained by taking 4 questions to each sub reasoning skills from tests developed previously. Language and expression of the test was checked by two Turkish teachers who are experts in the field. This test including 28 questions was implemented to 24 people for the control of intelligibility.
At the end of the implementation problems were identified as it was seen that the sentences in two questions in the test weren't understandable. So these 2 questions were omitted from the instrument. The 26 items of test were compiled from the following sources:
- Four questions were taken from the Test of Scientific Reasoning which was developed by Lawson (1978) and Spearmale Brown reliability coefficient of which was calculated as 0.72 and translated into Turkish by Ates (2002).
- Thirteen questions were taken from Logical Thinking Group Test which was developed by Roadrangka, Yeany and Padilla (1982) for which the Cronbach's Alphareliability coefficient was calculated to be 0.85. It was translated into Turkish by Aksu, Berberoglu and Paykoc (1991).
- Six questions were taken from Test of Logical Thinking which was developed by Tobin ve Capie (1981), reliability of which was calculated as 0,85 and translated into Turkish by Geban, Askar and Ozkan (1992).
- One question was taken from Abstract Operations Period Skills Test (AOPST) which was used by Demirbas and Ertugrul (2012) in their study named An Investigation into the Realization of Skills in the Science and Technology Lessons Expected to be Acquired in Piaget's Abstract Operations Stage.
- Two questions which measure the ability to test hypothesis about unseen events were developed by the researchers.

Questions in the subdimensions of the test are shown in Table 3.

Table 3: Questions in the Subdimensions of the Test

Subdimensions	Questions
Conservation Laws	1, 2, 3
Proportional Thinking	4, 5, 6, 7
Identifying and Controlling Variables	8, 9, 10, 11
Combinatorial Thinking	12, 13, 14, 15
Correlational Thinking	16, 17, 18, 19
Probabilistic Thinking	20, 21, 22, 23
Hypothetical Thinking	24, 25, 26

In the semi-open-ended questions; first, students are asked to find the answer of a question about a situation described as figure and writing by selecting one of the options given and then they're asked to explain how they reached to this answer. For each item, students were expected to provide an answer as well as an explanation of the answer. One point was awarded when both the answer and the explanation were correct; otherwise no points were awarded. Response scores of students for items in this instrument can range 0 to 26.

Validity and Reliability Study of SRST

The test was implemented to a group of 303 people consisting of students who were studying at Gazi University Gazi Faculty of Education Science Education Program. The distribution of the students according to class and gender are given in Table 4. Time was kept until all students completed the test and the ideal time for the implementation of the test was found to be 60 minutes.

Table 4: Students Participating in the Pilot Implementation

Gender	1st Grade	3rd Grade	4th Grade	Total
Female	75	134	53	262
Male	11	22	8	41
Total	86	156	61	303

Cronbach's alpha reliability coefficient related to reliability study of the test was determined as 0,76, which was taken as an adequate reliability coefficient value for the use of the test. Cronbach's alpha reliability coefficients related to subdimensions of the test were as presented in Table 5.

Table 5: Cronbach's Alpha Reliability Coefficient Related to Subdimensions of the Test

Subdimensions	Cronbach's Alpha Value
Conservation Laws	0,75
Proportional Thinking	0,75
Identifying and Controlling Variables	0,75
Combinatorial Thinking	0,75
Correlational Thinking	0,76
Probabilistic Thinking	0,75
Hypothetical Thinking	0,75
Total	0,76

Item difficulty is expressed as the percentage of people who answer the item correctly. The values related to item difficulty indices of the test used in the study are given in Table 6 and item discrimination indices are given in Table 6.

Table 6: Item Difficulty and Discrimination Indices

Evaluation of Items	Item Difficulty Index	Items
Difficult	0,20 - 0.29	7, 10, 11, 16, 17, 19, 24 and 25
Moderately Difficult	0,30 - 0,49	3 and 26
Easy	0,50 - 0,69	2, 4, 9, 12, 13, 15, 18 and 21
Very Easy	0,70- 1,00	1, 5, 6, 14, 20, 22 and 23
Evaluation of Items	**Item Discrimination Index**	**Items**
High Discriminating Power	0,40 and above	22 and 23
Good Discriminating Power	0,30 - 0,39	1, 3, 4, 5, 6, 7, 8, 9, 13, 15, 20 and 21
Moderate Discriminating Power	0,20 - 0,29	2, 10, 14, 18, 24, 25 and 26
Low Discriminating Power	0,00 – 0,19	11, 12, 16, 17 and 19

Based on Table 6, materials with a discriminative power index of 0.19 or less should be removed from the test or passed entirely through the test. Items in the range of 0.20-0.29 must be reviewed; items in the range of 0.30 to 0.39 can be used in the test without correction or with minor modifications; 0.40 and above items are the distinguishing ones and can be taken directly to the test (Kan, 2008). Test items were re-evaluated according to the relevant intervals.

Data Collection and Analysis

SPSS 20 statistics software was used to analyze quantitative data on scientific reasoning skills gained in the implementation of the study. The data of the students' scores were checked whether they provided the necessary assumptions for parametric tests. Later; results were reviewed with ANCOVA analyzes by taking pretest (covariates), posttest (dependent variable) and group (independent variable). Dependent t test was used in comparisons within the groups. The degree of relationship between the variables was examined.

FINDINGS

Pre-test on Scientific Reasoning Skills (Pre-Test)

The first question sought to answer "Is there a difference between the pre-scientific reasoning skills (pre-test) mean scores of students who completed POE Method and CASE Project based activities?".

Since almost intact classes participated in the study, there was a possibility of difference in students capabilities and pre-reasoning skills, characteristics could affect the variables under study. After seeing that the homojenity and normality assumptions were provided to use parametric test techniques, pre SRST scores of the two groups was examined with t test for independent samples whether there was a significant difference between them. As seen in Table 7, pre-reasoning mean scores were found to be statisticaly the same for the two groups.

Table 7: SRST Pretest %, SD and Independent t Test Results

Group	N	$\bar{X}$	S. D.	Sd	t	p
IG_1	47	12,72	3,82	91	-,24	,81
IG_2	46	12,91	3,81			

Findings Belong to Comparison of Pre-Scientific Reasoning Skills in terms of Gender

The second research question is "Is there a difference between pre-scientific reasoning skills mean scores of female and male students?". Independent t test was used for testing whether there was a difference between pre-scientific reasoning skills (pretest) mean scores of female and male students.

Table 8: SRST Pretest Mean Scores Independent t Test Results of Female and Male Students

Group	N	$\bar{X}$	S. D.	Sd	t	p
Female	80	12,74	3,74	91	-,50	,62
Male	13	13,31	4,25			

As shown in Table 8, as p=,62 > α=,05 it was seen that there was no significant difference between SRST pretest mean scores of female and male students. When interpreting these findings, the imbalance between the number of female students and male students should be considered.

Scientific Reasoning Skills Posttest Mean Scores

The third research question is "According to scientific reasoning skills posttest mean scores, is there a difference between the mean scores of IG_1 and IG_2 groups?". After determining conditions for pretest scores to be used as a covariate, pretest scores were included as a covariate in the analysis. IG_1 and IG_2 groups posttest mean scores were analyzed using ANCOVA techniques to learn whether there was a difference.

Table 9: Descriptive Statistics Belong to IG_1 and IG_2 Groups SRST Posttest Scores

Group	N	Mean	Corrected Mean	S. D.
IG_1	47	20,09	20,11	3,38
IG_2	46	17,17	17,15	4,24

As shown in Table 9; according to scientific reasoning skills corrected mean scores,the mean scores of IG_1 was higher thanIG_2. ANCOVA results on whether the observed difference between the scientific reasoning skills corrected posttest mean scores of the groups was significant are given in Table 10.

Table 10: ANCOVA Results For SRST Corrected Posttest Mean Scores of IG_1 and IG_2

SRST	Variance Source	Sumof Squares	Sd	Averageof Squares	F	p
Total	Group	203,90	1	203,90	14,83	,001*

*p<,05

When the ANCOVA results in Table 10 were examined; according to pretest scores of students' IG_1 and IG_2 groups, it was found that there was a significant difference between corrected mean scores of the posttest [F (1,90) = 14,83; p <,05]. In other words, it was seen that scientific reasoning skills of students' in IG_1 group who completed POE based activities developed statistically significantly more than that of students' in IG_2 group who completed CASE based activities.

Findings for Pre and Post Scientific Reasoning Skills Mean Scores of Students Who Completed POE Method Based and CASE Project Based Activities

The fourth question of the researchis "Is there a difference between pre and post scientific reasoning skills mean scores of students who completed POE Method based and CASE Project based activities?"was examined using t-test for dependent samples.

Table 11: Scientific Reasoning Skills Pre and Post Test Dependent t Test Results of IG_1

Group	$\bar{X}$	N	S. D.	Sd	T	p
Pretest Score	12,72	47	3,81	46	-11,03	,001*
Posttest Score	20,09	47	3,38			

*p<,05

As shown in Table 11, according to test results (p=,00 < α=,05) it was seen that there was a significant difference between SRST pretest and posttest mean scores. The mean value of the posttest is higher than that of the pretest. So, this difference also shows that the posttest is higher than the pretest in terms of mean score value.

The difference between pre and post scientific reasoning skills mean scores of students who completed CASE Project based activities was examined with t test for dependent samples. Scientific reasoning skills pre and post test dependent t test results which belong to IG_2 group are shown in Table 12.

Table 12: Scientific Reasoning Skills Pre and Post Test Dependent t Test Results of IG_2 Group

Group	$\bar{X}$	N	S. D.	Sd	T	p
Pretest Score	12,91	46	3,81	45	-6,20	,001*
Posttest Score	17,17	46	4,24			

*p<,05

As shown in Table 12, according to test results (p=,001< α=,05) it was seen that there was a significant difference between SRST pretest and posttest mean scores. The mean value of the posttest is higher than that of the pretest. So, this difference also shows that the posttest is higher than the pretest in terms of mean score value.

Findings for the Difference Between Post Scientific Reasoning Skills Mean Scores of Female and Male Students Who Completed POE Method and CASE Project Based Activities

The fifth research questionis "Is there a difference between post scientific reasoning skills mean scores of female and male students who completed POE Method based and CASE Project based activities?". Descriptive statistics values of female and male students' post test scores are presented in Table 13.

Table 13: Descriptive Statistics Values of Female and Male Students

Group	N	$\bar{X}$	S. D.	Min.	Max.
Female	80	18,16	4,05	6	25
Male	13	21,62	2,93	16	25

According to the descriptive statistics values of posttest scores in Table 13, the mean scores of the female and male students are 18.16 and 21.62 respectively. The standard deviation values are 4,05 and 2.93 respectively. Posttest score values of female students are ranged from 6 to 25. Posttest score values of male students are ranged from 16 to 25. ANCOVA analysis results made to determine whether there is a significant difference between posttest scores of the two groups are given in Table 14.

Table 14: ANCOVA Analysis Results According to SRST Corrected Posttest Scores of Female and Male Students

SRST	Variance Source	Sum of Squares	Sd	Average of Squares	F	p
Total	Gender	122,44	1	122,44	8,35	,01*

*p<,05

When Table 14 was examined, it was found that there was a significant difference between corrected posttest mean scores of female and male students [F(1,90)=8,35; p<,05]. In other words, a statistically significant difference was seen in favor of male students in scientific reasoning skills following the education of female and male students.

Findings for Teaching Method-Gender Interaction in terms of Post Scientific Reasoning Skills of Students Who Completed POE Method Based and CASE Project Based Activities

The sixth research question is "Is there a teaching method-gender interaction in terms of post scientific reasoning skills of students who completed POE Method based and CASE Project based activities?". Descriptive statistics values belong to post scientific reasoning skills of students who completed POE Method based and CASE Project based activities are shown in Table 15, ANCOVA results of comparison made to investigate the interaction effect are presented in Table 16.

Table 15: Teaching Method-Gender Interaction Descriptive Statistics of SRST Scores

	Female			Male			Total		
	N	$\bar{X}$	S.D.	N	$\bar{X}$	S.D.	N	$\bar{X}$	S.D.
IG_1	40	19,53	3,30	7	23,29	1,70	47	20,09	3,38
IG_2	40	16,80	4,30	6	19,67	2,94	46	17,17	4,24
Total	80	18,16	4,05	13	21,62	2,93	93	18,65	4,08

While testing the assumptions required for ANCOVA analysis which would be made, it was found that posttest score of the dependent variable had a normal distribution (p=,26 > α=,05) with K-S Normality Test. The variances of levels according to group and gender were homogeneous; respectively (p=,18 > α=,05) and (p=,22 > α=,05). In this case the results of ANCOVA analysis were found as in Table 16.

Table 16: Teaching Method-Gender Interaction ANCOVA Results of SRST Scores

Variance Source	Sum of Squares	Sd	Average of Squares	F	p
Group	109,74	1	109,74	8,60	,001
Gender	111,85	1	111,85	8,77	,001
Group x Gender	1,23	1	1,23	,10	,760

As it was seen in Table 16, a significant difference was found between SRST mean scores of IG_1 and IG_2 groups, (F(1,88)=8,60; p<,05). A significant difference was also found between SRST mean scores of female and male students, (F(1,88)=8,77; p<,05). However, the effect of teaching method-gender interaction to SRST posttest scores of students was found to be insignificant, F(1,88)=,10; p>,05. To put it another way, a situation such as one of the methods is more effective in the development of female students and one other is for male students is not the case.

DISCUSSION

In the light of obtained results, it can be said that POE Method has a positive effect on the development of students' scientific reasoning skills.

Discussion Regarding the First Research Question

The result in Table 7 shows that the scientific reasoning skills success of the students in IG_1 and IG_2 groups was at the same level before the implementation. Since groups have similar educational backgrounds, it is expected that their scientific reasoning skills and preliminary information will be at the same level.

Discussion Regarding the Second Research Question

In the result of the analysis made to test whether there is a significant difference between SRST pretest mean scores of female and male students, it was seen that there was no significant difference between the SRST pretest mean scores of female and male students. This result shows that the scientific reasoning skills success of female and male students was at the same level before the implementation.

Discussion Regarding the Third Research Question

According to the findings obtained from SRST posttest scores analysis of students in IG_1 and IG_2 groups, a statistically significant difference was found in the scientific reasoning skills as a result of education that students in IG_1 and IG_2 groups took. As a consequence, the lessons with POE Method was more effective than CASE Project based activities for scientific reasoning skills of students. The obtained results are consistent with previous studies demonstrating that activities prepared with POE Method are more effective in concept teaching by contributing to conceptual change (Koseoglu et al., 2002; Tekin, 2008). POE Method can be explained as discovering the preliminary knowledge in the prediction process, strengthening learning by addressing more senses of students in the observation process and allowing students to compare their predictions and observations in the explanation process (Aydın, 2010).

Among all subdimensions, a significant difference was seen between IG_1 and IG_2 groups inproportional thinking, probabilistic thinking and hypothetical thinking subdimensions in terms of corrected posttest scores. This difference was in favor of IG_1 completing POE Method based activities. For the other subdimensions, no difference was found between IG_1 and IG_2 groups in terms of corrected posttest scores. One of the most important benefits of the POE Method is to ensure the students their active participation in the event to explain the causes of the events. This allows students to bring self-description to the events instead of repeating the information in the book without thinking. Students are faced with the problem situations in the real life. They have the the opportunity to try and observe the comments and explanations they made for the events theoretically (White and Gunstone, 1992, p.58). By this way, students become involved in the learning activities by doing and living.

Discussion Regarding the Forth Research Question

In the result of the analysis made to test whether there was a significant difference between SRST pretest and posttest mean scores that belong to IG_1 group, it was seen that there was a a significant difference between SRST pretest and posttest mean scores. The mean value of the posttest was higher than the pretest. Among all subdimensions, it was seen that there was a significant difference between SRST pretest and posttest mean scores of students in IG_1 group. This was a significant difference in terms of corrected posttest scores. POE is a method used both in teaching science concepts and in conceptual change. One of the most important features of the POE Method is to ensure students their active participation to the event to explain the causes of it. This allows students to explain the events by using their own mental structures instead of repeating the information in the book without thinking. They are faced with the problem situation on the paper in the real life. They have the chance to try the comments and explanations made for the events theoretically (White and Gunstone, 1992, p.58).

In the result of the analysis made to test whether there was a significant difference between SRST pretest and posttest mean scores that belong to IG_2 group, it was seen that there was a a significant difference between SRST pretest and posttest mean scores. The mean value of the posttest was higher than the pretest. It was seen that CASE Project based activities based on research and inquiry were effective in improving abstract thinking and scientific reasoning skills (Shayer ve Adey, 1993).

Among all sub-dimensions except for hypothetical thinking, it was seen that there was a significant difference between SRST pretest and posttest mean scores of students in IG_2 group. This difference was significant in terms of corrected posttest scores. Posttest mean value in hypothetical thinking was higher than the pretest. However, it wasn't a statistically significant difference. Hypothetical thinking was the skill that the students could achieve at the lowest rate. These results are consistent with the study of Demirbas and Ertugrul (2012). In accordance with these results, it is seen that there are not enough emphasis to the development of hypothetical thinking in CASE Project based activities.

In the study in which the analysis of the questions used in the science lessons were made by Ozcan and Oluk (2007), it was found that the rate of the questions for hypothetical thinking skills was less than 1%. Hypothetical thinking skill must be supported by written questions.

Discussion Regarding the Fifth Research Question

When examining the results of the sum of the subdimensions, it was found that there was a significant difference between corrected posttest mean scores in comparison with pretest scores of female and male students. To put it another way a statistically significant difference occurred in scientific reasoning skills after the education that female and male students took. The difference between the average of the groups was in favor of males. It can be said that reasoning skills of male students were more developed compared to female students. In some earlier studies in this field, it was determined that male students have logical thinking skills at a higher level in comparison with female students (Kuzgun and Deryakulu, 2004, p.329; Zarotiadou and Tsaparlis, 2000). Aksu and Berberoglu (1991) emphasize that there is a meaningful relationship between logical thinking level and gender in favor of males. Koray and Azar (2008) reach the conclusion that gender creates a significant difference in terms of logical thinking and male students are more successful.

A significant difference was seen between female and male students in terms of corrected posttest scores of identifying and controlling variables and hypothetical thinking subdimensions. For other subdimensions no significant difference was found between corrected posttest scores of female and male students. Also, according to some research results in literature, it was found that logical thinking skills of students who are preservice teachers does not changedepending on the gender (Yaman and Karamustafaoglu, 2006). In addition; Yaman (2005), Valanides (1996) and Kılcal and Yazgan (2010) conclude that gender has no significant impact in terms of logical thinking.

Correct answers given by male students to questions related to identifying and controlling variables are more than female students. This result is supported by the findings of Yuzuak (2012). Female and male students received the same number of points approximately in the questions which measures probabilistic thinking and correlational thinking skills. This result is also supported by the findings of Yuzuak (2012).

When it comes to the questions measuring combinational thinking, proportional thinking and conservation laws no difference was seen between the mean scores of female and male students. In this regard, it can be said that scientific reasoning skills of female and male students in the study group are similar.

Discussion Regarding the Sixth Research Question
It was seen that the effect of teaching method-gender interaction to SRST posttest scores of students was insignificant. In other words, SRST posttest scores of students who were taught according to POE Method based and CASE Project based activities doesn't change according to gender or teaching method.

SUGGESTIONS

Teachers should know the cognitive development of the students very well and should do activities for this purpose. In science courses, studies involving scientific reasoning about applied studies can be done. Thus, it may be possible for students to be able to understand abstract concepts better.

In the study, the development of scientific reasoning skills of students was examined by POE Method. The effects of different methods and variables (problem solving, case studies and academic achievement, scientific process skills, and the elimination of misconceptions, etc.) to development of scientific reasoning skills can also be investigated.

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REFERENCES

Adey S. P. (1999). *The science of thinking, and science for thinking: a description of cognitive acceleration through science education (case).* Switzerland, Unesco: International Bureau of Education.

Aksu, M., Berberoglu, G.,&Paykoc, F. (1991). *Can the GALT test be used in a different culturesetting*? Ankara: Research Report.

Aydın, M. (2010). *The compare effect of using prediction-observe-explain method on students achievement in science and technology of remediation of misconceptions.* Master's Thesis, Zonguldak Karaelmas University, Institute of Social Sciences, Zonguldak.

Ates, S. (2002). *Comparison of classroom teaching and science teaching 3rd grade students' scientific reasoning skills*. Paper presented at V. National Science and Mathematics Education Congress. 16-18 September 2002. METU, Ankara.

Bilen K., (2009). *The influence of laboratory practices based on the "Predict-Observe-Explain" method on the prospective teachers' conceptual successes, scientific process skills, attitudes and views about the nature of science.* Doctoral Thesis, Gazi University Institute of Educational Sciences, Ankara.

Buyukozturk, S. (2012). *Data analysis handbook for social sciences*. Ankara: Pegem Akademi.

Coban, H. (2010). *Investigating the relationship between the level of students using mathematical reasoning skills and using metacognitive learning strategies*. Master's Thesis, Gaziosmanpasa University, Institute of Social Sciences, Tokat.

Demirbas, M. & Ertugrul, N. (2012). An investigation into the realization of skills in the science and technology lessons expected to be acquired in Piaget's abstract operations stage. *Kalem Education and Health Services Foundation.*

Geban, O., Askar, P., & Ozkan, G. (1992). Effects of computersimulatedexperimentsandproblem solving approaches on highschoolstudents. *Journal of Educational Research*, 86, 5-10.

Griffard, P. B. (2001). "The two-tier instrument on photosynthesis: What does it diagnose?". International Journal Science Education, *23*(10), 1039- 1052.

Kan, A. (2008). Development of measuring instrument, S. Tekindal (Editor). Measurement and evaluation in education. First Edition. Ankara. Pegem A, p. 246-284.

Kilcal, R. Y. & Yazgan, A. D. (2010). Investigating the formal operational thinking skills of7th and8th grade primary school students according to some variables. *İlköğretim Online, 9*(2), 723-733. http://ilkogretim-online.org.tr

Koray, O. & Azar A. (2008). An analysis of high school students' problem solving and logical thinking abilities in terms of gender and preferred field. *Kastamonu Journal of Education, 125*-136.

Koseoglu, F., Tumay, H. & Kavak, N., (2002). *An effective method of teaching based on constructivist learning theory and predict-observe-explain "Can you boil water with ice?".* Paper presented at V. National Science and Mathematics Education Congress. 16-18 September, METU, Papers, Volume I, p. 638- 645, Ankara.

Kuzgun, Y. &Deryakulu, D. (2004). *Individual Differences in Education.* Ankara: Nobel.

Lawson, A. E. (1978). The development and validation of a classroom test of formal reasoning. *Journal of Research in Science Teaching,15*(1), 11-24.

Lawson, A. (1983). Predicting science achievement: The role of developmental level, disembedding ability, mental capacity, prior knowledge, and beliefs. *Journal of Research in Science Teaching, 20*(2), 117-129.

Lawson, A. E. (1985). A review of research on formal reasoning and science teaching. *Journal of Research in Science Teaching, 22*(7), 569-617.

Lawson, Anton E. (1995). *Science Teaching and Development of Thinking*. Belmont, CL: Wadswortd.

Lawson, A. E.,Clark, B., Cramer-Meldrum, E., Falconer, K. A., Sequist, J. M. &Kwon, Y. (2000). Development of scientific reasoning in college biology: Do two levels of general hypothesis-testing skills exist? *Journal of Research in Science Teaching*, *37*(1), 81-101.

Lawson, A. E. (2004). The nature and development of scientific reasoning: a synthetic view. *International Journal of Science and Mathematics Education, 2,* 307–338.

Liew, C.W. &Treagust, D.F. (1998), "*The Effectiveness of Predict-Observe-Explain Tasks in Diagnosing Students' Understanding of Science and in Identifying Their Levels of Achievement*", Paper Presented at the Annual Meeting of The American Educational Research Association, San Diego.

MONE TNBE (2012). Primary Education Institutions (primary and middle schools) Training Program for Science and Technology.

MONE (2000). Primary Education School Science Curriculum Ankara: National Education Printing House.

Ozcan, S. & Oluk, S. (2007). The effect of the learning cycle approach on attitudes of students in elementary science lesson. *İlköğretim Online, 8*(1), 103-118. http://ilkoğretimonline.org.tr

Ozer, G. (2009). *Investigating the effect of scientific argumentation based instruction approach on students' conceptual change and success concerning the concept of mole.* Master's Thesis, Gazi University, Institute of Educational Sciences, Ankara.

Ozmen, H. (2004). Learning theories in science teaching and technology-supported constructivist learning. *The Turkish Online Journal of Educational Technology (TOJET), 3* (1).

Shayer, M. &Adey, P.S. (1993). Accelerating the development of formalthinking in middle and high school students IV: three years after a two year intervention. *Journal of Research in Science Teaching. 30*(4), 351-366.

Tekin, S. (2008). Development of chemistry laboratory's effectiveness through action research approach. *Kastamonu Journal of Education, 16*(2), 567-576.

Tobin, K. G.,&Capie, W. (1981). The development and validation of a group test of logical thinking. *Educational and Psychological Measurement*, 41, 413-423.

Valanides, N. C. (1996). Formal reasoning and science teaching. *School Science and Mathematics*, *96*(2), 99-111.

White, R. & Gunstone, R. (1992). *Probing Understanding.* London: The Falmer.

Yaman, S. (2005). Exploring effectiveness of problem based learning on developing logical thinking skills in science teaching. *Journal of Turkish Science Education,2*(1), 31-33.

Yaman, S. & Karamustafaoglu, S. (2006). Investigation of logical thinking skills and attitudes scale towards chemistry of prospective teachers. *Erzincan Journal of Education, 8*(1), 91-106.

Yazgan Inanc, B., Bilgin, M. and Kilic Atici, M. (2015). *Developmental psychology: child and adolescent development.* Ankara: Pegem.

Yuksel, I. (2015). Examination the effect of activities based on prediction observation explanation and acceleration of cognitive development on science teacher candidates' reasoning skills. PhDThesis, Gazi University, Institute of Educational Sciences, Ankara.

Yuzuak, V. (2012).Adaptation and application of Lawson's classroom test of science reasoning. Master's Thesis, Gazi University, Institute of Educational Sciences, Ankara.

Zarotiadou,E.,&Tsaparlis, G. (2000). Teaching lower-secondary chemistry with a piagetian constructivist and an ausbelian meaningful-receptive method: A longitudinal comparison. Chemistry Education Research and Practice, *1*(1), 37–50.