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Dear Colleagues,

TOJET welcomes you. TOJET looks for academic articles on the issues of educational technology and may address assessment, attitudes, beliefs, curriculum, equity, research, translating research into practice, learning theory, alternative conceptions, socio-cultural issues, special populations, and integration of subjects. The articles should discuss the perspectives of students, teachers, school administrators and communities. TOJET contributes to the development of both theory and practice in the field of educational technology. TOJET accepts academically robust papers, topical articles and case studies that contribute to the area of research in educational technology.

The aim of TOJET is to help students, teachers, school administrators and communities better understand how to use technology for learning and teaching activities. The submitted articles should be original, unpublished, and not in consideration for publication elsewhere at the time of submission to TOJET. TOJET provides perspectives on topics relevant to the study, implementation and management of learning with technology.

I am always honored to be the editor in chief of TOJET. Many persons gave their valuable contributions for this issue.

TOJET will organize the 20th International Educational Technology Conference (IETC 2020). The conference web page is www.iet-c.net

Call for Papers
TOJET invites article contributions. Submitted articles should be about all aspects of educational technology and may address assessment, attitudes, beliefs, curriculum, equity, research, translating research into practice, learning theory, alternative conceptions, socio-cultural issues, special populations, and integration of subjects. The articles should also discuss the perspectives of students, teachers, school administrators and communities.

The articles should be original, unpublished, and not in consideration for publication elsewhere at the time of submission to TOJET.

October 01, 2019

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Table of Contents

A Comparison of the Pretending Elements between Constructive Play and Pretend Play 1
Juhee PARK

Comparative Analysis of Teacher Education Programmes in Selected Countries 7
Pavla ANDRYSOVÁ, Štefan CHUDÝ

Faculty's Usage of Academic Support ICT Services at Kuwait University 16
Ammar H. SAFAR, Nedaa M. QABAZARD

Problem-Based Learning Modules with Socio-Scientific Issues Topics to Closing the Gap in Argumentation Skills 35
Rani PURWATI, SURANTO, SAJIDAN, Nanik Murti PRASETYANTI

Research Trends and Issues in Educational Technology: Content Analysis of TOJET (2012–2018) 46
İrem ERDEM AYDIN, Müjgan BOZKAYA, Evrim GENC KUMTEPE

Saudi Teachers' Perceptions Regarding Adopting Digital Games in Teaching Practice 62
Dhaifallah ALSUHAYMI, Ali ALZEBIDI

Using the Number Line and Educreations in a Second Grade Classroom: A Collaborative Action Research Project 70
Selma KOÇ

A Comparison of the Pretending Elements between Constructive Play and Pretend Play[1]

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INTRODUCTION

Pretending elements are 'as-if' elements. Pretending, in that it represents reality in 'as if' terms. Pretending elements demand symbolic transformation that is, pretending a role, pretending with an object, and pretending a situation. The term 'pretend play' is named as a symbolic play, imaginative play, make-believe play, fantasy play, and dramatic play. Pretend play allows children to explore their fears in a safe setting. A child can begin to overcome his or her fear of doctors by donning a lab coat and stethoscope and becoming the person who scares him or her. He or she replaces his or her fear with a sense of control (Colker, 2015). Through their pretend play, children create new pretend situations. These can contain within them a wide range of seemingly unconnected elements all drawn from the child's previous experiences. Pretend acts as a way of unifying experiences, knowledge, and understanding, helping the child to discover the links between the individual components. As children control the pretend play, they are also able to control its components. Children bring to the pretend to play existing knowledge, skills, and the understanding of the world, which they then assimilate within an existing scheme or create new and novel interconnections (Kitson, 2015; Wood, 2004).

Constructive play also has pretending elements. Constructive play involves open-ended exploration and gradually more functional, then evolving to 'make-believe' transformations. Four-and 5-year-olds often switch back and forth between constructive and pretend play, and it can be difficult to distinguish between the two forms of play (Kostelnik, Soderman, & Whiren, 2007; Drew, Christie, Johnson, Meckley, & Nell, 2008). The block construction, even without clear representational status for cars and trains, are symbolic expressions (Forman, 2006). Both pretend play and constructive play include symbolic modes of representations (Kostelnik, Soderman, & Whiren, 2004).

RESEARCH QUESTIONS

The main research questions posed in this study are as follows:

1. What are the pretending elements that appeared in constructive play?
2. What are the pretending elements that appeared in pretend play?
3. What are the teacher's roles to enhance the pretending elements in constructive play and pretend play?

METHODS

Participants. The participants for this study were ninety-eight 5-year-old children (49 boys and 49girls) attending childcare center and kindergarten located in A and S city in South Korea.

Observation. The place of block play was set up in an extra room separated from their classroom in the kindergarten and childcare center. The location for 'pretend play' was set up in their classroom in the childcare center. Ninety-eight (98) children were divided into 25 groups, 5 or 6 children were placed together, and they participated in block play sessions twice a week, and they participated in pretend play sessions once a week. They were grouped with the same classmates, and 2 girls 3 boys were one group or 3 girls 2 boys, or 3 girls and 3 boys were one group.

One play session lasted for 30 - 40 minutes. During the first 10 of 40 minutes, introduction activities were conducted by research assistants and constructive play sessions and pretend play sessions lasted for 30 minutes. They read storybooks to the children to stimulate constructive play and pretend play. The storybooks provided for block constructive play were *The Three Little Pigs, Hensel and Gretel, The Wizard of Oz, Manhee's House,* and *Block City.* The storybooks provided for clay dough constructive play were *The Story of the Little Mole; Who Knew it was None of His Business, Cosmos, The Man with a Lump, The Rainbow Fish, Childcare center,*

[1] "This work was supported by a Research Grant of Andong National University."

Breathing Pot, Transportations, and The Little Penguin Pororo. The storybooks used for pretend play were, *If I have My Mom and Dad, My Mom is Pilot*, and *Sleeping Beauty*.

Materials for block play and pretend play.

1) **Constructive Play.** Unit Block designed by Caroline Pratt, Lego Block, and Clay Dough consisted of five colors (white, black, red, blue, yellow) were provided for constructive play.
2) **Pretend Play.** a) House Miniature that consists of living room, room, bed, closet, kitchen, table, chair, refrigerator, garden, car, parking lot. b) Community Miniature that consists of a hospital, a police station, a post office, a big market, buildings, a church, and a street. c) Castle Miniature was provided for pretend play. In addition, props, dolls, and role-play costumes were provided.

RESULTS

1. The pretending elements that appeared in constructive play

Table 1 shows the pretending elements that appeared in constructive play.

Table 1. The pretending elements that appeared in constructive play

Categories	Items	Explanations (Definitions)	Examples
Self-Subjective Pretend Play	Pretending to Play a Role	Pretending of person, or personalized animals or objects	*After reading [The Three Little Pigs] fairy tale, a child construct three little pig's house and then point to himself / herself.* *"I'm the third pig. Oink-oink."*
	Pretending Play with an Object	Pretending of un-personalized objects or animals	*A child pretend as a tree behavior*
	Pretending a Situation	Pretending a time or a space situation	*"Here is under the sea."*
Projective Pretend Play	Pretending to Play a Role	Pretending of person, or personalized animals or objects	*After making a pig by clay dough and point to the construction,* *"This is the third pig. Oink-oink."*
	Pretending Play with an Object	Pretending of un-personalized objects or animals	*After making a pot by clay dough and point to the construction,* *"This is a pot."*
	Pretending a Situation	Pretending a time or a space situation	*"Now is night."*

(*Source:* Adapted from Exploring the Pretending Elements in Block Play, by J. H. Park and S. S. Han, 2017, *International Journal of Early Childhood Education*, *23*(5), 23-38.)

2. The pretending elements that appeared in pretend play

Table 2 shows the pretending elements that appeared in pretend play.

Table 2. The pretending elements that appeared in pretend play

Types of pretend play	Categories	Sub-Items	Explanations (Definitions)	Examples
Theatrical Pretend play	Pretending to Play a Role	Self-Subjective Pretend Play	Pretending a role as pretending of person, or personalized animals or personalized objects by himself/herself or themselves	*"I'm a doctor."* (Pretending of person) *"I'm a breathing pot."* (pretending personalized object)
		Projective Pretend Play	Pretending a role as pretending of person, or personalized animals or personalized objects by himself/herself or themselves, at the same time, pretending of person or personalized animals by objects or dolls	*"I'm a mom."* *(point to doll) "You're my baby. I'll give you a bottle of milk."*
	Pretending Play	Self-Subjective	Pretending of un-personalized objects or animals by	*"I'm a car."* (Pretending of

	with an Object	Pretend Play	himself/herself or themselves	un-personalized objects)
		Projective Pretend Play	As a child pretending a role, he or she pretends objects and uses them	*As a child pretending a doctor, he or she pretends necklace as a stethoscope.*
	Pretending a Situation	Pretending a Time	Pretending a time situation	*"Now is night."*
		Pretending a Space	Pretending a space situation	*"Here is a company."*
Doll Dramatic Pretend Play	Pretending to Play a Role	Projective Pretend Play	Pretending a role as pretending of person, or personalized animals or personalized objects by dolls, miniatures, or props	*A child holding a doll or a miniature man in his/her hand, and shouts "I'm a powerful king!!"* (Child pretends a miniature (sculpture) of a man as a powerful king.)
	Pretending Play with an Object	Projective Pretend Play	Pretending of un-personalized objects or animals by props, miniatures, or objects	*A child holding a block, "This is a car. Honk! honk!*
	Pretending a Situation	Pretending a Time	Pretending a time situation	*"Now is night."*
		Pretending a Space	Pretending a space situation	*"Here is a company."*
Mixed of Theatrical and Doll Dramatic Pretend Play	Pretending to Play a Role	Self-Subjective Pretend Play	Pretending a role as pretending of person, or personalized animals or personalized objects by himself/herself or themselves, at the same time, pretending a role as pretending of person or personalized animals by objects, props, miniatures, or dolls	*"I'm a mom. (pointing to a doll) "You're my baby. I'll give you a bottle of milk."(as a mom's voice)*
		Projective Pretend Play	Pretending a role as pretending of person, or personalized animals or personalized objects by objects, props, miniatures, or dolls	*"I'm a mom. (pointing to a doll) "You're my baby. I'll give you a bottle of milk" "Yes. Mommy" "Yummy, yummy!"(as a baby's voice)*
	Pretending Play with an Object	Self-Subjective Pretend Play	Pretending of un-personalized objects or animals by himself/herself or themselves	*"I'm a car." "Bung! bung!"*
		Projective Pretend Play	Pretending of un-personalized objects or animals by props, miniatures, or objects	*A child holds an object "This is a car."*
	Pretending a Situation	Pretending a Time	Pretending a time situation	*"Now is night."*
		Pretending a Space	Pretending a space situation	*"Here is a company."*

(*Source:* Adapted from Analysis of Narratives appeared in Young Children's imaginative Play, by J. H. Park and S. S. Han, 2018, *The Korea Open Association for Early Childhood Education Conference, 243*).

3. Teacher's roles to enhance the pretending elements

To enhance pretending elements in constructive play and pretend play, teachers should provide enough time, new props, a variety of miniatures and dolls, storybooks, and intervention.

1) Time

Play does not survive when children feel rushed; constructive play must be nurtured by time (Forman, 2006). More extended facilitate more complex and high level of play. Longer play periods were associated with more constructive and dramatic play. The researchers concluded that longer periods maybe necessary for children 'to become involved in mature, complex forms of play' (Tegano, Lookabaugh, May, & Burdette, 1991; Park & Han,

2018). Teachers should give plenty of time for pretend and constructive play (Park, 2019).

2) Props

Props can be added in phases to build children's knowledge and hold their interest (Salinas-Gonzalez, Arreguin-Anderson, & Alanis, 2018). Role play costumes, in other words, occupation props, for example, doctor's gown, nurse's hat, police officer's suit, and cooker's hat stimulate pretending elements. Also, prince and princess costumes, dad's shirt and mom's dress promote pretending elements. Teachers should provide basic props and add more props based on careful observation of children's interaction, and should add props that enhance the theme (Salinas-Gonzalez, Arreguin-Anderson, & Alanis, 2018).

3) Miniatures and dolls

A variety of dolls, for example, family dolls (dad, mom, sun, daughter, and baby dolls), a variety of miniatures, for example, people miniatures, animal miniatures, tree miniatures, signs miniatures, and other kinds of miniatures help pretending elements.

4) Storybooks

Before constructive play and pretend play, reading story books for children as an introduction activity is very useful to stimulate pretending elements in constructive play and pretend play. Children's play became more complex and abundant when they have stories related to the play theme (Park, 2007; Park, 2019).

5) Intervention

Intervention in pretend play enables the participating teacher to keep the activity going by motivating the children to persist and to pretend. Teacher intervention in play can have either positive or negative effects, depending upon timing and the role that the teacher assumes. If teachers observe carefully and link their involvement with children's current play interests, they can enrich and extend play episodes and stimulate pretending elements. On the other hand, if teachers take control of the play or try to redirect children toward unrelated themes, the results can be negative effects. While some children engage in such play readily, others need to be guided and encouraged to play a full part. The teacher can help to refocus the story to bring the group together and generate excitement by introducing tension into the story. These are both essential to the development of pretend play but difficult for young children to attain themselves. Interventions into pretend play become the subtle tools of the teacher working with children. Within the play, the teacher can enrich and deepen the play, and open up new learning areas for the children; intervene and structure the learning from within, without significantly reducing the children's ownership (Christie, 2006; Kitson, 2015).

6) Pre-experiences (Field trip)

Teacher's play plans, preparations, interests, field trips, pre-experiences, and encouragement will positively effect constructive play and pretend play. For children, pre-experiences of related the play theme will enhance the high quality of pretending elements in constructive play and pretend play. For example, before 'market pretend play' or 'market constructive play', teachers and children take a field trip to the market. Children observe the role of casher and costumer, and inside and outside market organization. Thus when children do 'the market pretend play', they represent the role, object, and situation of the market. Or when children do construct the market, it also affect construction related to the mart and their pretending elements. Before 'post office pretend play' or 'post office constructive play', teachers and children take a field trip to the post office. These will affect the pretending elements in 'post office pretend play' and 'post office constructive play'.

DISCUSSION

Pretend play leads to real-life learning. By imitating a firefighter using a horse, a doctor checking a patient's ear, or a construction worker building a skyscraper, children learn about community roles and services and feel proud and satisfied. While acting as mothers and fathers, children can be caring, loving, and responsible. Children learn through pretend play. When they pretend, children create pictures in their minds of past experiences and use their imaginations to think of new scenarios. These thoughts and images let children think about situations and objects that are not right in front of them and events that have not yet happened (Colker, 2015). Pretending elements are essential to cognitive, emotional, social, language, physical, and creative development.

Through constructive play, children learn by making. Constructive play also helps cognitive, emotional, social, physical, creative development. Constructive play is a continuous problem-solving, process and constructive play provides a window into children's thinking (Forman, 2006).

Pretending elements in pretend play were more specific and diverse than in constructive play. The constructive play also has symbolic and pretending elements. But in constructive play, the progress patterns of constructive

play were classified into three types. First, children do only constructive play. Second, children construct construction through blocks or clay, and then they play pretend play using their creations. Third, children do constructive play and pretend to play almost at the same time (Park & Han, 2011). Thus, in constructive play, children tend to focus on construction. So they need more time for construction. Especially during clay dough construction, more time is required than in block construction because clay doughs require more time to make dough compare to block construction. Thus, during the same time, compare constructive play with pretend play, children need more time to construct in constructive play than pretend play. When children do constructive play, they act using the constructions that they create, and props that are provided.

But in pretend play, children almost engaged in pretend play immediately. Sometimes children construct something to use for pretending. Also, they pretend by using dolls, miniatures, and props, or they pretend themselves. So they focus on acting in pretend play rather than in constructive play. And they will do more acting themselves than during constructive play. Because in constructive play, they construct construction and then they use them as pretending. But in pretend play, children pretend not only use props and dolls but also they pretend using (through) themselves. At that time, they often use role play costumes or not. For example, they wear a prince or princess costumes, or they use a doctor's gown and a nurses' hat as the person. Therefore, in pretend play, pretending elements are more diverse and specific than constructive play.

Furthermore, constructive play may be combined with pretend play because children often enjoy making props to support their play, and playing with what they have created (Wood, 2013). When pretend play and constructive play are integrated into the same scenario, higher quality play is achieved (Kostelnik, Soderman, & Whiren, 2004).

The seeds of imagination are found in early childhood when children engage in pretend play and constructive play. Through teacher's acceptance and nurturance of constructive play and pretend play, children may enter the fascinating realm of possibility (Singer & Singer, 2006). For teachers, pretend play offers a unique privilege and formidable responsibility. The privilege is to enter the magical worlds that children create in their pretense together; the responsibility is to help each child reach his or her potential in the powerful realm of shared pretend (Nourot, 2006).

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Comparative Analysis of Teacher Education Programmes in Selected Countries

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ABSTRACT
The present study deals with systems of teacher education in several European countries – specifically the Czech Republic, Slovakia, Germany, France and Finland. A comparative analysis of future teachers' preparation reveals a variety in many areas. We observe that the differences occur especially in admission process, qualification requirements concerning teacher performance, teacher preparation programmes, and teachers' further education.

INTRODUCTION
The aim of the study is to describe the education of future teachers in selected countries with focus on qualification requirements for teachers, teacher education curricula, admission procedures, and further education. There are various ways to become what is in academic writing referred to as 'an ideal teacher'. For this reason, it is difficult to ascertain the correct methods to cultivate and nurture talent for teaching or the method to become a master teacher. The focus of this study is teacher education in the Czech Republic and abroad, and the readiness of future Czech teachers to teach effectively. Research led to the creation of multiple models of teacher professional development, according to various pedagogical, psychological or integrated concepts. This paper works with the Five-stage Model of Adult Skill Acquisition by the Dreyfus brothers (1986) as it was further elaborated by Berliner (1995). Berliner worked both with Fuller's conclusions and studies of novice and experienced teachers. The model works with the following stages of the professional development of a teacher: *Novice*; *Advanced Beginner*; *Competent Teacher*; *Proficient Teacher*; *Expert Teacher*.

THEORETICAL BACKGROUND
The novice teacher focuses on their immediate survival with the help of basic, fragmentised methods. They are more interested in simple instructions and focus primarily on the content of lessons, short-term planning and immediate responses to various teaching situations. Most of their professional training is based on imitation and the advice of the others. The advanced beginner starts to develop automaticity of teaching and their techniques begin to acquire routine character. Based on a volume of episodic data, the teacher begins to perceive similarities and patterns. Unlike the novice teacher, they begin to form strategies for different teaching situations. Their focus shifts from their own performance to a more general perception of the teaching process. With that comes the ability to question themselves and search for answers regarding what/how/why they do certain things in the classroom. The competent teacher possesses a repertoire of strategies that allow them to deal successfully with common teaching situations. They use these strategies in full. In this stage of their professional development, they are confident enough to improvise in class and deliberately choose their methods according to the context of the situation. Although in the previous stages their focus was on the lesson content, the competent teacher begins to focus on specific students and their needs. They are able to set priorities and they show a tendency towards medium-term and long-term planning. In the penultimate stage, the performance of the proficient teacher is based both on intuition and explicit rules. They have developed problem-solving strategies of complex teaching situations and the class is more and more student-centred. The final stage of professional development – expert teacher – is characterised by intuitive approach to teaching situations. The teacher's performance is fluid and seemingly effortless. Their planning is flexible. The expert teacher is able to anticipate incidents rather than just react to them, they are aware of universal schemata in the learning process and their manifestations in specific incidents in their class. These models were subjected to criticism as they fail to full express that a teacher's development may include diversions, blind alleys, occasionally regressions; in addition, not everyone necessarily reaches the expert stage. Despite that, in various countries they to the establishment of standards meant to support professional development and also to allow evaluation of the quality of teaching (Tomková, Spilková, Píšová et al., 2012).

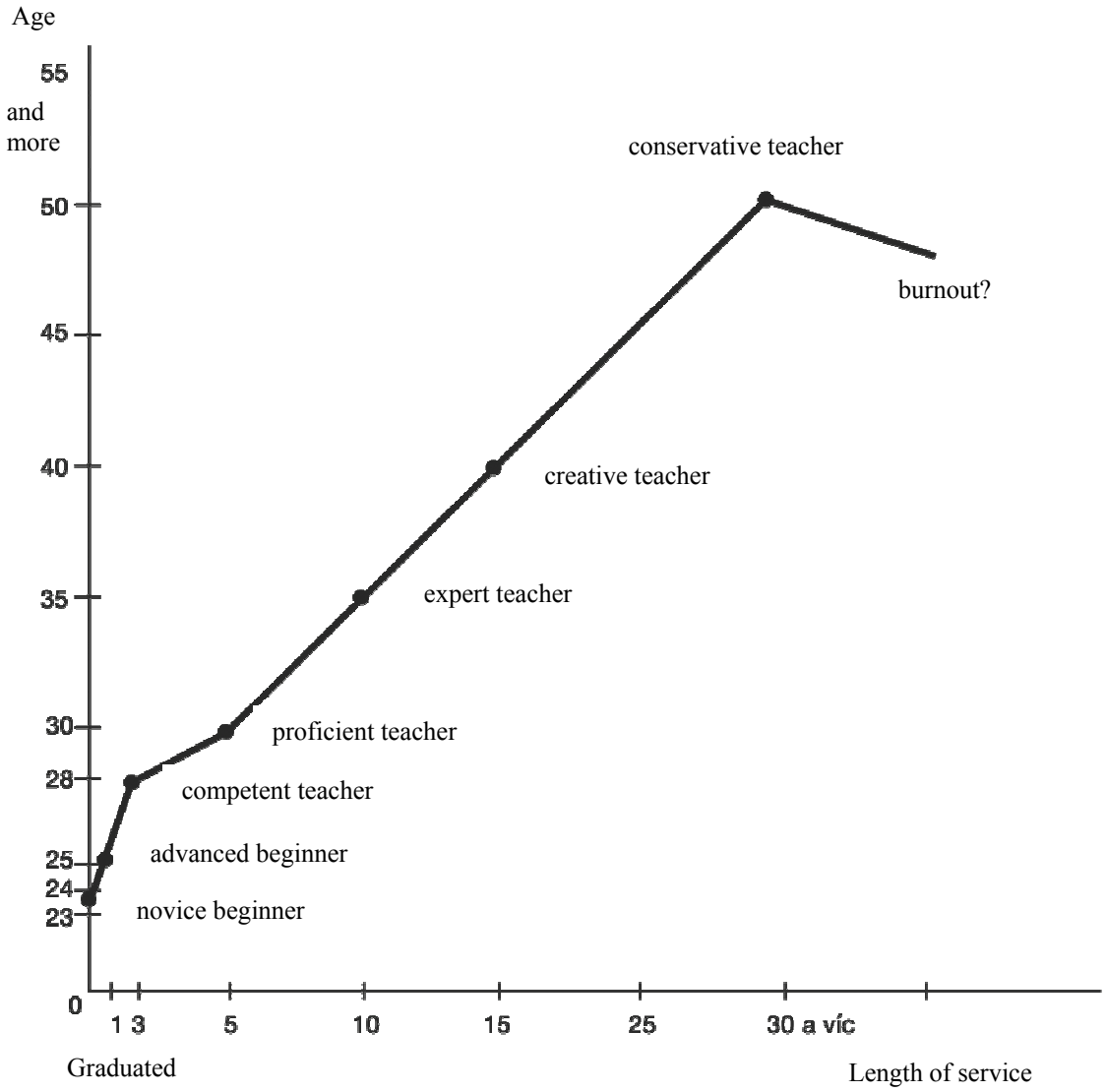

Figure 1: Stages of teacher professional development (adapted from Dreyfus & Dreyfus)

The key issue in quality of teaching and research are teaching competencies. Teaching competencies serve as the basis for the formation of professional standard. The professional standard is the norm that should define the key competencies necessary in the field, that is, competencies indispensable for a qualified standard performance. Professional standard can serve this purpose if it is consistently applied to teacher evaluation and if it is included in the process of professionalization of teaching. A development model of professionalization should be based on this triad of concepts: competence – standard – quality (Slavík et al., 2012, p. 75). In 2007, McKinsey published a paper, in which he studied twenty-five education systems around the world, including the best ten systems in the world, to find out why some schools succeed where others fail. He was trying to find similarities between these highly efficient education systems and learn about the methods used to improve the results of their students. The results imply that there are three key factors involved: finding the right people to become teachers, their further development that leads to effective teaching, and finally, a system capable of providing the best possible education for every child. According to other authors (Hattie, 2003; Barber, Mourshed, 2007) the quality of the teacher influences the students' academic results more than, for example, the quality of the school curriculum or the material conditions of the school in question. Improving the quality of teachers and the quality of the system responsible for their training and further education is currently generally accepted as the factors that play a crucial role in education reforms and innovations of education systems.

RESULTS OF COMPARATIVE ANALYSIS

The aim of this analysis is to describe and compare the systems of teacher training in selected countries of the European Union. For the purpose of this analysis, the following countries were selected:
The Czech Republic
Slovakia
Germany
France
Finland

The analysis places emphasis on the description of teacher training and its subsequent comparison, regarding qualification requirements for teaching, teacher education programmes from the point of view of their requirements and whether the requirements are placed centrally by the individual countries or by the universities themselves. Furthermore, the paper deals with the requirements for admission to teacher undergraduate programmes. The last category is further education of teachers, particularly from the perspective of voluntariness/obligation, in other words, whether life-long learning and improvement are mandatory or not. The survey is based on the results of information shared through Eurydice – the European network devoted to sharing information about national education systems and policies, as well as related literature, both Czech and foreign.

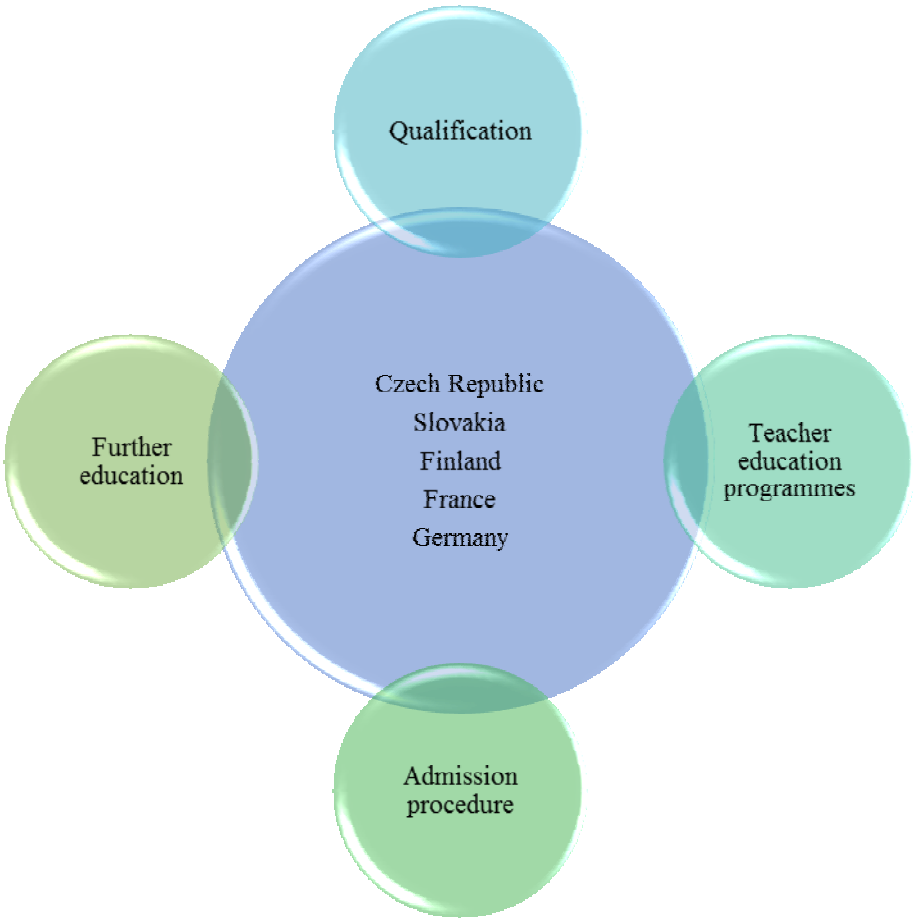

Figure 2: Categories of teacher preparation in selected European countries

The following charts present an overview of teacher training in individual countries in the areas of qualification requirements, requirements concerning teacher education programmes, demands on entrance examinations for applicants for studying teaching. The issue of further training and whether it is voluntary or obligatory is presented in these charts as well.

TEACHER TRAINING IN THE CZECH REPUBLIC

Teacher qualifications are regulated by corresponding education legislation, in particular the Education Act No. 561/2004 Coll. and The Act on Pedagogical Staff No. 563/2004 Coll. A pedagogical worker shall be a person

who performs direct teaching, direct educational function, or direct special educational needs activities or direct pedagogical-psychological activities directly affecting learners thus implementing education and training pursuant to the special legal regulation, who is an employee of a legal person carrying out the activities of a school, or an employee of the state, or a head teacher unless such a person is in a labour-law relation to a legal person carrying out the activities of a school who is not an employee of the state. Direct educational function shall be performed by a) a teacher, b) a teacher educator, c) educator, d) a special educational needs teacher, e) a psychologist, f) a teacher responsible for leisure activities, g) a teacher's assistant, h) a coach, i) a prevention worker in an educational psychology counselling centre, j) a pedagogical manager.

TEACHER EDUCATION PROGRAMMES

In the year 2017, the Ministry of Education, Youth and Sports published a manual concerning the process of assessment of undergraduate programmes that qualify an individual for the teaching profession. According to section 2 of the Act on Pedagogical Staff and on the Amendment to Some Other Acts No. 563/2004 Coll., the regulated professions include the job of a teacher, educator, special educational needs teacher, psychologist, teacher responsible for leisure activities, teacher's assistant and coach.

ADMISSION PROCEDURE

The admission procedure follows section 50 of Act No. 111/1998 Coll. On Higher Education Institutions. The form and content of the entrance exam is left in the purview of individual universities or faculties. The admission procedure begins upon receipt of the application for admission to study at a higher education institution or its constituent part that offers the relevant degree programme. The application must include the applicant's forename/names, surname, identity number, if this has been assigned, and place of permanent residence in the Czech Republic or place of residence outside the Czech Republic; foreigners must also include the date of birth, sex, place of residence in the Czech Republic and their citizenship.

The decision on admission to studies in a degree programme provided by a faculty is made by the Dean of the faculty. The decision on admission to studies in a degree programme provided by a higher education institution is made by the Rector. Admission to studies at private higher education institutions is decided by the official body specified in their internal regulations. General regulations on administrative procedures do not apply to the decision on admission to studies. The decision must be made within no more than thirty days from the time when the admission conditions were verified. The decision must contain a justification, information about the option of lodging a re-examination appeal and it must be delivered to the applicant. If an applicant's place of residence is unknown, delivery of the decision takes the form of posting it on the official notice board. Applicants are entitled to examine their materials relevant for the decision on their admission to studies. The applicant is entitled to request a re-examination of the decision. The appeal is submitted to the official body within thirty days from the announcement. Missing the deadline may be pardoned for serious reasons. If the appeal administrative body is the Dean, they may allow an appeal and review the decision. Failing that, they forward the appeal to the Rector. The Rector shall review the decision, if it was issued contrary to the law, internal regulations of the higher education institution or the requirements stipulated by section 49, subsections 1 and 3. Otherwise, they reject the appeal and confirm the original decision. A higher education institution or faculty must make public the information concerning the course of the admission procedures within fifteen days of their conclusion. Should written entrance examinations constitute a part of the admission procedure, the higher education institution or faculty will release a statistical survey of all the component parts of the entrance examinations, including the requirements for basic statistical data. Higher education institutions or faculties process and make available data about the applicants for statistical purposes in agreement with a special regulation.

FURTHER PROFESSIONAL DEVELOPMENT

Further education follows section 24 of the Act on Pedagogical Staff. It is stated there that whilst performing their function, pedagogical workers have the duty to renew, strengthen and supplement their qualifications through further education. The headmaster shall organise further education of pedagogical staff in accordance with the plan of further education which shall have been laid down after preceding negotiations with a relevant trade union body. Whilst laying down the plan of further education, the study interests of a pedagogical worker, the school's needs and budget must be taken into consideration. Further education of pedagogical staff shall be achieved at higher education institutions, by self-education, or through a certificate issued by an educational institution which organised further education. If nothing impedes them, pedagogical workers are entitled to twelve working days off per academic year. The headmaster shall assign the days off. Pedagogical staff shall be entitled to financial compensation equalling the amount of lost earnings.

TEACHER TRAINING IN THE SLOVAKIA

Teacher qualification requirements are regulated by Act No. 317/2009 Coll. on Teaching Staff and Vocational Training Employees and on the Amendment to Some Other Acts and by Decree No. 437/2009 Coll. by the Ministry of Education, Science, Research and Sport of the Slovak Republic which stipulates qualification requirements and specific qualification requirements for various categories of pedagogical workers and expert employees. It is possible to obtain teaching qualification: by studying selected programmes in teacher education programmes at universities or vocational colleges; the graduates are able to teach subjects corresponding to their qualifications in primary schools and high schools, through undergraduate studies at a university or a vocational college and simultaneous supplementary pedagogical studies; the students achieve not only specialised but also pedagogical education and they are able to teach the subjects in their field in high schools, by higher education studies at a vocational college; after graduation from a supplementary pedagogical programme, the graduate is qualified to teach relevant subjects in specialist schools. Specialist employees may broaden the range of their qualifications through participation in retraining programmes (e. g. related to IT or foreign languages). Through further pedagogical studies, new subject or specialisation may be added to the skill set of a qualified teacher, such as work with children with special behavioural and educational needs.

TEACHER EDUCATION PROGRAMMES

The contents of education are stipulated by individual pedagogical faculties. Study programmes are regularly evaluated by the Accreditation Committee (according to the criteria negotiated with representatives of individual institutions of higher education and approved by the Ministry of Education). Every university establishes the number of applicants to be accepted (the government decides how many students in each course of study shall be subsidized by the state). Recruitment of academic staff is within the purview of universities (Mičicová, Šamová, 2016, p. 11).

ADMISSION PROCEDURE

According to section 6 of the Higher Education Act, the number of accepted applicants, the admission requirements, and decision-making in the admission process is in the competence of the institutions of higher learning themselves. Therefore, no law stipulates mandatory testing of vocational qualifications. Talent tests, however, are required in courses of study related to artistic and physical education subjects.

FURTHER PROFESSIONAL DEVELOPMENT

Organisation, content, extent and forms of further teacher education is regulated by the Decree of the Ministry of Education on continuous education, credits and attestations of pedagogic employees and professional employees. A pedagogic/professional employee shall fulfil the requirements for the relevant professional position and update or renew their competencies. Every school prepares its own plan of further education of pedagogic employees and presents the plan to its statutory authority. The plan should include a list of specific priorities of the institution, schedule, and a draft budget for educational activities. The person responsible for the organisation of continual education is the headmaster, who acts according to a yearly plan. The school administration decides on continual education of pedagogic employees according to the priorities and development strategies. The credit system, salary policy, evaluation and remuneration systems allow for active and inventive teachers to receive higher pay packet for developing their qualifications, competencies and performance. The number of credits assigned to individual accredited programmes of continuing education is based on the scope, difficulty and conclusion. The credits are valid for seven years and they are required when filing an application for the first and second attestation. They are also needed for a teacher to be eligible for a salary bonus (Mičicová, Šamová, 2016, p. 11-12).

TEACHER TRAINING IN FINLAND

According to the Teaching Qualifications Decree (986/1998), the law distinguishes three types of teachers: class teacher – teacher of 1^{st} – 6^{th} grade, who teaches all subjects and may teach in preschool institutions as well; teacher of specific subjects – in 7^{th} – 9^{th} grade of primary school, or high school (both general and vocational) and adult education; specialist teacher – for the education of students with special needs The initial teacher training is provided by universities. The responsibility is shared between pedagogical and other faculties. Teachers in primary and secondary schools must achieve a master's degree, gain minimum of 60 ECTS credits in basic or intermediate level of study of their qualification subject and 60 ECTS credits in pedagogical training (20 being set aside for work in teacher training schools). Perfect command of the language used at school (usually Finnish or Swedish) is required of high school teachers (Mičicová, Šamová, 2016, p. 12.). Ensuring the quality of education is based on management rather than control (for this reason, school inspections were abolished).

TEACHER EDUCATION PROGRAMMES

Teacher qualifications for general and specialist schools were unified at the beginning of 1999. Training includes study of pedagogy, subject didactics and practical training. Pedagogical faculties enjoy full autonomy in the process of curriculum creation. In 2007, The Advisory Board for Professional Development of Education Personnel was established to support teacher education and to predict changes in needs in initial teacher training. Based on the resulting evaluation and assessments the Ministry of Education published a set of goals and recommendations for the development of initial and continuous teacher education the pedagogical faculties should adopt (Mičicová, Šamová, 2016, p. 13). Teacher education programme requires 180 credits (ECTS) to complete a bachelor's degree (which does not yet qualify one for teaching) and then 120 credits to complete a master's degree. Credits work on the assumption that in traditional place-based study an academic load of a student requires 60 credits per academic year where one credit represents 25-30 working hours per week. Work in teacher training schools is included in the programme (Průcha, Kansanen, 2015, p. 90). Requirements placed on the academic staff of pedagogical faculties are no different for other faculties. The basic requirement is a successful graduation from a doctoral study programme and a Ph.D. degree.

ADMISSION PROCEDURE

In Finland, teaching is a very popular career choice. 10-15% of applicants are accepted to teaching programmes every year, of which 80% are women (Průcha, Kansanen, 2015, p. 89.). The content of the entrance examination developed gradually. The admission is currently divided into two rounds. In order to make the entrance exam to undergraduate teaching programmes easier and to promote cooperation between schools, the Vakava network was created in 2011 – the students must read up on several assigned academic articles, roughly 180 pages. The aim of the exam is to test reading comprehension and the ability to apply the information gained from reading. In the second part, the applicants are evaluated based on their general predispositions for teaching. This part is created by faculties themselves. The interviews are mainly focused on the applicant's motivation for teaching, or more precisely, their motivation for work with people. Academic results in high school are taken into consideration as well as the applicant's artistic or sport activities, or activities related to teaching. In the past, some faculties included so-called microteaching in their entrance exam (Průcha, Kansanen, 2015, p. 88).

FURTHER PROFESSIONAL DEVELOPMENT

The obligation to take part in further education is stipulated by schools' statutes and collective agreements. Teachers must undergo between one and five days of further teacher education, according to the relevant agreement. Participation in further education programmes does not automatically lead to benefits, such as pay increase or career advancement. The obligation for further teacher education is outlined in the law only in general terms – participation is decided by individual universities (Mičicová, Šamová, 2016, p. 14). Most schools organise training for beginner teachers. A model of peer-group mentoring was established to support beginner teachers (Heikkinen, Tynjälä, Jokinen, 2012, in Průcha, Kansanen, 2015, p. 94-95).

TEACHER TRAINING IN FRANCE

Teachers are civil servants and their role is regulated by *acts on civil service*. In the 2013, the system of teacher training has undergone a significant reform. Students pursuing a master's degree in education must take a competitive exam at the end of their first year. That applies to all future teachers, from pre-school to secondary education. Master's programmes of study take place in *Écoles Supérieures du Professorat et de l'Éducation* (ESPE – colleges of teaching and education), specialised schools within universities. One is located in every *académie* (education authority at the regional level) (Cornu, 2015). After the exam, successful students become trainee teachers. In the second year of their studies, their time is divided equally between learning and practice in schools. If a student from a different branch of study successfully passes the competitive exam, they are allowed to simply continue their studies in a master's programme of study. In their second year, the students become civil servants in a probationary period and therefore they are paid for their work. After a reform, the exam now aims to focus both on theoretical knowledge of the student and their pedagogical skills (Bokdam, van den Ende, Broek, 2014). The number of available places in the exam is regulated by a ministerial decree every year. The decision affects the budget of the Ministry of Education and therefore it must be approved by the Parliament. Every teacher in France should have a master's degree. Master's programmes of study and preparations for the exam are within the authority of individual universities. Regardless of branch of study, a bachelor's degree is required for the admission to a master's programme of study (Mičicová, Šamová, 2016, p. 14).

TEACHER EDUCATION PROGRAMMES

During their first year, future teachers are required to take part in study visits to gain their first professional experiences with teaching. The study visits are limited to observation and teaching under supervision. The aim of these study visits is to prepare students for the competitive exam and to encourage them to think about possible topics of their diploma theses. According to a survey conducted by TALIS, French teachers are insufficiently

prepared for their job. More than 90% consider themselves well versed in their teaching subject. However, only 40% consider themselves sufficiently prepared in terms of pedagogy. This is the lowest number out of all 34 countries that participated in the survey (Education and Research in Figures, 2015). In 2013, the Ministry of Education published two ministerial orders: ***A reference table of professional competencies for pedagogical staff***, which establishes aims and common culture for all education professionals that should be acquired during their training (the reference table lists 14 competencies – a new approach, as the stress was previously placed on acquiring knowledge). ***A national framework for the curriculum of the MEEF Master's degree***. The curriculum must be followed by universities in order to gain accreditation. (Supporting teacher competence development: for better learning outcomes *[online]*.) At present, every teacher in France, including kindergarten teachers, should have a master's degree.

ADMISSION PROCEDURE

Applicants to public universities are admitted on the grounds of *Baccalaurréat* or its equivalent. Entrance exams are required only by *grandes écoles* in France. The requirement for admission to master's programme of study is a bachelor's degree, regardless of field of study (Mičicová, Šamová, 2016, p. 15).

FURTHER PROFESSIONAL DEVELOPMENT

Creating a plan for further education is the responsibility of the rector of every *académie*. They determine the priorities of further teacher education in accordance with the priorities of the Ministry of Education. Primary school teachers are required to undergo 18 hours of further education in courses organised by the local *académie* in cooperation with the relevant university. Professional development, however, is not mandatory. The teachers are responsible for their own professional development – for instance, they may take a sabbatical leave (Bokdam, van den Ende, Broek, 2014).

TEACHER TRAINING IN GERMANY

The responsibility for the education system in Germany lies primarily with the individual states. The coordination of cooperation in education, professional training, higher education, research and cultural affairs is organised by The Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany, which was founded in 1948. The resolutions of The Standing Conference provide recommendations and must be implemented into the legal codes of the individual states for them to be binding. Teacher training is then regulated by the laws and implementing regulations of the individual states. The regulations deal with studying, examinations, the First State Examination, bachelor's and master's degree examinations, practical teacher training, and preparatory service. In each state, the responsibility lies with the Ministry of Education Culture/Ministry of Education and Science. In Bavaria, teacher qualifications are established by the law on teacher training from the 12th of December 1995. First and Second State Examinations are organised by the state examination authorities or boards of the Land. In the case of bachelor's and master's programmes of study (on the basis of which it is possible to enter preparatory service), the responsibility of the state for teacher training is ensured through the process of accreditation. The programme must be approved by the representative of the highest educational authority (Mičicová, Šamová, 2016, p. 3-4).

TEACHER EDUCATION PROGRAMMES

Teacher training is divided into two stages. The first one comprises of studies in one of the following six types of teaching careers: Teaching careers at primary level – a bachelor's degree study programme (7 semesters, 210 ECTS credits). Studies are focused not only on studying a teaching subject, but also on pedagogical training. The course is concluded by the First State Exam or by obtaining relevant academic qualifications. Teaching careers at primary level or individual lower secondary level (7 semesters, 210 ECTS credits). This type of studies is also focused on studying a teaching subject (one or two) and pedagogical training. The course is concluded by the First State Exam or by obtaining relevant academic qualifications. Teaching careers at all or individual lower secondary level schools (7 semesters, 210 ECTS credits). The studying is also focused on studying a subject (one or two) and pedagogical training in 2:1 ratio. The course is concluded by the First State Exam or by obtaining relevant academic qualifications. Teaching careers for the general education subjects at upper secondary level and grammar schools (6 semesters in bachelor's degree study programme, 4 semesters in master's programme of study, 300 ECTS credits). The studies are focused on studying subjects (180 ECTS credits minimum) and pedagogical training. The course is concluded by the First State Exam or by obtaining relevant academic qualifications – master's degree (Mičicová, Šamová, 2016, p. 4).

ADMISSION PROCEDURE

The only requirement for admission to teaching courses is the successful completion of tertiary education qualifications, usually the *Abitur* exam at the end of grammar school studies (*Basic Structure of the Education System in the Federal Republic of Germany: Diagram*. *Kulturminister Konferenz*).

FURTHER PROFESSIONAL DEVELOPMENT

Continued professional development is perceived as obligatory, however, there are no legal regulations for the minimal scope of further teacher education. On the other hand, continued development allows teachers to teach new subjects or to be promoted. The status of a teacher, once obtained, does not change. According to the law, further teacher education is not obligatory. If specified in an employment contract, it may become obligatory (Mičicová, Šamová, 2016, p. 6).

CONCLUSION

This study that we present deals with a comparison of teaching preparation in selected countries. We consider the concept of teaching preparation in Finland to be very inspiring as here teacher training is based on the idea of an autonomous and professional teacher and the ideal of lifelong learning. The aim of teacher training is to cultivate and develop pedagogical thinking of teachers who can combine pedagogical research results with vocational challenges. In France teacher preparation is aimed at getting professional skills, education is based on a concept that mixes academic courses and practical training in schools. The common basis of preparation for all pedagogues is the background that creates their common culture. Teachers should possess learning based on newest research as well as take a scientific view in the classroom using latest knowledge not only of their area of study but also of pedagogical sciences during all their career; therefore, there is a lot of emphasis on research in learning content.

The conducted analysis shows that there is no uniform concept of professional preparation in the selected countries as we can see from the total list of the individual components. However, in all the presented countries it is evident that it is always aimed at achieving better quality and aware of the importance of efficient learning which is the basis of national culture. Qualifications necessary to become a teacher are subject to legal regulations in all observed countries. The found differences between approaches to the individual components are mostly the result of particular and historical situation of each country.

We can see wide differences between the countries in admission process and further education. For example, pedagogy study requirements are evaluated within the admission process in Finland, whereas in Germany only after university graduation and so-called preparation service while taking the second state examination. Some countries have professional standards as the core of the career system which defines several teaching work quality levels. For example, in Slovakia four levels are defined, in other countries professional standards are not defined, while in some countries the introduction of standards is under discussion.

Regarding professional attributes of teachers, there is a request especially for knowledge and skills; in some countries personality and professional characteristics necessary for doing the job have been set. What is dominant is knowledge of the subject taught combined with psychodidactic competences; furthermore, communication related skills as well as a request or motivation for lifelong learning linked to reflection and self-reflection. We can also meet a greater emphasis on an ability to educate in diversified classes. Competences for interdisciplinary and project learning and higher level cooperation including international cooperation have been specified. The analysis we conducted shows the search for a balance between theoretical and practical preparation. Professional forming also includes ethical aspects, it is clear that the study of professional ethics and the existence of ethical chambers develop a sensitivity for value and moral problems, which can help teachers better understand their professional and social role. In these countries we can also notice a trend towards democratization of the teaching profession that leads, inter alia, to gradual reduction of differences in requirements for preparation of various types and levels of teaching. Besides these presented facts, it is interesting to compare European countries that had been divided between Eastern Bloc and Western Bloc for decades, as not only “Eastern” systems have been looking for a new shape since 1990´s. We can notice similar issues for example in France or Germany that also face a lot of problems, and by means of reforms and constant changes try to find an optimal way to teacher preparation efficiency.

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Faculty's Usage of Academic Support ICT Services at Kuwait University

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ABSTRACT
This study aimed to identify the degree of usage by Kuwait University (KU) faculty members of the academic support information and communication technology (ICT) tools, services, systems, and resources provided by KU. The study comprised an exploratory descriptive research design, using a survey questionnaire technique. A total of 304 faculty members willingly participated in the study. Regardless of two decades of massive investment to situate ICT tools, services, systems, and resources as a pivotal tenet of KU's teaching, learning, research, and administration practices, the findings revealed that formal academic usage of these ICT services and resources by KU faculty is only "average" (overall mean score is 3.48 (*SD* = 0.937) on a 6-point rating scale). This implies that the potential benefits of these academic support ICT systems and services have not yet been attained, in terms of serving KU's strategic objectives. Lack of technical support, awareness of availability, time, knowledge/training, and impracticality (e.g., difficulty accessing ICT services and resources due to slow speed connection, or too much maintenance, etc.) were among the key factors that led KU faculty members either to not use at all or to infrequently use academic support ICT services and resources provided by KU. In light of these findings, a number of important implications are provided to help increase the extent of ICT tools and resource usage by KU faculty members. Other academic institutions can use this study as a reference to evaluate their faculty members' ICT use.
Keywords: academic support ICT services/resources/tools/systems; usage; university faculty members; higher education.

1. INTRODUCTION

Scholarly studies on the effect of ICT have been growing significantly over the past three decades and undoubtedly offer evidence that the use/integration of ICT tools and services has a meaningful influence on organizations' effectiveness and efficiency worldwide (Safar, 2012a, 2012b), including PK-12 education and post-secondary higher education institutions. These entities are envisioned as dynamic communities for teaching and learning in this knowledge-based digital era, and they are meant to prepare learners for their future lives, thus contributing to producing an informed (i.e., knowledgeable) and engaged digital citizenry (Safar, 2018a).

KU acts in accordance with its commitment to the national developmental strategic plan (i.e., "Kuwait Vision 2035" or "New Kuwait") for reforming the country toward becoming an active and effective knowledge-based society. ICT tools and services play a momentous role in the developmental efforts by opening up new prospects for the formation and exchange of knowledge, for education and training, and for the promotion of imagination, creativity, innovation, and thinking, as well as for cultural growth and intercultural dialogue (Safar, 2018a). Therefore, KU endorses/embraces many ICT-mediated initiatives/programs and supports the widespread integration of ICT tools and services into the organization in all areas including administrative, financial, and academic. Indeed, KU provides rich ICT resources and services for its faculty members, academic support staff, employees, and students (Ashkanani, 2017; Kuwait University, 2018). These include, but are not limited to, the following ICT integrated systems: (1) e-mail; (2) Office 365; (3) Blackboard e-learning; (4) TRACK e-training; (5) library information resources; (6) faculty portal; (7) academic staff evaluation; (8) research projects and awards, also known as the research sector online forms system; (9) distance learning; (10) student bookshop; (11) human resources management (HRM), also known as the employee self-service system; (12) custody of materials; (13) password management; (14) academic aptitude tests registration; (15) student admission; (16) student portal, also known as the student registration or student information system; and (17) wireless fidelity (Wi-Fi) network.

KU administration encourages its faculty members and academic support staff to continuously integrate these academic support ICT services and resources into all disciplinary areas in various educational settings to empower the processes of teaching and learning, as well as to enhance the university's educational performance (Ashkanani, 2017; Safar, 2012a, 2012b). Although a massive amount of funds has been made readily available, over two decades, for the implementation of these ICT tools and services at KU, academic and scientific research efforts are limited—mainly regarding the extent of usage of these academic support ICT tools, resources, and services by KU stakeholders (Safar, 2018b). Therefore, such studies are important because they may contribute to the development of the academic support ICT services provided by KU and help ensure KU provides the best possible academic support services and resources in the future. Other institutions in the global academic community can use this study as a reference/guide that inspires them to start evaluating their stakeholders' ICT use in order to achieve the proclaimed objectives behind their implementation and increase the effectiveness and efficiencies of their usage—that is, to generate a high return on investment (ROI) rate from academic usage perspectives which implies that the potential benefits of these academic support ICT systems and services are attained, in terms of serving the academic institutions' strategic objectives.

1.1 Study Objectives

This study aimed to identify the degree of usage by KU faculty members of academic support ICT services and resources provided by KU. To attain this objective, faculty members' views and perceptions were measured, based on the following research questions:

1. What is the extent of usage by KU faculty members of the academic support ICT services and resources provided by KU?
2. Which factors hinder the use of academic support ICT services and tools by KU faculty members?
3. Does the socio-demographic profile (e.g., gender, type of college, type of major, type of class, academic rank/position, teaching experience, and ICT efficacy level) of KU faculty members affect their degree of use of academic support ICT services and resources?

2. BACKGROUND

2.1 KU at a Glance

KU was founded in 1966 and is a large public research university with extensive faculties and disciplines (i.e., academic departments and programs) located in different geographical areas in the State of Kuwait. KU's humanities and social sciences faculties include the Colleges of Arts, Business Administration, Education, Sharia and Islamic Studies, Social Sciences, and Law. Its scientific faculties consist of the Colleges of Science, Architecture, Life Sciences, Computing Sciences and Engineering, Medicine, Allied Health Science, Pharmacy, Dentistry, Public Health, and Engineering and Petroleum (Kuwait University, 2018). As of the fall semester of the 2018-2019 academic year, KU has a total of 1,601 faculty members, 757 academic support staff, 4,058 employees, and 38,298 students (i.e., undergraduates 35,841; graduates 2,457) (Office of the Vice President for Planning, 2018). KU encourages, supports, and facilitates the integration of ICT tools and services/resources within the organization for teaching, learning, training and professional development, researching, and administration purposes (Kuwait University, 2018).

2.2 KU E-mail Service

This service provides KU faculty members, academic support staff, employees, and students with a communication and collaboration tool, currently embedded through Microsoft Office 365 using Outlook application.

2.3 KU Microsoft Office 365 Service

Through Office 365 service, KU stakeholders are granted free access to a collection of productivity applications/tools and services that enable them to create, communicate, collaborate, and even share their work effectively in real-time without boundaries—without worrying about lost formatting. The service has many powerful tools that are accessible anytime and from anywhere using favorite digital devices such as PCs, tablets, and smartphones. It includes the following Office Online applications: Word, PowerPoint, Excel, Outlook, OneNote (a digital notebook that is used to capture and organize all your class materials in one place), Sway (a presentation tool used to engage and communicate visually in new ways by creating interactive lessons that spark students' creativity and innovation), Class Notebook (a tool that enables you to individualize learning by bringing learners together in effective collaborative workspaces, group works, or providing them with individual support in private notebooks within the application), Teams (a digital hub that integrates conversations, content, and apps together in one place to be more collaborative and engaged; this app enables educators to create collaborative classrooms, connect in professional learning communities, and communicate with school staff),

OneDrive (a personal cloud storage service with a capacity of one TB), SharePoint (a tool for creating Websites), and Forms (a tool that enables surveys, quizzes, and polls to be easily created). This service also provides the additional benefit of allowing KU stakeholders to download and install certain Office applications (Word, PowerPoint, Excel, OneNote, and Outlook) on up to five PCs (e.g., desktop computers and laptops) and five digital devices (e.g., tablets and smartphones) for free.

2.4 KU Blackboard E-learning Service

This service provides an e-learning management system (LMS) or content management system (CMS), namely Blackboard, for administering e-learning at KU and which can be used by KU faculty members, academic support staff, employees, and students for e-teaching, e-learning, and e-training purposes.

2.5 KU TRACK E-training Service

This service enables KU stakeholders to enroll in e-training courses, offered by Track Learning Solutions, from a library containing SkillSoft full courseware catered specifically for Kuwait University. The training courses are accessible anytime and from anywhere using PCs, tablets, and smartphones. The available topics for the English courses, of which there are approximately 3000, include Desktop Apps courseware, Information Technology general courseware, Information Technology Certifications courseware, Business Skills courseware, and Business Certifications courseware, along with around 60 Arabic soft skills courses (TRACK Learning Solutions, 2019).

2.6 KU Library Information Resources Service

This online service provides KU stakeholders with access (i.e., either within KU campuses or remotely, off campus) to a high quality print and electronic collection of multi-disciplinary information resources in different languages (e.g., Arabic, English, and French) and formats in order to assist in the educational process and the academic programs and scientific research studies that are conducted at KU. Examples include library catalogs, databases, books, periodicals/journals, manuscripts, dissertations and theses, and audio-visual materials, which can be accessed, viewed, saved/downloaded, printed, and shared by KU stakeholders anytime and anywhere using PCs, tablets, and smartphones.

2.7 KU Faculty Portal Service

This online service enables KU faculty members and academic support staff to view the course timetable (i.e., schedule) for the current and upcoming semesters. The system also allows them to submit grades, view the results of students' evaluations, change their KU login passwords, and edit (i.e., add/change) their personal contact emails.

2.8 KU Academic Staff Evaluation Service

This online system administers the Academic Staff Evaluation service provided by the Center of Evaluation and Measurement (CEM) at KU. It enables KU students to access the academic staff evaluation form for each of their registered classes in a specific time period, announced by CEM every semester, using PCs, tablets, and smartphones from anywhere and anytime during that specified period. The results of these students' evaluations can be viewed later by KU faculty members and academic support staff through the online system, also anytime and anywhere using PCs, tablets, and smartphones

2.9 KU Research Projects and Awards Service

This service is also known as the research sector online forms system. The online system administers the workflow of KU stakeholder proposals for KU grants that are offered to subsidize a variety of research projects and to develop specialized and advanced research units and laboratories within KU in order to revolutionize the lab culture. The system also enables KU stakeholders to fill out the forms and submit the specific documents required for KU awards.

2.10 KU Distance Learning Service

This service enables KU faculty members and academic support staff to have access to e-learning facilities at KU (Ashkanani, 2017); either the two fully equipped smart classrooms or computer labs, which are located within KU E-Learning Center, or the 16 smart lecture halls, which are located throughout KU faculties/colleges across KU campuses.

2.11 KU Student Bookshop Service

This specific service allows KU faculty members and academic support staff to fill out an online order form requesting all the textbooks required for their academic courses. The online system also enables KU

stakeholders to view the availability of all textbooks in the KU Student Bookshop, which can either be searched for by a specific college or department or by a faculty member or academic support staff.

2.12 KU Human Resources Management (HRM) Service

This service is also known as the employee self-service system. It enables KU faculty members, academic support staff, and employees to do the following: (1) access their personal information and edit/update their emails, phone numbers, and contact addresses only; (2) view their pay slips (i.e., which include their financial and payroll information); (3) fill out the "Return from Leave" form (i.e., for KU faculty members and academic support staff only); (4) apply for leaves, permissions, forgotten fingerprint, and exit visa request/s, which they can also monitor to see if they are completed or pending, and they can trace the approval history for any request (i.e., for KU employees only); (5) view summary reports of their attendance/fingerprint logs (i.e., showing their absence summary, late minutes, and deductions), permissions (i.e., including the number of permissions and duration in hours per month), and leaves (i.e., indicating the type of leave and the total number of days); and (6) sending notifications to KU stakeholders. This online service can be accessed anytime and from anywhere using PCs, tablets, and smartphones.

2.13 KU Custody of Materials Service

This online service enables KU faculty members, academic support staff, and employees to check out all the equipment and materials that are officially registered in/under their custody.

2.14 KU Password Management Service

This online system enables KU users, who have forgotten their passwords or who have triggered an intruder lockout or who periodically change their passwords as a precautionary measure for security reasons, to reset or change their university account (i.e., login ID) password, without calling or visiting an IT help desk for assistance.

2.15 KU Academic Aptitude Tests Registration Service

This service enables prospective KU undergraduate students to register for the academic aptitude tests (e.g., English language test, Arabic language test, French language test, chemistry test, and mathematics test) required for the admission to certain faculties at KU. Students can also access their results in these placement tests online.

2.16 KU Student Admission Service

This service administers the admission process at KU. It allows undergraduate students to apply for study at KU. They can fill out the application form and submit all of the required documentations through the online system. Notifications and admission letters will be sent to the applicants upon final admission approval.

2.17 KU Student Portal Service

This online system is also known as the student registration system or student information system. It provides KU students with several academic services that can be accessed anytime and from anywhere using PCs, tablets, and smartphones, and these are: (1) registration services, such as students' ability to register for (i.e., enroll in) their designated classes for the upcoming semesters, view their wish lists, schedules, major sheets, and calendars, as well as reserve an appointment with a registration counsel, all done using the student registration system; (2) grading services, such as students' ability to view their official grades, as well as their capability of using a "What-if-Grade" service; (3) transfer services, such as students' ability to request transfer to other departments or colleges at KU, as well as their capability of using the "What-if-Transfer" service; (4) requests and forms services, such as students' ability to request student clearness, transcripts, and "to whom it may concern" letters/certificates; (5) evaluation services, such as students' ability to assess their course/s by filling out the evaluation questionnaire designated for each class in which they are enrolled; (6) financial aid services, such as students' ability to apply for social welfare and student funds; and (7) other services, such as students' ability to view KU's course schedule, course catalog, and the help guides for registration, wish list, and transfer. The system also enables KU students to access their profiles, and update some of their personal information such as their emails, phone numbers, and contact addresses. They can also change their portal login password, if needed, through the system. Finally, this online service gives KU students direct access to other ICT academic support services provided by KU, such as: (1) email service (i.e., Outlook application within Office 365 suite), e-learning service (i.e., Blackboard system), and e-training service (i.e., TRACK system).

2.18 KU Wireless Fidelity (Wi-Fi) Network Service

This service gives KU faculty members, academic support staff, employees, and students access to a free Wi-Fi high-speed broadband Internet connection throughout KU facilities, buildings, and campuses.

3. METHODS AND MATERIALS

3.1 Research Design

This study used an exploratory descriptive research design centered primarily on a quantitative approach, which deployed a survey questionnaire technique, a convenience sampling method, and descriptive and inferential statistics. This research model is considered one of the most appropriate research methods for a research study of this nature (Creswell, 2014; Healey, 2016; Levin, Fox, & Forde, 2013).

3.2 Instrument

An online survey questionnaire was developed, comprising two main sections. The first section asked about participants' socio-demographic profile such as their gender, rank, experience, type of courses, college, major, type of class, ICT efficacy level, ICT usage, and ICT ownership. The second section sought information to answer the research questions of this study. A total of 27 items (questions/statements) were included in this section. The questionnaire contained the following types of question: (1) multiple choice single answer questions; (2) checkbox multiple answer questions; (3) rating scale questions using a 6-point Likert scale (i.e., 1 = never, 2 = very rarely, 3 = rarely, 4 = occasionally, 5 = frequently, and 6 = very frequently); and (4) open-ended questions.

The study instrument was carefully constructed after reviewing previous research studies. It was then submitted for review to a panel of experts in the field and was later pilot tested with a selection of KU faculty members who were not part of the study's sample. The tool was carefully assessed by the experts based on its validity and reliability, and it achieved a 0.819 Cronbach's alpha (α) coefficient value (considered "good" in most social sciences and humanities research studies) (Levin et al., 2013).

3.3 Sample

A stratified sample of 304 faculty members from KU's colleges were voluntarily and randomly scrutinized and surveyed for this study in the spring semester of the 2018/2019 academic year. The sample represented various ethnic and academic backgrounds.

3.4 Data Collection

The data were collected over a three-month period during the spring semester of the 2018/2019 academic year from all KU colleges using an anonymous questionnaire that was administered through an online survey tool to all KU faculty members via a link in an e-mail (or other social networking services) asking for voluntary participation and completion of the survey. Participants were instructed to respond to the questionnaire truthfully and honestly. They were guaranteed that their responses would remain confidential and would only be used for statistical analysis purposes.

3.5 Methods of Analysis

Several means of statistical analysis were employed to analyze the collected data. The descriptive analysis techniques used were frequency, percentage, mean, and standard deviation. The inferential statistics methods utilized were one-way analysis of variance (ANOVA), Dunnett's C multiple comparisons test, Scheffe's multiple comparisons test, and the independent-samples t-test. These statistical procedures met the basic parametric assumptions required for their application. When performing inferential tests, an alpha level of 0.05 was selected.

4. RESULTS AND DISCUSSION

The socio-demographic profile of the respondents will first be depicted and the results will then be presented and discussed thoroughly, based on the research questions. Each research question will be portrayed separately.

4.1 Demographic Profile of Respondents

Table 1 outlines the demographic profile of KU faculty members who voluntarily participated in this study.

Table 1:*Frequencies and Percentages of Participants' Demographic Information*

Variable	Category	*N*	%
Gender	Male	216	71.1
	Female	88	28.9
Academic Rank/Position	Assistant professor	173	56.9
	Associate professor	82	27.0
	Professor	49	16.1

Years of Experience	< 5 years	85	28.0
	5 to < 10 years	69	22.7
	10 to < 20 years	80	26.3
	> 20 years	70	23.0
Type of Courses	Undergraduate	151	49.7
	Graduate	5	1.6
	Both	148	48.7
Type of College	Humanities & social sciences faculties	144	47.4
	Scientific faculties	160	52.6
Type of Major	Arts majors	120	39.5
	Scientific majors	184	60.5
Type of Class	Traditional	137	45.1
	Blended	167	54.9
ICT Efficacy Level	Low/Beginner	26	8.6
	Moderate/Intermediate	177	58.2
	High/Expert	101	33.2
ICT Daily Usage	1 to < 3 hours	103	33.9
	3 to < 6 hours	140	46.1
	> 6 hours	61	20.1
ICT Ownership	Desktop PC	279	91.8
	Laptop PC	267	87.8
	Tablet	117	38.5
	Smartphone	304	100.0
	PDA	24	7.9
	e-Reader	57	18.8

4.2 Extent of Use of ICT Services and Resources

RQ-1 tackled the extent of KU faculty members' use of the academic support ICT services and resources provided by KU. A total of 14 survey items addressed RQ-1.

RQ-1. What is the extent of usage by KU faculty members of the academic support ICT services and resources provided by KU?

First, the results revealed that the overall average use by KU faculty members of the academic support ICT services and resources provided by KU is considered "average" as their secured overall mean score is 3.48 (*SD* = 0.937) on a 6-point rating scale. Other studies have reported similar findings; for example, Al-Senaidi's (2009) study at Sultan Qaboos University (SQU) exploring the ICT use of 300 faculty members found that they used ICT tools and resources "sometimes," signifying that they do not frequently use ICT services and resources in their instructional processes, to perform professional tasks for their work, research, and study. Another study by Selwyn (2007) demonstrated the limited formal academic use of ICT tools and services in the higher education community by university faculty and students; specifically, the study described ICT use as limited, linear, and rigid. However, different findings were also reported by studies such as Thanuskodi (2011) to measure the use of ICT services and resources among faculty members of self-financing engineering colleges in India. The findings of Thanuskodi's study revealed that faculty members are heavily dependent on e-resources for their work, research, and study; and their attitudes towards e-resources seem very positive.

Second, the findings of this study also asserted that among the 14 academic support ICT services and resources provided to faculty members by KU, "e-mail" is the most frequently used (*M* = 5.42, *SD* = 1.078), followed by "faculty portal" (*M* = 4.94, *SD* = 1.146), "Microsoft Office 365" (*M* = 4.48, *SD* = 1.798), and "academic staff evaluation" (*M* = 4.27, *SD* = 1.586). The results also indicated that "library information resources" (*M* = 3.93, *SD* = 1.628) and "Wi-Fi network" (*M* = 3.92, *SD* = 1.817) services are occasionally used by KU faculty members. As for "Blackboard e-learning" system, KU faculty members rarely use it (*M* = 2.95, *SD* = 1.942) and this was also the case for "HRM" (*M* = 2.90, *SD* = 1.675) and "student bookshop" (*M* = 2.81, *SD* = 1.675) services. The least used services comprised "TRACK e-training" system (*M* = 2.06, *SD* = 1.547) and "distance learning" service (*M* = 1.89, *SD* = 1.458), which were very rarely used by KU faculty members. Some previous studies have reported different results; for example, in her study, Buarki (2016) indicated that faculty members

at the College of Basic Education (CBE) in the State of Kuwait, which is maintained under the supervision of the Public Authority for Applied Education and Training (PAAET), have mostly used ICT for "searching and accessing research," while the least common use was "web-based class management tools (i.e., Blackboard or Moodle)." Tables 2-3 provide detailed information about the descriptive statistics results.

Table 2:*Descriptive Statistics of Usage of Academic Support ICT Services and Resources by KU Faculty Members, in Descending Order*

Rank	ICT Service/System	*N*	Min.	Max.	*M*	Std. Deviation
1	E-mail	304	1	6	5.42	1.078
2	Faculty Portal	304	1	6	4.94	1.146
3	Microsoft Office 365	304	1	6	4.48	1.798
4	Academic Staff Evaluation	304	1	6	4.27	1.586
5	Library Information Resources	304	1	6	3.93	1.628
6	Wireless Fidelity (Wi-Fi) Network	304	1	6	3.92	1.817
7	Research Projects and Awards	304	1	6	3.54	1.696
8	Password Management	304	1	6	3.28	1.564
9	Blackboard E-learning	304	1	6	2.95	1.942
10	Human Resources Management (HRM)	304	1	6	2.90	1.675
11	Student Bookshop	304	1	6	2.81	1.675
12	Custody of Materials	304	1	6	2.29	1.574
13	TRACK E-training	304	1	6	2.06	1.547
14	Distance Learning	304	1	6	1.89	1.458

Table 3: *Descriptive Statistics regarding Usage of the Academic Support ICT Services and Resources by KU Faculty Members, in Descending Order*

Rank	ICT Service/System	*Never*		*Very Rarely*		*Rarely*		*Occasionally*		*Frequently*		Very Frequently		*M*	Std. Deviation
		N	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%		
1	E-mail	3	1.0	10	3.3	8	2.6	25	8.2	46	15.1	212	69.7	5.42	1.078
2	Faculty Portal	6	2.0	9	3.0	12	3.9	59	19.4	103	33.9	115	37.8	4.94	1.146
3	Microsoft Office 365	41	13.5	20	6.6	15	4.9	36	11.8	61	20.1	131	43.1	4.48	1.798
4	Academic Staff Evaluation	25	8.2	30	9.9	25	8.2	67	22.0	71	23.4	86	28.3	4.27	1.586
5	Library Information Resources	44	14.5	24	7.9	25	8.2	79	26.0	80	26.3	52	17.1	3.93	1.628
6	Wireless Fidelity (Wi-Fi) Network	52	17.1	27	8.9	42	13.8	33	10.9	72	23.7	78	25.7	3.92	1.817
7	Research Projects and Awards	56	18.4	41	13.5	38	12.5	62	20.4	66	21.7	41	13.5	3.54	1.696
8	Password Management	44	14.5	73	24.0	47	15.5	65	21.4	45	14.8	30	9.9	3.28	1.564
9	Blackboard E-learning	124	40.8	27	8.9	27	8.9	38	12.5	42	13.8	46	15.1	2.95	1.942
10	Human Resources Management (HRM)	97	31.9	43	14.1	40	13.2	63	20.7	38	12.5	23	7.6	2.90	1.675

11	Student Bookshop	100	32.9	54	17.8	37	12.2	50	16.4	42	13.8	21	6.9	2.81	1.675
12	Custody of Materials	146	48.0	52	17.1	34	11.2	27	8.9	33	10.9	12	3.9	2.29	1.574
13	TRACK E-training	182	59.9	33	10.9	27	8.9	25	8.2	25	8.2	12	3.9	2.06	1.547
14	Distance Learning	199	65.5	31	10.2	24	7.9	19	6.3	21	6.9	10	3.3	1.89	1.458

Note. Never = Not at all or do not use, Very Rarely = Once a month, Rarely = 2-3 times a month, Occasionally (sometimes) = 2-3 times a week, Frequently (often) = 1-2 times a day, Very Frequently (most often) = More than 2 times a day, $N = 304$, Minimum = 1, and Maximum = 6.

4.3 Reasons for not Using ICT Services and Resources

RQ-2 tackled the reasons why KU faculty members do not use some academic support ICT services and resources provided by KU. A total of 13 items in the questionnaire addressed RQ-2.

RQ-2. What factors hinder the use of the academic support ICT services and tools by KU faculty members?

The findings presented in Table 4 disclose detailed information regarding the key reasons why KU faculty members have not used at all or have not frequently used various academic support ICT services and resources provided by KU.

Table 4: *Descriptive Statistics of KU Faculty Members' Factors for not Using the Academic Support ICT Services and Resources, in Descending Order*

Rank	Reason	*N*	%
1	Lack of technical support	111	36.5
2	Unawareness of their availability	104	34.2
3	Lack of time	99	32.6
4	Lack of knowledge/training	96	31.6
5	Impracticality (e.g., difficulty accessing ICT services and resources due to slow connection speed, too much maintenance, etc.)	95	31.3
6	Not having received instructions to do so	79	26.0
7	Lack of academic support	76	25.0
8	Lack of interest/enjoyment	67	22.0
9	Requirement of extra effort	60	19.7
10	Health concerns (e.g., radiation, eye fatigue, and tiredness)	55	18.1
11	Lack of confidence in using ICT tools, services, and resources	29	9.5

Some research studies have reported similar results; for example, Ibrahim (2004) discovered that the United Arab Emirates University (UAEU) faculty members' frequency of use of electronic resources was low due to lack of time, lack of awareness, language barrier, and ineffective communication channels. Al-Ansari's (2006) study revealed that lack of time and access are the major obstacles to KU faculty members' Internet use. Similarly, Al-Senaidi (2009) and Al-Senaidi, Lin, and Poirot (2009) revealed some of the factors that affected the adoption and use of ICT tools and resources by SQU faculty members, including lack of institutional support, lack of time, lack of equipment, lack of confidence and skills to use ICT services and resources, as well as disbelief regarding the benefits of ICT. Moreover, Ashkanani (2017) reported that lack of efficient training affected KU instructors' use of the e-learning system at KU, while Al-Ansari (2006), Thanuskodi (2011), and Buarki (2016) found that the extent of use of ICT tools and resources by faculty members was negatively affected by slow speed Internet and Wi-Fi connectivity campus-wide as well as the slow speed off-campus accessibility due to the technical features/specifications of these services and resources, or due to too much maintenance, making them impractical for use.

4.4 Statistically Significant Differences among Faculty Members

RQ-3 addressed whether or not there are significant differences among KU faculty members' responses to the questionnaire.

RQ-3. Would the socio-demographic profile (e.g., gender, type of college, type of major, type of class, academic rank/position, teaching experience, and ICT efficacy level) of KU faculty members affect their degree of use of academic support ICT services and resources?

The results demonstrated that the socio-demographic profile of KU faculty members did, to some extent, influence their use of academic support ICT services and resources. The findings revealed several significant differences among the subgroups with respect to types of college, major, class, academic rank/position, and ICT efficacy level. The participants from scientific faculties, holding scientific majors, using a blended teaching and learning strategy, with higher academic rank, and advanced ICT efficacy level had a greater tendency to use the academic support ICT services and resources. These differences can be interpreted logically owing to the nature and characteristics (i.e., personal and occupational) of such participants, who are more likely to use ICT services, tools, systems, and resources than others. On the other hand, no such significant differences were found among KU faculty members with respect to gender (i.e., similar to Al-Senaidi et al., 2009) and years of teaching experience. Some research studies have reported similar results; for example, Buarki (2016) asserted that there is a statistically significant and strong association between "frequency of ICT use" and "ICT skills level." Tables 5-11 provide detailed information regarding these significant differences.

Table 5: *Inferential Statistics of KU Faculty Members' Responses to RQ-1 for "Gender" Differences*

ICT Service/System	Category	*N*	*M*	Std. Deviation	*t*	*df*	Sig. (2-tailed)
E-mail	Male	216	5.36	1.140	-1.725	302	0.086
	Female	88	5.59	0.892			
Microsoft Office 365	Male	216	4.37	1.830	-1.695	302	0.091
	Female	88	4.75	1.697			
Blackboard E-learning	Male	216	2.82	1.911	-1.787	302	0.075
	Female	88	3.26	1.991			
TRACK E-training	Male	216	2.04	1.562	-0.309	302	0.757
	Female	88	2.10	1.516			
Library Information Resources	Male	216	3.88	1.599	-0.938	302	0.349
	Female	88	4.07	1.701			
Faculty Portal	Male	216	4.89	1.172	-1.160	302	0.247
	Female	88	5.06	1.076			
Academic Staff Evaluation	Male	216	4.25	1.537	-0.476	302	0.635
	Female	88	4.34	1.708			
Research Projects and Awards	Male	216	3.53	1.670	-0.114	302	0.910
	Female	88	3.56	1.767			
Distance Learning	Male	216	1.83	1.389	-1.114	302	0.266
	Female	88	2.03	1.615			
Student Bookshop	Male	216	2.75	1.646	-1.019	302	0.309
	Female	88	2.97	1.745			
Human Resources Management (HRM)	Male	216	2.93	1.680	0.347	302	0.729
	Female	88	2.85	1.672			

Custody of Materials	Male	216	2.34	1.586	0.864	302	0.388
	Female	88	2.17	1.548			
Password Management	Male	216	3.23	1.519	-0.864	302	0.388
	Female	88	3.40	1.672			
Wireless Fidelity (Wi-Fi) Network	Male	216	3.92	1.856	-0.066	302	0.948
	Female	88	3.93	1.727			

Table 6: *Inferential Statistics of KU Faculty Members' Responses to RQ-1 for "Type of College" Differences*

ICT Service/System	Category	*N*	*M*	Std. Deviation	*t*	*df*	Sig. (2-tailed)
E-mail	HSS faculties	144	5.19	1.200	-3.709	302	0.000**
	Scientific faculties	160	5.64	0.908			
Microsoft Office 365	HSS faculties	144	3.90	1.952	-5.534	302	0.000**
	Scientific faculties	160	4.99	1.473			
Blackboard E-learning	HSS faculties	144	2.71	1.797	-2.076	302	0.039*
	Scientific faculties	160	3.17	2.044			
TRACK E-training	HSS faculties	144	1.74	1.278	-3.441	302	0.001**
	Scientific faculties	160	2.34	1.708			
Library Information Resources	HSS faculties	144	3.72	1.619	-2.132	302	0.034*
	Scientific faculties	160	4.12	1.619			
Faculty Portal	HSS faculties	144	4.83	1.134	-1.507	302	0.133
	Scientific faculties	160	5.03	1.152			
Academic Staff Evaluation	HSS faculties	144	4.01	1.637	-2.806	302	0.005**
	Scientific faculties	160	4.51	1.505			
Research Projects and Awards	HSS faculties	144	3.23	1.646	-3.068	302	0.002**
	Scientific faculties	160	3.82	1.697			
Distance Learning	HSS faculties	144	1.58	1.180	-3.522	302	0.000**
	Scientific faculties	160	2.16	1.625			
Student Bookshop	HSS faculties	144	2.89	1.730	0.754	302	0.452
	Scientific faculties	160	2.74	1.626			
Human Resources Management (HRM)	HSS faculties	144	2.72	1.633	-1.877	302	0.061
	Scientific faculties	160	3.08	1.699			
Custody of Materials	HSS faculties	144	1.89	1.359	-4.368	302	0.000**
	Scientific faculties	160	2.66	1.667			
Password Management	HSS faculties	144	3.06	1.568	-2.353	302	0.019*
	Scientific faculties	160	3.48	1.538			
Wireless Fidelity (Wi-Fi) Network	HSS faculties	144	3.55	1.847	-3.451	302	0.001**
	Scientific faculties	160	4.26	1.727			

Note. HSS = Humanities and social sciences, * = The mean difference is significant at the 0.05 level, and ** = The mean difference is significant at the 0.01 level.

Table 7: *Inferential Statistics of KU Faculty Members' Responses to RQ-1 for "Type of Major" Differences*

ICT Service/System	Category	*N*	*M*	Std. Deviation	*t*	*df*	Sig. (2-tailed)
E-mail	Arts majors	120	5.13	1.223	-3.888	302	0.000**
	Scientific majors	184	5.61	0.928			
Microsoft Office 365	Arts majors	120	3.73	2.008	-6.246	302	0.000**
	Scientific majors	184	4.97	1.456			
Blackboard E-learning	Arts majors	120	2.68	1.750	-2.009	302	0.045*
	Scientific majors	184	3.13	2.042			
TRACK E-training	Arts majors	120	1.73	1.250	-3.085	302	0.002**
	Scientific majors	184	2.28	1.681			
Library Information Resources	Arts majors	120	3.73	1.640	-1.787	302	0.075
	Scientific majors	184	4.07	1.611			
Faculty Portal	Arts majors	120	4.78	1.146	-1.903	302	0.058
	Scientific majors	184	5.04	1.137			
Academic Staff Evaluation	Arts majors	120	4.08	1.622	-1.689	302	0.092
	Scientific majors	184	4.40	1.554			
Research Projects and Awards	Arts majors	120	3.22	1.631	-2.708	302	0.007**
	Scientific majors	184	3.75	1.709			
Distance Learning	Arts majors	120	1.52	1.145	-3.660	302	0.000**
	Scientific majors	184	2.13	1.587			
Student Bookshop	Arts majors	120	3.03	1.763	1.864	302	0.063
	Scientific majors	184	2.67	1.604			
Human Resources Management (HRM)	Arts majors	120	2.68	1.651	-1.939	302	0.053
	Scientific majors	184	3.05	1.678			
Custody of Materials	Arts majors	120	1.86	1.355	-3.980	302	0.000**
	Scientific majors	184	2.58	1.645			
Password Management	Arts majors	120	3.07	1.549	-1.896	302	0.059
	Scientific majors	184	3.41	1.562			
Wireless Fidelity (Wi-Fi) Network	Arts majors	120	3.56	1.869	-2.844	302	0.005**
	Scientific majors	184	4.16	1.747			

Note. * = The mean difference is significant at the 0.05 level, and ** = The mean difference is significant at the 0.01 level.

Table 8: *Inferential Statistics of KU Faculty Members' Responses to RQ-1 for "Type of Class" Differences*

ICT Service/System	Category	*N*	*M*	Std. Deviation	*t*	*df*	Sig. (2-tailed)
E-mail	Traditional	137	5.09	1.300	-5.014	302	0.000**
	Blended	167	5.69	0.758			
Microsoft Office 365	Traditional	137	3.99	1.944	-4.449	302	0.000**
	Blended	167	4.88	1.563			
Blackboard E-learning	Traditional	137	2.41	1.829	-4.548	302	0.000**
	Blended	167	3.40	1.923			
TRACK E-training	Traditional	137	1.66	1.302	-4.139	302	0.000**
	Blended	167	2.38	1.656			
Library Information Resources	Traditional	137	3.67	1.672	-2.538	302	0.012*
	Blended	167	4.14	1.565			
Faculty Portal	Traditional	137	4.72	1.259	-3.000	302	0.003**
	Blended	167	5.11	1.014			
Academic Staff Evaluation	Traditional	137	3.90	1.624	-3.818	302	0.000**
	Blended	167	4.58	1.490			
Research Projects and Awards	Traditional	137	3.28	1.714	-2.461	302	0.014*
	Blended	167	3.75	1.655			
Distance Learning	Traditional	137	1.55	1.124	-3.685	302	0.000**
	Blended	167	2.16	1.637			
Student Bookshop	Traditional	137	2.50	1.535	-2.948	302	0.003**
	Blended	167	3.07	1.746			
Human Resources Management (HRM)	Traditional	137	2.48	1.515	-4.088	302	0.000**
	Blended	167	3.25	1.724			
Custody of Materials	Traditional	137	1.84	1.302	-4.703	302	0.000**
	Blended	167	2.66	1.681			
Password Management	Traditional	137	3.09	1.522	-1.914	302	0.057
	Blended	167	3.43	1.585			
Wireless Fidelity (Wi-Fi) Network	Traditional	137	3.50	1.815	-3.771	302	0.000**
	Blended	167	4.27	1.747			

Note. * = The mean difference is significant at the 0.05 level, and ** = The mean difference is significant at the 0.01 level.

Table 9: *Inferential Statistics of KU Faculty Members' Responses to RQ-1 for "Academic Rank" Differences*

ICT Service/System		Sum of Squares	*df*	Mean Square	*F*	Sig.
E-mail	Between Groups	2.746	2	1.373	1.182	0.308
	Within Groups	349.514	301	1.161		
	Total	352.260	303			
Microsoft Office 365	Between Groups	2.443	2	1.221	0.376	0.687
	Within Groups	977.396	301	3.247		
	Total	979.839	303			
Blackboard E-learning	Between Groups	1.457	2	0.729	0.192	0.825
	Within Groups	1140.803	301	3.790		
	Total	1142.260	303			
TRACK E-training	Between Groups	17.690	2	8.845	3.764	0.024*
	Within Groups	707.245	301	2.350		
	Total	724.934	303			
Library Information Resources	Between Groups	6.016	2	3.008	1.135	0.323
	Within Groups	797.534	301	2.650		
	Total	803.549	303			
Faculty Portal	Between Groups	3.319	2	1.660	1.266	0.283
	Within Groups	394.493	301	1.311		
	Total	397.813	303			
Academic Staff Evaluation	Between Groups	6.223	2	3.112	1.239	0.291
	Within Groups	756.115	301	2.512		
	Total	762.339	303			
Research Projects and Awards	Between Groups	26.934	2	13.467	4.799	0.009**
	Within Groups	844.592	301	2.806		
	Total	871.526	303			
Distance Learning	Between Groups	19.203	2	9.602	4.624	0.011*
	Within Groups	624.994	301	2.076		
	Total	644.197	303			
Student Bookshop	Between Groups	5.747	2	2.873	1.024	0.360
	Within Groups	844.566	301	2.806		
	Total	850.313	303			
Human Resources Management	Between Groups	12.478	2	6.239	2.242	0.108

(HRM)	Within Groups	837.756	301	2.783		
	Total	850.234	303			
Custody of Materials	Between Groups	11.547	2	5.773	2.350	0.097
	Within Groups	739.397	301	2.456		
	Total	750.944	303			
Password Management	Between Groups	7.012	2	3.506	1.438	0.239
	Within Groups	733.778	301	2.438		
	Total	740.789	303			
Wireless Fidelity (Wi-Fi) Network	Between Groups	14.408	2	7.204	2.200	0.113
	Within Groups	985.697	301	3.275		
	Total	1000.105	303			

Note. * = The mean difference is significant at the 0.05 level, and ** = The mean difference is significant at the 0.01 level.

Table 10: *Inferential Statistics of KU Faculty Members' Responses to RQ-1 for "Years of Experience" Differences*

ICT Service/System		Sum of Squares	*df*	Mean Square	*F*	Sig.
E-mail	Between Groups	4.671	3	1.557	1.344	0.260
	Within Groups	347.589	300	1.159		
	Total	352.260	303			
Microsoft Office 365	Between Groups	20.893	3	6.964	2.179	0.091
	Within Groups	958.946	300	3.196		
	Total	979.839	303			
Blackboard E-learning	Between Groups	5.918	3	1.973	0.521	0.668
	Within Groups	1136.342	300	3.788		
	Total	1142.260	303			
TRACK E-training	Between Groups	4.987	3	1.662	0.693	0.557
	Within Groups	719.947	300	2.400		
	Total	724.934	303			
Library Information Resources	Between Groups	10.582	3	3.527	1.334	0.263
	Within Groups	792.968	300	2.643		
	Total	803.549	303			
Faculty Portal	Between Groups	3.097	3	1.032	0.785	0.503
	Within Groups	394.716	300	1.316		
	Total	397.813	303			

Academic Staff Evaluation	Between Groups	2.415	3	0.805	0.318	0.812
	Within Groups	759.923	300	2.533		
	Total	762.339	303			
Research Projects and Awards	Between Groups	2.647	3	0.882	0.305	0.822
	Within Groups	868.879	300	2.896		
	Total	871.526	303			
Distance Learning	Between Groups	16.063	3	5.354	2.557	0.055
	Within Groups	628.134	300	2.094		
	Total	644.197	303			
Student Bookshop	Between Groups	1.290	3	0.430	0.152	0.928
	Within Groups	849.023	300	2.830		
	Total	850.312	303			
Human Resources Management (HRM)	Between Groups	4.013	3	1.338	0.474	0.700
	Within Groups	846.220	300	2.821		
	Total	850.234	303			
Custody of Materials	Between Groups	1.612	3	0.537	0.215	0.886
	Within Groups	749.332	300	2.498		
	Total	750.944	303			
Password Management	Between Groups	9.535	3	3.178	1.304	0.273
	Within Groups	731.254	300	2.438		
	Total	740.789	303			
Wireless Fidelity (Wi-Fi) Network	Between Groups	15.291	3	5.097	1.553	0.201
	Within Groups	984.815	300	3.283		
	Total	1000.105	303			

Table 11: *Inferential Statistics of KU Faculty Members' Responses to RQ-1 for "ICT Efficacy Level" Differences*

ICT Service/System		Sum of Squares	*df*	Mean Square	*F*	Sig.
E-mail	Between Groups	17.230	2	8.615	7.740	0.001**
	Within Groups	335.030	301	1.113		
	Total	352.260	303			
Microsoft Office 365	Between Groups	73.419	2	36.709	12.190	0.000**
	Within Groups	906.420	301	3.011		
	Total	979.839	303			

Blackboard E-learning	Between Groups	11.667	2	5.834	1.553	0.213
	Within Groups	1130.592	301	3.756		
	Total	1142.260	303			
TRACK E-training	Between Groups	12.488	2	6.244	2.638	0.073
	Within Groups	712.446	301	2.367		
	Total	724.934	303			
Library Information Resources	Between Groups	14.983	2	7.491	2.860	0.059
	Within Groups	788.567	301	2.620		
	Total	803.549	303			
Faculty Portal	Between Groups	13.797	2	6.899	5.407	0.005**
	Within Groups	384.015	301	1.276		
	Total	397.813	303			
Academic Staff Evaluation	Between Groups	6.088	2	3.044	1.212	0.299
	Within Groups	756.251	301	2.512		
	Total	762.339	303			
Research Projects and Awards	Between Groups	12.307	2	6.153	2.156	0.118
	Within Groups	859.220	301	2.855		
	Total	871.526	303			
Distance Learning	Between Groups	22.513	2	11.256	5.450	0.005**
	Within Groups	621.684	301	2.065		
	Total	644.197	303			
Student Bookshop	Between Groups	1.616	2	0.808	0.286	0.751
	Within Groups	848.697	301	2.820		
	Total	850.313	303			
Human Resources Management (HRM)	Between Groups	27.391	2	13.695	5.010	0.007**
	Within Groups	822.843	301	2.734		
	Total	850.234	303			
Custody of Materials	Between Groups	44.767	2	22.384	9.541	0.000**
	Within Groups	706.177	301	2.346		
	Total	750.944	303			
Password Management	Between Groups	6.923	2	3.462	1.420	0.243
	Within Groups	733.866	301	2.438		
	Total	740.789	303			

Wireless Fidelity (Wi-Fi) Network	Between Groups	49.845	2	24.923	7.894	0.000**
	Within Groups	950.260	301	3.157		
	Total	1000.105	303			

Note. ** = The mean difference is significant at the 0.01 level.

5. CONCLUSION AND RECOMMENDATIONS

Academic support ICT tools and services have made extraordinary advances in the academic world; these technologies have affected and changed the manner in which academics work (i.e., how they think, teach, learn, study, communicate, collaborate, interact, administer, publish, preserve, exchange, read, write, and research information differently) (Rafiq & Warraich, 2016; Rao, Tripathi, & Kumar, 2016; Raynard, 2017; Safar, 2018b; Safar & Alkhezzi, 2013; Safar, Jafer, & Alqadiri, 2014). An enormous amount of funding has been made readily available, over two decades, for the employment of these ICT tools, resources, and services at KU; however, research studies covering the extent of usage of these technologies by KU's stakeholders are limited (Safar, 2018b). Regardless of two decades of massive investment to situate ICT tools, services, systems, and resources as a pivotal tenet of KU's teaching, learning, research, and administration practices, the findings revealed that formal academic usage of these ICT services and resources by KU faculty is only "average" (overall mean score is 3.48 (*SD* = 0.937) on a 6-point rating scale). This implies that the potential benefits of these academic support ICT systems and services have not yet been attained, in terms of serving KU's strategic objectives. The results of this study clearly reveal that the academic support ICT tools, resources, and services at KU do not yet fit flawlessly into the established chain of education workflow for KU faculty members. Yet, if we are eager to achieve the proclaimed objectives behind the implementation of these academic support ICT tools, resources, and services at KU, reconsideration is highly required prior to completing their execution. Thus, we make the following recommendations to encourage and increase the effectiveness and efficiencies of KU faculty members' usage and satisfaction of the academic support ICT tools, resources, and services:

1. Instigate a better and well-planned/defined media awareness/publicity campaign on a large scale within KU for its faculty members.
2. Develop innovative practices and partnership with KU faculty members by providing them with more, and ongoing, training sessions/courses—administered either by instructional technologists or experienced and proficient faculty members—on how to efficiently and effectively integrate the academic support ICT tools, resources, and services within academic life.
3. Take the following dimensions into consideration, and invest more efforts in them, when implementing the academic support ICT tools, resources, and services at KU: (a) academic support, (b) technical support, (c) usability, (d) suitability, (e) applicability, (f) compatibility, (g) interactivity, (h) media richness, (i) ICT efficacy level, (j) ICT ownership, (k) teaching experience, (l) type of class (i.e., whether traditional or online or blended), (m) users' preference, (n) assessment/evaluation and selection, (o) return on investment (i.e., cost/benefit), and (p) technology (Safar, 2018b). These abovementioned points emerge as key requisites for effective service delivery and enhancement of the academic support ICT tools, resources, and services within KU.
4. Provide scalable broadband high-speed Internet access within all KU campuses to sustain the implementation of the academic support ICT tools, resources, and services that are replacing the traditional means.
5. Numerous variables can foresee KU faculty members' behavioral intentions to use the academic support ICT tools, resources, and services; for example, personal innovativeness, motivation, ICT competences and skills, and challenges/barriers (Safar, 2018b). Thus, more research studies (quantitative and qualitative) should be conducted in the near future covering these and other related aspects for a wide range of participants with different academic backgrounds from all KU colleges to validate and extend the findings.
6. Try to resolve the issues/challenges that were reported by KU faculty members—which are deemed to be the foremost factors constraining KU faculty members' usage of the academic support ICT tools, resources, and services—in order to contribute to faculty members' successful use of these technologies and services to support their own academic lives/careers.
7.

5.1 Limitations of the Study

This research study has covered the extent of use, by KU's faculty members only, of academic support ICT services and resources provided by KU; additional studies should examine the viewpoints of academic support

staff, students, and employees. The physical infrastructure limitations of the KU campuses being based in different geographical locations may be considered a physical limitation when collecting data. This leads to another major study limitation, namely the small sample size, which can be overcome by using various ICT means for data collection purposes. More data need to be collected to impart credence and validation to the findings in the future.

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Problem-Based Learning Modules with Socio-Scientific Issues Topics to Closing the Gap in Argumentation Skills

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ABSTRACT
Problem-Based Learning (PBL) modules based on the topic of socio-scientific issues are behaved to be effective to improve argumentation skills. This aim of the research was to look at the effectiveness of PBL modules on the topic of socio-scientific issues, in order to empower argumentation skills for students with high and low achievements. Method was used the 2x2 factorial design. Samples of this research were participants of the twelfth-grade students of senior high schools in Surakarta. Cluster of random sampling technique was used to determine the samples, and the samples were divided into two groups, namely the control group using conventional modules and the experimental group using PBL modules. Each sample group was divided into two groups base on high and low achievements. The instrument used to obtain the data on argumentation skills was an essay test. The results showed that the application of PBL-based modules is more effective in improving students' argumentation skills than conventional modules and the PBL-based module can minimize the gap in argumentation skills in students with high and low academic achievements.
Keywords: argumentation skills, PBL-based module, socio-scientific issues, academic achievement.

INTRODUCTION
The development of science and technology in the 21st century produced more challenging in the competition of human experts that is inseparable from the role of the quality of education could promote more competitiveness (Ana *et al*., 2019). Educational experiences have been changes and the developments in educational sciences require qualified human resources with various skills (Wüstenberg *et al*., 2014). One of the necessary skills is the argumentation skill (Evagorou and Osborne, 2013). Argumentation skills are ability of people to construct data and information which can eventually produce strong and precise ideas (Cetin, 2014).

These skills are essential in the academics activities (Abdollahzadeh *et al*., 2017) especially for developing, evaluating and validating knowledge (Weng *et al*., 2017). Argumentation skills contribute to improving conceptual understanding more deeply (Aydeniz and Ozdilek, 2016) and allowing students to be more active in the learning process by providing opportunities to share, reflect, and revise their ideas with others (Cavlazoglu and Stuessy, 2018). Empowering argumentation skills could also allow students to develop their communication skills (McNeil *et al*., 2016) and improve scientific literacy (Kaya, 2013). According to Toulmin (2003), argumentation skills consist of six aspects, there were: claim, data, warrant, backing, qualifier, and rebuttal. The category of argumentation skills can be divided in four categories consisting of: level 1 (an argument containing a claim with a simple structure); level 2 (an argument consisting of a claim and data); Level 3 (an argument consisting of claims supported with data, warrant, or backing, but not containing rebuttal); Level 4 (level 3 is added by one or more rebuttals) (Garcia *et al*., 2013).

Studies on mastering students' argumentation skills in Indonesia showed apprehensive results. This can be seen from Indonesia's achievements in the Trends in International Mathematics and Science Study (TIMSS) in 1999, 2003, 2007, 2011 and 2015. Indonesian students' ranking is almost at the bottom list. This results indicate that Indonesian students are not accustomed to solving problems which require the aspects high-order thinking such as reasoning, application, analysis and evaluation (Mullis *et al*., 2015). This argumentation skill study was

carried out through a written test. It shows that the students' argumentation skills were at level one by 17.8%, in which the arguments given by the students only contained simple claims. The students were at the second level by 3.35%, in which the arguments given by the students were supported by data without the support of warrant and backing. The results of the preliminary test showed that the rebuttal aspect had not developed and there were gaps in argumentation skills among students.

The gap in argumentation skills among the students with different academic achievements was needed to be addressed. Academic achievement is one indicator that is important in assessing student learning progress (Tabbodi *et al.*, 2015). Student academic achievement can be classified into high low achievement (Ozguc and Cavkaytar, 2015). There are several factors influencing the students' academic achievements; among others are family characteristic, intellectual level, psychological characteristic, classroom climate and learning duration (Budsankom *et al.*, 2015). The gap in academic achievements between high achievement (HA) and low achievement (LA) students can be reduced, if LA students are given sufficient time to learn according to their needs and abilities. The difference in speed in receiving learning becomes one of the factors that causes the gap between HA and LA students because of the same duration of learning in the classroom.

Argumentation skills do not arise naturally in most people. This would be depends on the environment and practice (Mcneill, Alez-howard *et al.*, 2017). Argumentation skill empowerment can be integrated in the classroom learning system (Manz, 2015). One way to empower argumentation skills in the classroom is to integrate socio-scientific issues (SSIs) in the learning process (Christenson, 2014; Åkerblom and Lindahl, 2017; Pitiporntapin and Sadler, 2016). SSIs is characterized by two important elements, namely the relationship of science content and social interests (Genel and Topçu, 2016; Topçu et al., 2017) that are complex, open, and controversial (Lindahl and Lundin, 2016), thus providing opportunities for students to conduct evaluations (Sadler *et al.*, 2016) and discussions (Tidemand and Nielsen, 2017) in finding and identifying concepts or principles learned (Potter and France, 2018). The issues presented in the learning process are daily problems (Yu *et al.*, 2014) which are not structured or complex that leads to multiperceptions (Rosli *et al.*, 2013) and will encourage representation that will support the claim so that a good argument is formed (Namdar and Shen, 2016). The more contextual the problem is presented, the better the learning takes place (Ridlo, 2014).

Teachers have an important role in providing an effective learning environment, but the level of student argumentation does not depend solely on how the teacher engages students in the advancement of thinking skills. One way to empower argumentation skills is to use modules that consider the history, theory and perspective of argumentation in learning in advance (Archila, 2014). Modules which can be used to empower argumentation skills must contain learning materials that package a multi-perspective problem that is tied to social, economic, political and ethical or moral aspects so that SSIs are the suitable topic to be integrated in the learning module (Morris, 2014).

The problem-solving process needs to be integrated in learning because it is an important key in science learning (Williams, 2018) and is an crucial factor for students in adjusting their behaviour in dealing with a problem (Yigiter, 2013). A module that contains components of problem identification, analysis of learning problems and issues, discovery and reporting, presentation of solutions and reflections, as well as an overview, integration and evaluation is called Problem-Based Learning (PBL) module. The PBL module is one form of reading literature with instructions focused on the learning process and learning content. The use of PBL-based modules can accommodate students to identify problems, define and represent problems, explore possible strategies or solutions, act on selected solutions, and examine and evaluate outside classroom learning (Kuzle, 2017; Niss, 2018).

The argumentation skills can be empowered through ill-structured problem which is used as a trigger in the PBL syntax (Tawfik, 2017; Fang *et al.*, 2018). The learning process is packaged in the form of an investigation of a socio-scientific issue as outlined in the module so that students are encouraged to collect and analyse data to build evidence-based explanations (de Sá Ibraim and Justi, 2016). Students can deliver arguments based on their initial knowledge to connect past experiences with new situations when given the opportunity to learn with problem solving (Cheng *et al.*, 2018).

Therefore, it is necessary to conduct a research to determine whether PBL-based modules on the topic of socio-scientific issues can significantly reduce the gap in argumentation skills between HA and LA students and are more effective than conventional modules. The aims of this research were to find out: (1) how PBL-based modules with the topic of socio-scientific issues influence argumentation skills compared to conventional modules; (2) what is the effect of the academic achievement on argumentation skills; and (3) whether the PBL-

based module with the topic of socio-scientific issues is more effective to close the gap of argumentation skills between HA and LA students than the conventional module.

RESEACH METHOD

Research Design

The aim of this study was to examine the effectiveness of PBL-based biology modules on students' argumentation skills, the effect of academic achievement on students' argumentation skills, and the interaction between modules and academic achievement on argumentation skills. Prior to this research, PBL-based module product development on the SSIs topic had been carried out with reference to the research and development (R & D) method (Borg and Gall, 2003). SSIs topics used in this research include recombinant DNA, cloning, IVF and hybridoma techniques. The independent variables are the PBL-based biotechnology module and conventional module. The dependent variable is the students' argumentation skills. The moderator variable is the level of student academic achievement. The level of student academic achievement was chosen as the moderator variable due to different levels of academic achievement in each class. Based on the variables involved and the objectives to be achieved, the design of this research was used a 2x2 factorial design (Creswell, 2012). The design of this research is presented in Table 1.

Table 1. *Application of PBL-based Module with 2X2 Factorial Design*

		Module	
		PBL (X_1)	Conventional (X_2)
Learning Achievement	High (Y_1)	$X_1 Y_1$	$X_2 Y_1$
	Low (Y_2)	$X_1 Y_2$	$X_2 Y_2$

X_1 : PBL-based module
X_2 : Conventional module
Y_1 : High achievement
Y_2 : Low achievement
$X_1 Y_1$: Argumentation skills of HA students using PBL-based biotechnology modules
$X_1 Y_2$: Argumentation skills of HA students using conventional modules
$X_2 Y_1$: Argumentation skills of LA students using PBL-based modules
$X_2 Y_2$: Argumentation skills of LA students using conventional modules

Participant

The research populations were at senior high schools in Surakarta. The samples used were 214 twelfth-grade students majoring in science in the second semester of 2018/2019. Sampling was conducted by intact group technique to determine two groups of sample classes. Class XII Science 2 was chosen as the control class (using conventional modules) and XII Science 7 as the experimental class (using PBL-based biotechnology modules). The students in each sample class were grouped into two, HA and LA, based on daily test average scores. The illustrations of the research samples can be seen in Table 2.

Table 2. *Sample Distribution*

Classes	∑HA	∑LA	Treatment	Daily Test Average Score
Control	10	10	Conventional Module	LA: 44-60; HA: 68-86
Treatment	10	10	PBL-Based Module.	LA: 45-59; HA: 69-84

Instrument

The instrument of data collection in this research was a written test prepared using the rubric of argumentation skills according to Toulmin (2003), which consists of 6 aspects: (1) claim, (2) data, (3) warrant, (4) backing, (5) qualifier, and (6) rebuttal. The instrument has been validated by expert before being used for collecting data of students' argumentation skills.

Data Analysis Technique

The data were analysed using the ANCOVA test with a significance level of 0.05 with pretest scores as covariates (Ary *et al*., 2010). Least Significant Difference (LSD) test was used to measure the difference in the average value of the variables. The data analysis techniques used were descriptive statistical and inferential statistical analyses. Descriptive statistical analysis is used to describe or explain the collected data about the profile of students' argumentation skills and the level of academic achievement in applying PBL-based biotechnology modules and conventional modules. Inferential statistical analysis is used to analyse the data from the results of the argumentation skills test.

FINDINGS

Results of Biotechnology Module Development Based on Problem Based Learning

The PBL module was developed according to the PBL syntax and the aspects of argumentation skills visualized on the objectives, material, activities and evaluation questions to empower students' argumentation skills. The PBL syntax can encourage students to empower higher thinking processes so that the PBL-based biotechnology module has the potential to enable argumentation skills training. The following was the module developed by the PBL syntax:

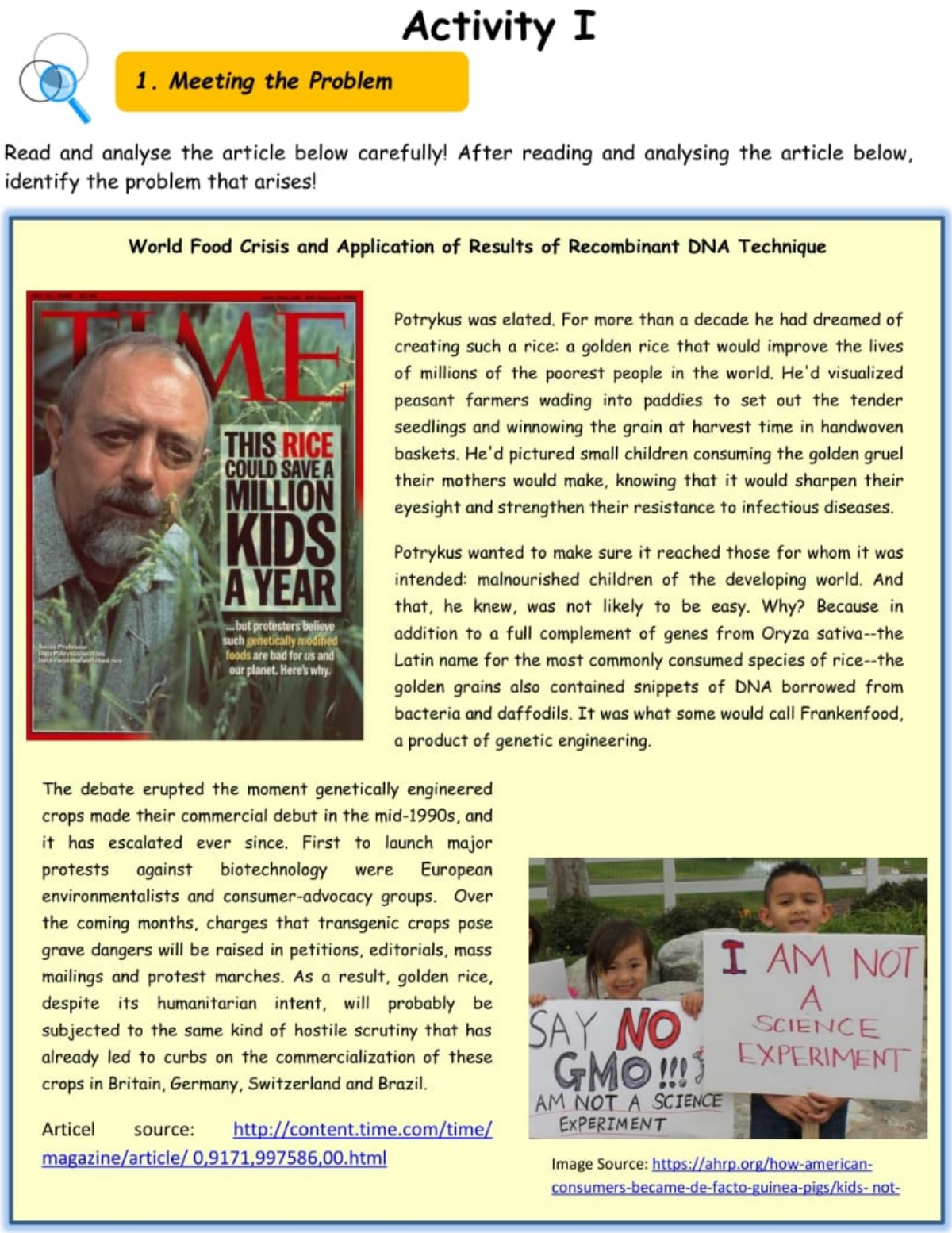

Figure 1. Meeting the Problem Stage in the PBL-based module

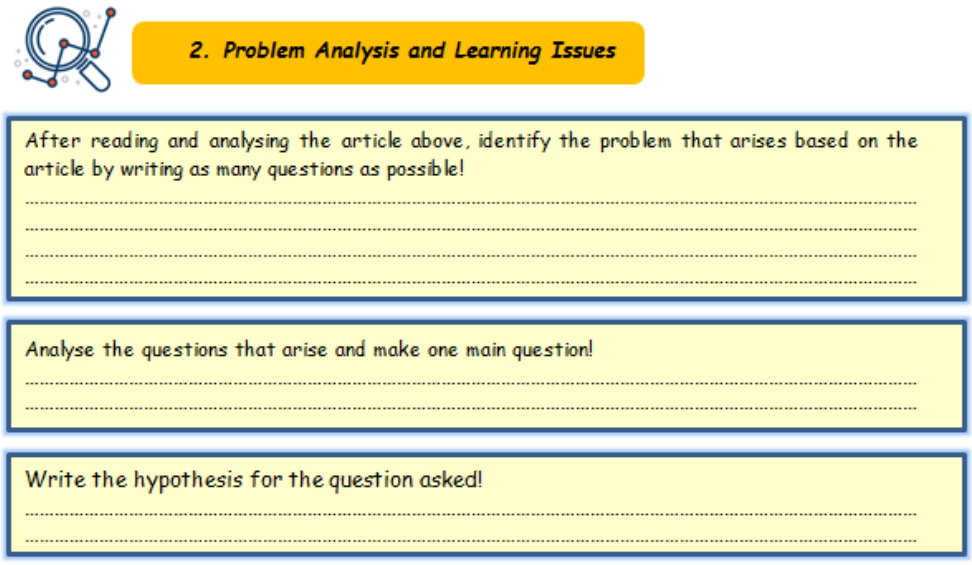

Figure 2. Problem Analysis and Learning Issues Stage in the PBL-based module.

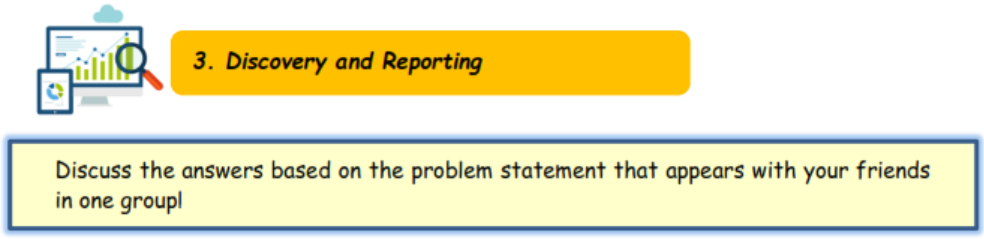

Figure 3. Discovery and Reporting Stage in the PBL-based module.

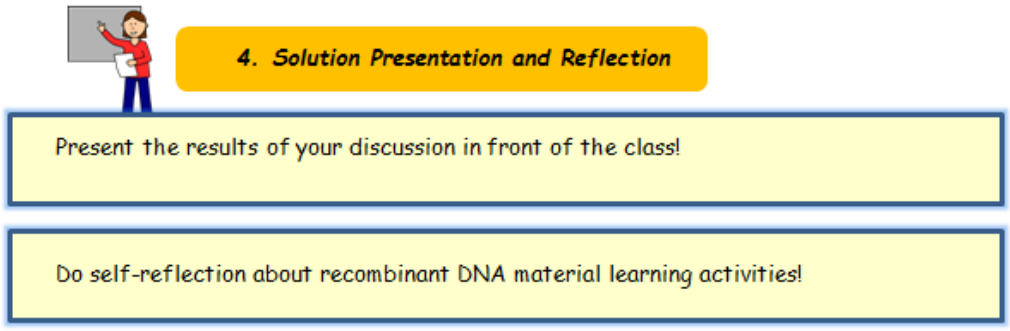

Figure 4. Solution Presentation and Reflection Stage in the PBL-based module.

The activities expected from the students are visualized in Table 3.

Table 3. *Activities Student in the Learning Process*

PBL Syntax	Activities in Module	Student Activities
Meeting the problem	Students are stimulated with the socio-scientific issues related to biotechnology.	Identifying the problems raised in the module.
Problem Analysis and Learning Issues	Students are directed to ask relevant questions to build meaningful relationships between prior knowledge and key concepts.	Proposing possible explanations or hypotheses to solve problems.
Discovery and Reporting	Students are directed to have discussions.	Discussing and exchanging information and correcting each of the ideas that arise.
Solution Presentation and Reflection	Students are directed to present in front of the class and reflect on learning	Presenting and reflecting on the solutions found.

The Results of PBL-Based Biotechnology Module Application towards Argumentation Skills for Students with High and Low Achievement

The SPSS 24 program was used to analyse the data and results showed that based on the results of the normality test, the value of the students' argumentation skills is 0.076, which means the sample from the population of twelfth-grade science students is normal. The homogeneity test resulted in the *p* value of 0.598, which means that the data of students' argumentation skills have the same or homogeneous variants. The results of the covariance analysis of data on argumentation skills in the module, academic achievement and interaction between modules and academic achievement can be seen in Table 4.

Table 4. *ANCOVA Test Results on Student Argumentation Skills*

Source	Type III Sum of Squares	Df	Mean Square	F	P
Corrected Model	[78,801] A.	4	19,700	12,919	.000
Intercept	46,471	1	46,471	30,475	.000
Pre	29,329	1	29,329	19,233	.000
Modules	44,992	1	44,992	29,504	.000
Achievement	3,659	1	3,659	2,400	.130
Modules * Achievement	.012	1	.012	.008	.930
Errors	57,946	38	1,525		
Total	564,928	43			
Corrected Total	136,747	42			

a. R Square = .576 (Adjusted R Squared = .532)

Table 4 shows the significance of module variation with a value of p <0.0001, less than the alpha value of 0.05 (<0.05), which means the application of different modules significantly influences students' argumentation skills. Table 5 visualizes the analysis results the different effects of the modules on argumentation skills.

Table 5. *The Effect of the Module on Argumentation Skills Student at 12th grade*

Modules	Pre-test Average	Post-test Average	Differences	Average Corrected	Notation
PBL	0,492	4,018	3,526	4,451	A
Conventional	1,076	2,406	1,330	2,010	B

Table 5 shows that the PBL-based modules on the socio-scientific topic has significant effect compared to conventional ones. The PBL-based biotechnology module has an average argumentation skill of 4.451, which is higher than the conventional module does of 2.010. It indicates that the group of students using PBL-based biotechnology modules has higher argumentation skills compared to that using conventional modules. The results of the analysis of differences in academic achievement on argumentation skills are visualized in Table 6.

Table 6. *The Difference in the Effect of Academic Achievement on Argumentation Skills*

Academic Achievement	Pre-test Average	Post-test Average	Differences	Average Corrected	Notation
High	0,970	3,928	2,958	3,550	A
Low	0,631	2,346	1,715	2,911	B

Table 6 shows that the score for corrected argumentation skills in HA students is 3.55 and LA students 2.911. These results indicate that the HA student group has better argumentation skills than the LA student group. The LSD test results, as shown in Table 7, exhibits the interaction between the learning module and academic achievement and its effect on students' argumentation skills.

Table 7. *LSD Test Results Confirm the Interaction of Learning Module with Academic Achievement on Argumentation Skills*

Interactions	Pre-test Average	Post-test Average	Differences	Average Corrected
Conventional – Low	0,750	1,620	0,870	1,708
Conventional – High	1,500	3,428	1,928	2,312
PBL – Low	0,439	3,526	3,087	4,114
PBL – High	0,528	4,345	3,807	4,789

Table 7 shows HA and LA students who learned using PBL-based modules have higher argumentation skills than those using conventional modules. LA students who learned using PBL-based modules seem to improve their argumentation skills more effectively than those using conventional modules. PBL-based modules on socio-scientific issues succeeded in improving LA students' argumentation skills at almost the same level as HA students' skills even though the average score did not exceed the average score of HA students. The following are the examples of student answers to recombinant DNA topics in four levels of argumentation categories. Another research shows that learning with PBL will make students face additional challenges, which has a positive effect on students' argumentation skills (Wecker and Fischer, 2014). These were the examples of the student answers in the DNA recombinant topic in four different level of argumentation.

Level 1 : "I disagree."

Level 2 : *"No, because the bacteria Agrobacterium tumefaciens, has been inserted by anti-pest genes so that the composition of amino acids in Agrobacterium DNA also changes which then makes it non-poisonous to plants. Instead, Agrobacterium tumefaciens has the ability to insert or release anti-pest genes into the DNA of kapok plants."*

Level 3 : *"I disagree, because the cause of the tree not attacked by pests is that it has been infected by the cry gene originating from the soil bacteria, Bacillus thuringiensis. Agrobacterium tumefaciens, in this case, is used as a vector because it has the property of being able to join / infiltrate DNA genes from plants."*

Level 4: *"I disagree. Agrobacterium tumefaciens is a vector used to transform plants. This bacterium can transfer genes into plant genomes through explants either in the form of leaf discs or other parts of plant tissues that have high regeneration potential. The bacteria from the type of plasmid Ti are stripped of their virulence (disarmed), so that the plant cells transformed by Agrobacterium tumefaciens and which are capable of regenerating will form a genetically engineered healthy plant. The Kapok tree does not contain harmful bacteria. The tree is only inserted with the Cry gene from Bt. The gene only attacks certain types of insects and is not harmful to humans, so the tree is suitable for planting."*

The research focuses on improving argumentation skills and minimizing the gap in argumentation skills between HA and LA students by using PBL-based modules with SSIs topics. The results showed that the application of PBL-based modules had a significant effect on students' argumentation skills. Table 6 shows that PBL-based modules improve argumentation skills more effectively than conventional modules. In other words, students using PBL-based modules have higher argumentation skills than those using conventional modules.

Also, the research findings correspond with the research of Christenson dan Chang Rundgren (2015) which shows that the topic of GMOs can improve students' argumentation skills. Biotechnology material on the genetic technology topic can improve the students' argumentation skills and understanding of content Sadler *et al*. (2016). PBL-based modules with SSIs topics have a large contribution to empower the argumentation skills found in each stage of learning. Students will be triggered to carry out learning activities and construct knowledge during the learning process (Cetin *et al*., 2019).

PBL steps stimulate the student to find solutions by developing argumentation skills in group discussions. At the meeting the problem stage, students are faced with problems in the form of socio-scientific issues that trigger them to make ideas as solutions to problems which are a temporary claim. The use of ill-structured problems gives different effects to students in constructing content knowledge to be more in-depth, holistic and structured (Kim and Clariana, 2016). SSIs that are used as triggers in learning increase students' active participation throughout learning using PBL-based modules (Demiral and Cepni, 2018). Students are motivated to identify claims that are socially accepted critically, and then strengthen with supporting ideas or refute them with evidence (Braund *et al*, 2013).

In the problem analysis and learning issues stages, students formulate a problem based on their initial claim (Fadzil, 2017). At this stage, students practice thinking of evidence and reasons as hypotheses or temporary answers to answer the problem formulation they are raising. Students can obtain data, warrant and backing at the stage of discovery and reporting. The activities of direct experimental discovery or discussion of literature can help them build their knowledge and improve negotiations among group members. Evidence in the form of data and reasons for findings and negotiations will be used to support claim.

The module activities in the solution presentation and reflection stage improve the aspect of rebuttal because at this stage students experience cognitive conflict from the discussion process. Each group reports and presents the

results of group discussions to other groups in a classic way so that there is discussion between groups. During the discussion, students are faced with various claims. They are asked to bring evidence and alternative reasons to reject other claims or alternative claims submitted by other groups.

Student assignments require the student to reach decisions that guide them in making rebuttal (Eemeren *et al*., 2013). This requires students to engage in a deep learning process, including articulating evidence for counterargumental and rebuttal possibilities. The higher rebuttal value can be an indication that students learn to see problems from different perspectives. At this stage, claims arise in the form of conclusions or decisions (Kim *et al*., 2015). Claims that appear at the final stage are actual claims because they have been supported by correct and logical data, warrant, backing and rebuttal to solve problems.

PBL involves utilizing intelligence from within individuals, groups of people and the environment for meaningful, relevant, and contextual problem solving (Serevina and Sari, 2018). Learning takes place in a process where students working together in groups of 4-5 people to solve problems (Selcuk, 2015). This is consistent with the statement Solbes *et al* (2018) that science learning must have meaning in social interactive processes.

The development of group activities and the use of contextual situations are the conditions needed to improve argumentation skills. The learning process with PBL allows students to discuss and make decisions about a problem well (Kan'an, 2018). Students build a system of meaning and understanding of facts through their interactions with their friends (Erdogan, 2019), thus triggering them to find a lot of information and improve the quality of argumentative processes (Torres and Cristiancho, 2018). This is in line with the research results which show that the argumentation skills of LA students who experience learning using PBL-based modules improve even higher at almost the same level as HA students even though the average score does not exceed that of HA students. The improvement of academic performance can be observed from the increase in the score of the argumentation skills from the pre-test to the post-test activities.

Social environment is one of the learning facilitators, where everyone has a 'zone of proximal development' which means that there is a gap between individual abilities that can be reduced by getting help from his more capable colleagues (Prayitno *et al*., 2017). An important aspect of scaffolding is when problems are very complex, students can ask for help from their friends in one group. Scaffolding through peer tutors provides more study time for LA students.

Module characteristics also allow LA students to independently learn outside of class hours. Sufficient time to study about SSIs can improve LA students' academic performance. The module characteristics consist of self-instruction, self-contained, stand alone, adaptive and user friendly (Prawita *et al*., 2019). 1) Self instruction means that with modules the students can learn independently and they do not depend on others; 2) Self-contained means that the required learning material is contained in a module that aims to provide the opportunity for students to learn the learning material completely because the learning material is arranged as one complete unit; 3) Standalone means that the module does not depend on teaching materials or other media or does not have to be used together with teaching materials and other media; 4) Adaptive means the module has a high adaptability to the development of science and technology; 5) User friendly (familiar) means that every instruction and information exposure that appears on the module is helpful and friendly to the user. User friendly includes using language that is simple, easy to understand, and uses commonly used terms.

CONCLUSION

Based on the above findings, it can be concluded that PBL-based modules on SSIs were believed more effective in improving students' argumentation skills rather than conventional modules for both HA and LA students. This is based on ANCOVA test results on student argumentation skills shows the significance of module variation with a value of $p < 0.0001$. The use of PBL-based modules can minimize the gap in the argumentation skills between LA and HA students because it allows students to produce scaffolding with peer tutors. In addition, they have more time outside the formal learning hours.

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Research Trends and Issues in Educational Technology: Content Analysis of TOJET (2012–2018)

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ABSTRACT
The overall aim of this study was to review research trends and issues in the field of educational technology specifically focused on the articles published in the Turkish Online Journal of Educational Technology (TOJET) from 2012 to 2018. Content analysis was used to examine (a) general characteristics of studies; (b) research themes and issues; and (c) research design in TOJET for the period of study. The data was collected from the website TOJET to establish publication characteristics and compare current trends with the previous patterns in the field of educational technology. The findings show that for the period of last 7 years a total of 560 articles were published in the TOJET.
Keywords: Educational Technology, Research Trends, Content Analysis

INTRODUCTION

The field of educational technology deals with design, development, implementation and evaluation of learning and teaching processes (Alkan & Kurt, 1998). Advances in technology provided new dimensions for efforts to make learning processes more effective and efficient. As a result, we came across many more studies focus on how these new dimensions effect the leaners, instructors, learning environments, and processes in the literature. Due to the fact that educational technology is an everchanging field of study that has constantly been influenced by these new trends, discoveries, technologies, etc. (Reiser & Dempsey, 2007), it is important to review the up-to-date studies to be able to identity the areas needing more research and to lead the future research. These periodically conducted systematic reviews do not only provide an insight about how deep and widely the chosen topic has been investigated but also presents a big picture about the field and help the researchers see the future trends. In the educational technology literature, there are a number of important reviews (Bodily, Leary&Richard, 2019; Marin, Duart, Galvis & Zawacki-Richter, 2018; Zawacki-Richter & Latchem, 2018) that reveals very important hints for researchers and practitioners. This study covers the results of a follow-up study that intended to analyze the articles published in The Turkish Online Journal of Educational Technology (TOJET) between 2012 and 2018. So, the purpose of this study was to update the previous one that covered the articles published between 2008 and 2011. During the analyses, number of authors, country(ries) the study conducted, topic focused, instructional mode, research method employed including participants and instruments (data collection) were among the major variables we focused.

The study has revealed that a great deal of articles published in TOJDE during 2012-2018 was written by mostly international (live outside Turkey) multiple authors (co-authorship). The studies focused more on higher education and learners than other levels of education and groups. The study has also shown that studies mostly deal with instructional media, design and development, evaluation, learning and teaching approaches. Especially, instructional design, technology integration into education, educational games, mobile learning and collaborative learning are among the most frequently investigated topics in these research studies. Moreover, face-to-face learning mode, quantitative methods, and survey design preferred more than their alternatives.

The results of this study support some of the previous studies. For instance, Kılıç-Çakmak, et al (2015) reviewed 617 articles published in 6 educational technology journals (AJET, BJET, C&E, ETR&D, ET&S, L&I) indexed by SSCI, and found out that instructional design was the most frequently examined topic in those articles. They also observed that quantitative method was also employed way more than qualitative and use of questionnaires to collect data was widely preferred. The study also revealed that those studies mostly focused on undergraduate

students. The same researchers repeated their study in 2016 covering two more journals. This time they conducted the content analysis of 583 articles and reached almost the same results (Kılıç-Çakmak, et al, 2016).

In another study, Baydas, Küçük, Yılmaz, Aydemir and Göktaş (2015) examined some other journals of educational technology and uncovered that online learning, learning approaches and learning environments as the most frequently studies topics. Similarly, Zawacki-Richter and Latchem (2018), and Marin et al. (2018) also stated that pedagogy behind use of technology, and instructional design are the topics mostly investigated; and Perez-Sanagustin et al. (2017) noted the high preferability of quantitative methods in the research studies. On the other hand, Bond and Bunstins (2018) conducted another content analysis of the articles published in the Australian Journal of Education Technology (AJET) during 2013-2017 and observed a trend in research methods preferred after 2015: more mixed method studies were spotted. Bodily et al. (2019) analyzed the keywords included in the articles published in 65 journals related to the field of educational technology indexed by Scopus Database. They found out that in 2014, MOOCs and Social Network Analysis were the most frequently noted keywords while in 2015 and 2016, MOOCs, gamification, flipped classroom, and open education were the ones. In the same study, the authors also observed a shift in the targeted populations (participants): from K12 in 2009 to learners in MOOCs, Wikis, and Blogs.

In the light of the available systematic reviews in the literature, it wouldn't be wrong to state that the research studies related to educational technology conducted during 2012-2018 show similarities especially regarding the research trends and methods, and these are influenced by the advances in technology.

METHODOLOGY

Research Method

Similar to the previous study, we conducted a content analysis study reviewing articles published in the Turkish Journal of Online Education Technologies (TOJET) between 2012-2018. Content analysis is a research method that can be used to make valid inferences by coding and interpreting different types of data. By systematically evaluating a meaningful pieces of contents in verbal communication materials, written texts, visual materials (e.g., graphics, icons), qualitative data can be converted into quantitative data. Generally, researchers develop a coding sheet to collect data on the frequency and intensity of coding unites and themes in the research articles. However, in this study, the coding scheme developed in the previous study (Bozkaya, Erdem Aydın, & Genc Kumtepe, 2012) was used in order to compare earlier results and patterns with those from this current data set.

Data Source

The main purpose of this content analysis study, which is the continuation of the previous two studies (Alper & Gülbahar, 2009; Bozkaya et al., 2012), is to evaluate the general research tendency in the articles published in TOJET and compare the findings. The Turkish Online Journal of Educational Technology established in 2002 is a multidisciplinary peer-reviewed journal in the field of educational technology. It is a quarterly electronic journal indexed/abstracted in many databases including Education Research, EBSCO and ERIC. In addition, TOJET has been indexed in the Social Science Citation Index (SSCI) between January 2007 and December 2012, Volume 6 Issue 1 - Volume 11 Issue 4. Therefore, it is believed that examining past and present research actions and agendas depending on years and periods will provide an significant contribution to the field of education technology.

Similar objectives of both studies, the first review work by Alper and Gülbahar (2009) covered the articles published between 2003-2007 in TOJET and the following study conducted by Bozkaya et al. (2012) between 2008 and 2011 were to examine the trends and issues in the field of educational technology. As emphasized above, research and practices trends have been examined through similar variables in the current study. The major themes in the coding sheet includes research topics, instructional mode, the number of authors, target population, educational (school) level, academic subject taught, research method, research theories, data collection technique, and sample size. A total number of 560 articles were published in TOJET between 2012 to 2018 capturing 7 volumes and 28 issues. All these articles were extracted and used as the main dataset for the current study. The characteristics of the data source are presented in Table 1.

Table 1: Information about Data Source (n=560 articles)

Journal	Publication Frequency (issues/year)	Abstracted/ Indexed in	Publication Volumes/Issues & Years included in this study	Number of articles in each volume & issue between 2012 – 2018
TOJET	2012: 1 issue 2003-20118: 4 issues	21 Databases ie., ERI, ERIC, EBSCO	Vol. 1–4: 2012	20; 28; 37; 45
			Vol. 1–4: 2013	21; 34; 15; 23
			Vol. 1–4: 2014	22; 21; 23; 10
			Vol. 1–4: 2015	17; 27; 15; 17
			Vol. 1–4: 2016	14; 14; 19; 14
			Vol. 1–4: 2017	19; 13; 15; 18
			Vol. 1–4: 2018	23; 18; 12; 6
			Total	**560**

Coding Procedure and Data Analysis

Previously developed coding system was used to systematically review and compare studies within the similar conceptual framework. This coding scheme includes variables in the following main areas (I) general characteristics; (II) research themes and issues; and (III) research design of studies. The area of "general characteristics" contains variables as total number of publications, authorship contribution (solo studies vs. the presence of collaboration), the affiliated countries of authors who contributed to TOJET, educational/school level, target population, and academic subject area. The second area reflects "research themes and issues" including variables as research topics and theories, instructional modes, and type of media in articles. The last area "research design" involves variables as research research methods and strategies, data collection methods and sample size.

Each article was coded by two field experts, specializing in educational technology and communication and open and distance education. Each coder worked separately on a subset of articles and then they replicated each other's work for these studies. The third author performed random cross-checks to verify the accuracy of the information and also to ensure results are reliable. The third researcher reviewed about 100 articles to check and validate the actions of the two initial coders. Intercoder agreement/reliability was measured using Cohen's Kappa statistics (κ) (1960). Rietveld and van Hout (1993) suggest Kappa values and the related reliability levels as .00 – .20 slight, .21- .40 fair, .41-.60 moderate, and .61-.80 substantial agreement. According to this scale, inter-coder agreement scores in this study ranged from .70 to .82, indicating moderate to relatively high agreement for each variable.

RESULT

General Characteristics of Research Studies

Number of Articles Published

Table 2 shows the number of articles published from 2012 through 2018. The publication frequency of TOJET is not stable although it was stated that the journal produces for volumes per year. During this period of time, the highest publication rate was observed in 2012 with 130 articles and 23.2 percent. After that year, the total number of published articles has been declined gradually.

Table 2: Number of Articles Published from 2012 to 2018 (n=560)

Year	Frequency (f)	Percent (%)
2012	130	23.2
2013	93	16.6
2014	76	13.6
2015	76	13.6
2016	61	10.9
2017	65	11.6
2018	59	10.5
Total	560	100.0

As emphasized in the findings of our previous study (Bozkaya et al., 2012), since TOJET was in the SSCI index between 2007 and 2012, the number of articles in each volume and issue was quite high. However, as shown in Figure 1, a remarkable decrease was observed in the number of articles after 2012. Such decline may also be related to the decrease in the acceptance rates of the journal during the referee process.

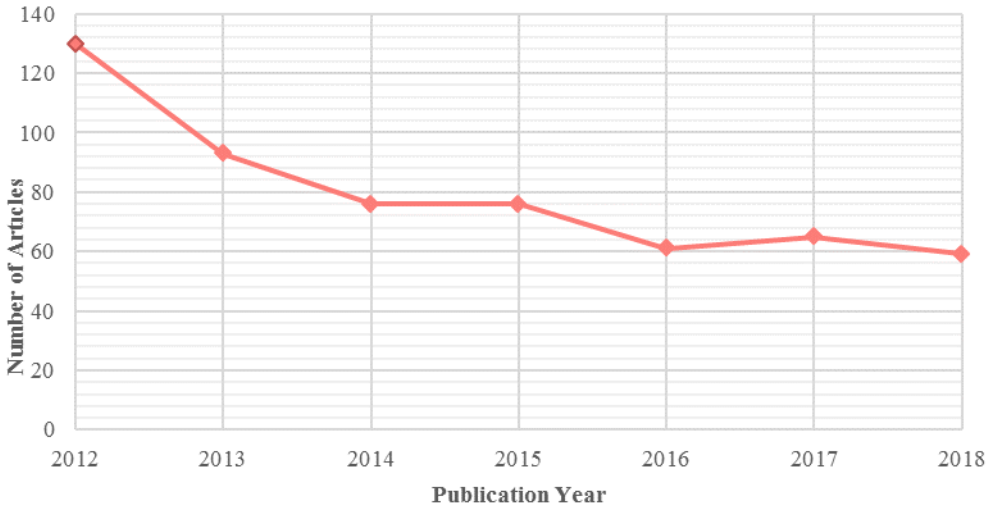

Figure 1: Year wise distribution of articles

Presence of Research Collaboration

Research is actually a collaborative effort. There are many actors in this process such as researcher, data collector and analysis, editor so on. The field of educational technology may require an interdisciplinary methodological approach to perform a research enterprise. Multi-author and multi-disciplinary studies are important in terms of their potential to bring different perspectives to the field.

Authorship patterns per year of period are presented in Table 3 & 4. The findings illustrate that for the period of seven years TOJET formed 560 articles with various authorship patterns. The maximum number of author per paper in TOJET was found to be 16. In general, the number of authors in this period was observed as 6 or less researchers per paper.

Table 3. Distribution of Number of Authors

Number of Authors	f	%
1	189	33.8
2	160	28.6
3	103	18.4
4	75	13.4
5	21	3.8
6	7	1.3
7	3	0.5
8	1	0.2
16	1	0.2
Total	560	100.0

The distribution of authorship shows that for years of 2012 (74%), 2013 (70%), 2017 (69%), and 2018 (69%), multi-authored articles were higher than solo studies. That gap narrows down during 2014 (43%), 2015 (43%) and 2016 (38%) and single authored papers were more than multiple authored papers. Overall, the total number of single-authored papers contributed to 189 (34 %) articles while a total of 371 (66%) multi-authored papers in this seven-year period of TOJET.

Table 4. Distribution of Number of Authors

Number of Authors	Year f (%)							
	2012	2013	2014	2015	2016	2017	2018	Total
1	34 (26)	28 (30)	33 (43)	33 (43)	23 (38)	20 (31)	18 (31)	189 (34)
2	31 (24)	33 (36)	26 (34)	17 (22)	16 (26)	20 (31)	17 (29)	160 (29)
2-5*	65 (50)	32 (34)	17 (23)	26 (35)	25 (36)	25 (38)	24 (40)	211 (37)

Total	130	93	76	76	61	65	59	560 (100)
Degree of collaboration (DC)**	0.74	0.70	0.57	0.57	0.67	0.69	0.69	0.66

** * Indicates number of authors 5 or more*
** DC=Nm/Nm+Ns e.g., for 2012 C= (31+65)/130

Subramanyam (1983) suggests a measure to determine the the degree of collaboration in research studies in a discipline. That index was calculated using the following formula;

$$DC = Nm/(Nm + Ns)$$

Where; DC is the degree of collaboration, Nm is the number of multi-authored papers, and Ns is the number of single authored papers. This equation is simply expressed by DC = (number of multi-authored papers) / (total number of papers). The results reveled that the overall degree of collaboration in the articles published in the TOJET from 2012 to 2018 was 0.66, indicating that multi-authored studies (371 articles out of 560) have dominated this journal. The findings of this study on the authorship pattern yielded similar outcomes with the previous content analysis study covering the years 2008-2011 (Bozkaya et al., 2012). The degree of collaboration over the four-year period for the previous study is calculated to be 0.64.

Country-Wise Distribution of Articles

The content analysis for the period of 7 years from 2012 to 2018 revealed that the TOJDE reached a very wide audience of authors located in 52 countries. In some collaborative studies among these articles, it was observed that the authors of different countries came together to carried out a study whereas some other studies were conducted in countries different than where the authors live. However, the top five countries with highest authorship contribution are Turkey, Taiwan, Malaysia, Saudi Arabia, and USA. In the previous content analysis, the studies were from 28 countries in total and similar trend was observed in distribution of countries in TOJET (Bozkaya et al., 2012). The list of affiliated countries of authors who contributed to TOJET from 2012 to 2018 are presented in Table 5.

Table 5: Country-Wise Distribution of Articles (n=560)

Country	Year (f)							
	2012	2013	2014	2015	2016	2017	2018	Total n (%)
Turkey	35	25	28	15	21	15	13	152 (27)
Taiwan	57	24	10	7	-	-	-	98 (18)
Malaysia	12	19	12	8	9	5	8	73 (13)
Saudi Arabia	4	2	2	6	2	4	9	28 (5)
USA	2	1	0	5	3	5	1	17 (3)
Others	20	22	24	35	26	36	28	194 (34)
Total	130	93	76	76	61	65	59	560 (100)

**Including Australia, Bahrain, Belgium, Canada, China, Colombia, Cyprus, Czech Republic, Denmark, Germany, Ghana, Greece, Hong Kong, Hungary, India, Indonesia, Iran, Italy, Japan, Jordan, Korea, Kuwait, Kyrgyzstan, Lithuania, Malaya, México, Mozambique, Netherland, Norway, Oman, Palestine, Philippines, Poland, Portugal, Serbia, Singapore, Slovakia, Slovenia, South Africa, South Korea, Spain, Sudan, Sweden, Thailand, Turkish Republic of Northern Cyprus, UK, United Arab Emirates.*

Of these, 152 (27%) of the 560 research studies were conducted in Turkey (Table 5). As previously highlighted that the most important reason for this more publications, the TOJET is the best known journal in the field of educational technology in Turkey. Similar to the previous study, many articles were published by the researchers in Taiwan (18%) and Malaysia (13%). Unlike the previous study, Saudi Arabia (5%) took the 4th place instead of the Turkish Republic of Northern Cyprus. The studies in the United States have a rate of 3% in all publications which is similar to the earlier finding (4%). The remaining 52 countries accounted for 34 percent in total studies. Compared to previous content analyses, researchers in different countries have contributed to the journal over the years.

Target Groups by Educational Level

Target groups per year were summarized by educational level in Table 6 and Figure 2. Similar to the results of the previous study (Bozkaya et al., 2012), more than one third of the studies (n=170) reviewed focused on the subjects at K-12 while the majority of studies targeted participants in higher education (n=370). At both levels, most studies were conducted on students (n=377). This is followed by teachers / instructors (n=109) and other groups (n=54).

Table 6: *Distribution of Articles by Educational Levels and Target Groups*

		Year (f)								
Educational Level	Target Group	2012	2013	2014	2015	2016	2017	2018	Total n	Grand Total n(%)
K-12	Teachers	7	5	5	8	7	12	4	48	170 (30)
	Students	33	19	13	9	14	9	9	106	
	Others[1]	2	1	1	2	3	5	2	16	
Higher Education	Instructors	10	11	6	6	8	8	12	61	370 (70)
	Students	64	49	43	40	23	26	26	271	
	Others[2]	3	7	3	8	6	6	5	38	

[1] *Others refer to Administrators/Principals, Adults, Parents, Field Experts, ICT Coordinators.*
[2] *Others refer to Administrators, Authorities, Field Experts, Designers, Employees, Trainees.*
Note: Some articles include more than one target group

The group called the "others" at the K-12 level refer to administrators or principals, adults, parents, field experts, and ICT staff. Correspondingly, "others" as the target group in higher education level consist of administrators, authorities, field experts, designers, employees, and trainees for this content analysis.

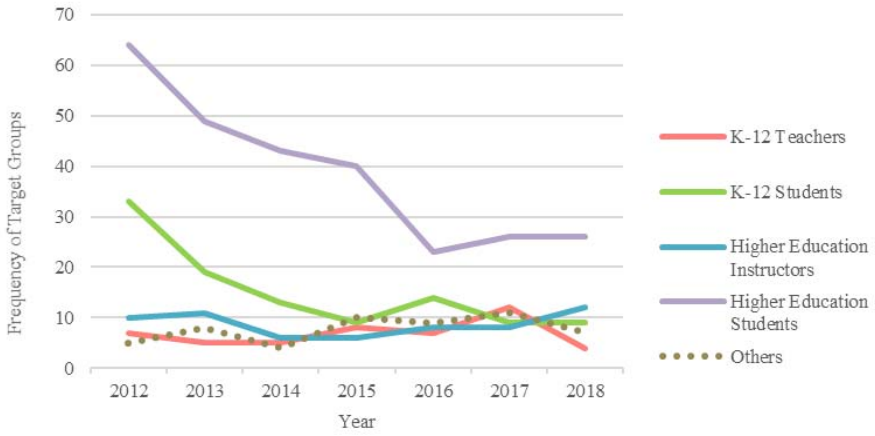

Figure 2: Distribution of target groups by educational level

Academic Subject

Subject area/disciplines were grouped based on the former study's classification as social sciences, language, mathematics, science and engineering, and physical education. It should be noted that some studies are based on more than one subject area. Table 7 illustrates that similar to the previous study between 2008 and 2011, the focus from 2012 to 2018 was still on social sciences (n=298).

Table 7: Distribution of Subject Area

	Year (f)							
Area	2012	2013	2014	2015	2016	2017	2018	Total n(%)
Social Sciences[1]	83	66	44	28	11	31	35	298 (53)
Language	18	12	16	18	12	9	9	94 (17)
Mathematics	10	7	2	4	6	1	2	32 (6)
Science & Engineering[2]	12	8	13	16	17	17	8	91 (16)
Physical Education	2	-	-	-	2	-	1	5 (1)

[1] Including education, educational technology, distance education, literature, commerce, ethics, music education, and early childhood education
[2] Including biology, chemistry, physics, computer science, information technology and architecture
Note: Some articles addressed more than one subject area

In this period of time, an increase was observed in the studies conducted in the field of language (17%). In addition to common languages such as English, Malay, Japanese, Korean, Arabic, Dutch, Italian language studies also came to the fore during this period. Another popular field in these years was science and engineering (n=91). Especially, with the spread of STEM education, which deals with the fields of science, mathematics, technology and engineering as a whole, integrated studies in these areas are notable. Physical education is an area of health sciences. In this period, a decrease was observed in the studies carried out in this field (n=5).

II- Research Themes and Issues

Research Topics

First of all, all studies were categorized based on research themes in our earlier study (Bozkaya et al., 2012). In addition, two new themes that did not fall into the prior categories were developed as culture and review studies. Both preset and emergent themes were described as below:

1. *Media Study* –This theme refers to media comparison studies such as F2F and other media forms. Specifically, media studies on the effects of teaching-learning process, learning characteristics and variables (attitudes of learners and educators towards the media, academic performance, technology perception, familiarity, self-efficacy, satisfaction, motivation, social presence and age related studies, learning styles, interaction types/levels, use of technology) were placed in this theme.
2. *Design & Development* – This theme refers to the studies on instructional design, software development or modeling technology to enhance the effectiveness and efficiency of teaching and learning process.
3. *Evaluation* – This theme refers to assessment and evaluation-based studies on teaching and learning process.
4. *Teaching & Learning Approaches* – This theme refers to the studies used in teaching-learning theories and approaches (constructive learning, cooperative learning, problem based learning, blended learning, distributed learning, project-based learning, media richness, social network analysis).
5. *Culture* – *T*his theme includes cultural studies in the field of educational technology. Topics such as classroom culture, learner culture and learning community are covered in this theme.
6. *Review Studies* – This theme includes meta-analysis, literature review and content analysis.
7. *Others* – This theme covers studies that cannot be included in any of the above topics. For example, social responsibility of higher education, cyberbullying tendency, action plan, folklore, disabilities etc.

Table 8 shows research themes extracted from articles in TOJET published 2012 through 2018. All research themes except *Teaching and Learning Approaches* showed similar distributions from the previous study. As observed in previous years, *Media Studies* have been the most studied research theme (57%) in this period. In both content analysis periods (2008-2011 and the 2012-2018), media studies had 57% of all studies. Similarly, the research in the context of *Design & Development* and E*valuation* had a share of 20% and 18% in 2008-2011 and 19% and 11% in 2012-2018. On the other hand, in the previous period, the theme of *Teaching and Learning Approaches* had a rate of 19%, while this ratio decreased to 6% in this period (see Table 8).

Table 8: Research Themes

Theme	Year (f)							Total n(%)
	2012	2013	2014	2015	2016	2017	2018	
Media Study	72	64	49	37	31	34	29	317 (57)
Design & Development	31	17	16	9	8	8	19	108 (19)
Evaluation	10	4	5	9	16	14	2	60 (11)
Teaching & Learning Approaches	11	3	2	13	3	2	1	35 (6)
Culture	2	1	1	-	-	-	1	5 (1)
Review Studies	3	4	3	1	1	4	6	22 (4)
Others	-	-	-	7	2	3	1	13 (2)

Note: Some studies focused on more than one theme

Two new research themes "Culture and Review Studies" that were not included in the previous classification were observed in a total of 26 studies between 2012 and 2018. In terms of research theme "Culture, the results of the current study (n = 5 studies; 1%) were similar to those of Zawacki-Richter's research in 2009. He pointed out in his study on Research Areas in Distance Education: A Delphi Study, culture and cultural differences have been the most neglected field in distance education. However, especially in recent years, meta-analysis and content analysis studies have emerged as a research theme not only in this field but also in many other areas. From 2012 through 2018, only 13 studies did not fit into any existing research theme and coded as others in this stage.

Research Theories

Research theories incorporated in the studies are classified into four academic fields as Learning Theories, Psychological Theories, Sociological Theories, and Communication and Media Theories. Table 8 presents the frequency distribution of the theories used in articles. Moreover, Figure 3 illustrates a packed bubble chart of research theories to present data in a cluster of circles. Theories in this chart defined as individual bubbles, and the size of the bubbles shows sum of frequencies in the related category.

Similar to the results of our previous study (Bozkaya et al., 2012), learning theories (n=149) have been more subject to research in this 7-year period than other theories. Within this category, the most commonly used theories are Constructivist Learning Theory (n=32), Technology Acceptance Model (n = 17), and Cognitive Learning & Load Theory (n = 16). In addition, Collaborative Learning Theory (n = 11), Problem Based Learning Theory (n = 11), Mobile Learning (n = 10) and Game-based Learning Theory (n = 10) are among the prominent learning theories in this group. Unlike the previous content analysis study, it has been observed that approaches such as flipped classroom, Ubiquitous Learning, and STEM education, which have become popular in recent years, were also included in the studies.

Following the theories of learning, the most commonly used theories and approaches in this period originated from the psychological (n=30) and sociological (n=28) fields. While it was determined that Self Efficacy Theory (n=17) in the field of psychology was mostly preferred, Social Network Theory (n=18) which is one of the sociology theories was found to be widely used in the studies. Social Presence Theory and Diffusion of Innovations Theory in Communication and Media Theories formed the theoretical framework of the studies as in the previous period (2008-2011).

Table 9: Research Theories

Learning Theories/Models/Approaches	f
Constructivist Theory	32
Social Learning Theory	6
Collaborative Learning Theory	11
Blended Learning Theory	8
Active Learning Theory	3
Behaviorist Learning Theory	3
Problem Based Learning Theory	11
Project Based Learning	1
Critical Thinking Theory	2
Cooperative Learning	5
Community of Inquiry	5
Competency Theory	3
Cognitive Learning & Load Theory	16
Technology Acceptance Model	17
Game-Based Learning	9
Ubiquitous Learning	4
Flipped Classroom	2
Mobile Learning	10
STEM Education	1
Total	149
Psychological Theories	
Neural Networks	1
Schema Theory	2
Self-Efficacy	17
Self-Regulated Learning	5
Motivation Theory	4

Mental Memory Theory	1
Total	30
Sociological Theories	
Social Network Theory	18
Digital Divide/Digital Learning	4
Cultural Theory	2
Knowledge Management &Building Theories	2
Social Inclusion Theory	1
Universal Design	1
Total	28
Communication & Media Theories	
Social Presence Theory	3
Diffusion of Innovations Theory	2
Total	5

Note: Some articles used more than one approach

Figure 3: Frequency Distribution of Research Theories

Instructional Mode

The instructional mode of the studies is presented in Table 10. A total of 62 studies' research modes were not specified. The remaining 498 studies were examined in three main groups as traditional mode (face-to-face), distance mode, and the combined strategies.

Table 10: *Studies Classified by Instructional Mode (n=498)*

	Year (f)							
Instructional Mode	2012	2013	2014	2015	2016	2017	2018	Total n(%)
Traditional Mode (F2F)	104	80	66	46	35	52	45	428 (86)
Distance Mode	11	5	2	8	5	4	4	39 (8)
Combined Strategy								
a-F2F with Distance mode*	-	1	2	6	11	2	2	24(5)
b- F2F vs. Distance mode**	1	-	-	1	2	1	2	7 (1)
Total	116	86	70	61	53	59	53	498

**Blended or hybrid models*
***Comparative studies*

As indicated in the previous content analysis between 2008 and 2011 (Bozkaya et al., 2012), the combined group was dealt with in two groups as blended and/or mixed teaching methods mode and comparative research. While the studies in traditional mode were 58% between 2008 and 2011, the research using this instructional mode increased to 86% in this period. However, distance mode, which was 33% in the earlier period, decreased to 8% between 2012-2018. One of the combined strategies using both face to face and distance instructional mode in the previous period (6%) showed similarity with the current period of time (5%). On the other side, research comparing two different instructional strategies decreased from 4% to 1%.

Type of Media

Table 11 provides the types of media used in some articles published in the TOJET during 2012-2018 period. Among these, the most preferred learning environments are web-related media. Media such as blogs, wiki, second life, interactive animation, electronic book, social networking sites, interactive whiteboard, and discussion forums are categorized as Web 2.0 tools.

Table 11: Type of Media

Teaching & Learning Media	f
Computer-based instruction	48
Web-based instruction	112
Video & visual media*	37
Web 2.0 tools**	125
Instructional TV	5
Mobile tools***	28

** Videogames, caricature, animations, videoconference, augmented and virtual reality applications, robotics learning activities.*
***Blogs, wiki, second life, interactive animation, electronic book, social networking sites, interactive whiteboard, discussion forums.*
****Mobile tools included PDA, mobile phones, tablets etc.*
Note: Some studies included more than one type of media.

Environments containing visual content and animations such as videogames, caricature, animations, videoconference, augmented and virtual reality applications, robotics learning activities are grouped as video & visual media. On the other hand, devices such as PDAs, mobile phones and tablets are categorized under Mobile Tools. As can be seen from the table, interactive TV was the least preferred media among these environments.

III- Research Design

Research Methods

The research methods were examined in three categories as quantitative, qualitative and mixed methods. The studies outside these 3 groups were classified as others. As it appeared in the previous study (62%), 73% of these are the most preferred quantitative research methods (see Table 12).

Table 12: Research Methods (n=560)

	Year (f)							
Method	2012	2013	2014	2015	2016	2017	2018	**Total n(%)**
Quantitative	90	61	45	41	37	37	30	341 (73)
Qualitative	21	14	13	10	7	8	10	83 (18)

Mixed	1	0	1	2	3	2	1	10 (2)
Others*	7	4	6	5	6	3	5	36 (8)
Total	119	79	65	58	53	50	46	470

** Including review and program introduction studies*

The ratio of qualitative studies conducted in this period (18%) showed a very similar trend with the 2008-2011 period (17%) (Bozkaya et al., 2012). On the other hand, the rate of mixed method studies which were around 14% in the previous period decreased to around 2% in this period. The studies grouped as Others (8%) included review and program introduction studies.

Strategies of Inquiry

Similar to the content analysis conducted for research strategies in 2008-2011 (58%), descriptive studies (53%) were the most observed quantitative methods among all strategies in this period. Following this, true and semi-experimental designs continued to be popular in this period. Studies with true experimental design showed a similar rate compared to the previous content analysis period of TOJET (7% and 8% respectively), while semi-experimental studies showed a 3% increase in the 2012-2018 period of time. Other quantitative research strategies such as meta-analysis, pattern analysis, correlational design, and causal models had a 5% rate over a 7-year period.

Table 13: Strategies of Research Inquiry

	Year (f)							
Strategies of Inquiry	2012	2013	2014	2015	2016	2017	2018	Total n(%)
Experimental	9	8	4	4	6	3	3	37 (8)
Quasi-Experimental	7	8	1	6	4	2	2	30 (6)
Descriptive	65	32	41	28	22	32	30	250 (53)
Other Quantitative Strategies[1]	5	4	1	5	2	6	1	24 (5)
Exploratory Case Study	8	9	5	6	5	5	4	42 (9)
Other Qualitative Strategies[2]	6	7	3	5	8	7	5	41 (9)
Mixed Method Strategies[3]	1	0	1	2	3	2	1	10 (2)
Others*	7	4	6	5	6	3	5	36 (8)
Total	119	79	65	58	53	50	46	470

[1] *Meta-analysis, pattern analysis, correlational design, causal models*
[2] *Phenomenology, grounded theory, action research, ethnography, narrative inquiry, heuristic evaluation*
[3] *Sequential methods, content analysis, Delphi study*
**Include theoretical inquiry, design-based research, eye-tracking research.*
Note: Some articles included more than one strategy

Although the exploratory case study ratio, which is one of the qualitative research designs in 2012-2018 period (9%), decreased by 5% compared to the previous period (14%), the interest towards qualitative research showed a similar trend with 18 percent. In this period, research strategies such as sequential mixed methods, content analysis and Delphi study were included under the mixed method. Finally, others included other strategies such as theoretical inquiry, review studies, design-based research, eye-tracking research.

Data Collection Methods

In most of the studies, multiple data collection methods were used together to validate the results. In 560 researches, survey (n = 260) was used most among the data collection techniques and methods in 2012-2018. This was followed by interview (n = 149), achievement tests (n = 83), scale (n = 78), documents (n = 72), observation (n = 42) and field notes (n = 17).

Table 14: Data Collection Techniques

	Year (f)							
Techniques	2012	2013	2014	2015	2016	2017	2018	**Total n(%)**
Survey / Questionnaire	62	47	46	30	21	30	24	260 (37)
Interview[1]	30	24	21	24	16	15	19	149 (21)
Achievement Test	15	16	12	17	9	7	7	83 (12)
Scale	28	7	5	15	10	8	5	78 (11)

Documents[2]	10	13	3	10	12	14	10	72 (10)
Observation	12	8	2	6	3	4	7	42 (6)
Field Notes	7	2	0	5	2	0	1	17 (2)
Logs	1	1	-	1	-	1	-	4 (1)

[1]*Including one-to-one and focus group interviews*
[2]*Including articles, emails, written artifacts, assignments, postings, journals/diary, autobiography, portfolio, audio/video files, essays*
Note: Most of the studies integrated more than one type of data collection techniques

Documents data includes articles, emails, written artifacts, assignments, postings, journals / diary, autobiography, portfolio, audio / video files, essays. In addition to these data collection techniques, we should say that because of learning environments such as MOOCs and learning management systems, learner logs are being defined as data.

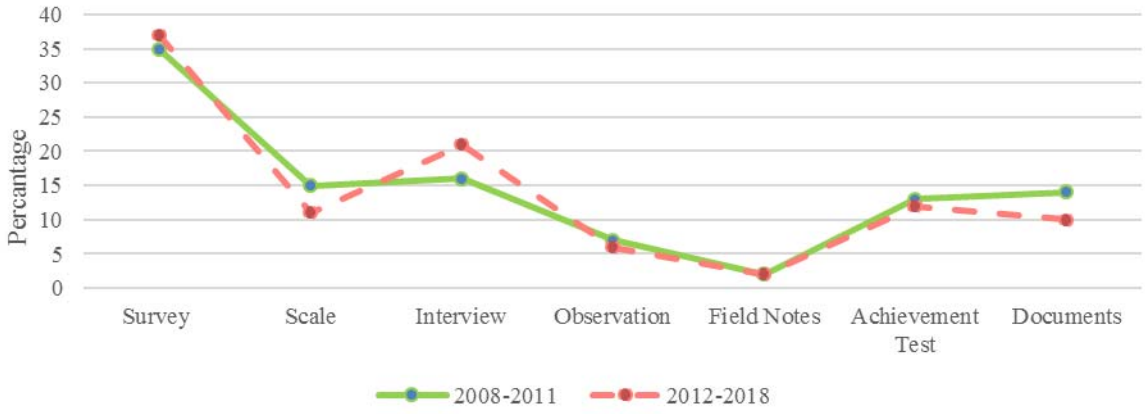

Figure 4: Distribution of Data Collection Techniques in 2008-2011 and 2012-2018 Periods

In Figure 4, data collection techniques are given in comparison with the results of the previous period content analysis. As can be seen from the figure, almost all data types have similar rates in both periods. The most preferred data collection methods are still based on survey studies such as survey, scale, questionnaire.

Sample Size

Finally, the samples used in these research were classified as in Table 15. As in the previous content analysis period 2008-2011, approximately 18% of all studies constituted the small sample group. A total of 88 small sample studies (n <30) were predominantly involved in qualitative studies.

Table 15: Sample Size (n=498)

Range of samples	Year (f)							Total
	2012	2013	2014	2015	2016	2017	2018	n(%)
<30	13	15	9	12	13	16	10	**88 (18)**
30 – 59	20	20	12	13	12	10	5	**92 (18)**
60 – 89	20	9	6	10	5	2	8	**60 (12)**
90 – 119	9	12	7	4	8	4	3	**47 (9)**
120 – 149	6	5	4	4	0	3	3	**25 (5)**
150 – 179	4	3	3	2	2	2	4	**20 (4)**
180-209	4	4	3	2	0	0	4	**17(3)**
>209	42	21	21	16	15	22	12	**149(30)**
Total	**118**	**89**	**65**	**63**	**55**	**59**	**49**	**498**

Figure 5 compares the sample size distributions between 2008-2011 and 2012-2018. As seen in both periods, similar distributions were observed in the sample sizes.

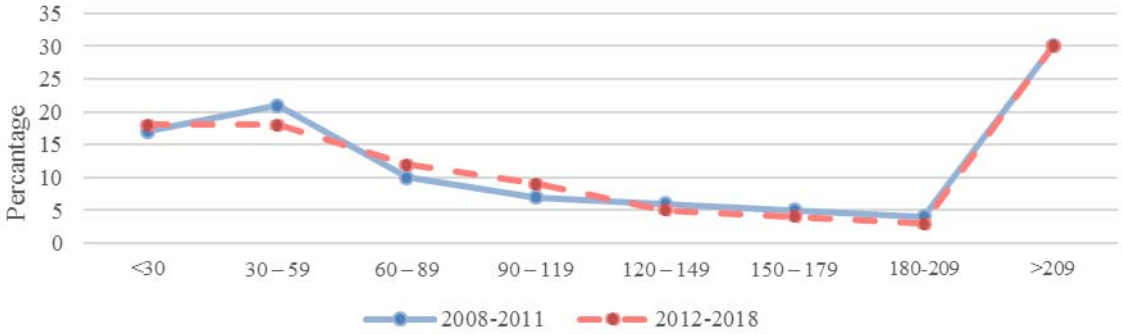

Figure 5: Distributions of Sample Sizes in 2008-2011 and 2012-2018 Periods

Studies on large sample groups have emerged at a high rate in recent years due to studies that require substantially large participants such as massive open online courses (MOOCs) and social networking theory.

DISCUSSION AND CONCLUSION

Research trends and topics are influenced by the advancements and changes in technology. In this study, same as the previous one, the findings were discussed under three categories: (1) general characteristics of studies; (2) research themes and issues; and (3) research method and design. The study covered analysis of total 560 articles published during 2012-2018 in 28 volumes. These articles are analyzed by topics covered, educational level focused, instructional mode preferred, instructional approach and design employed, theoretical or conceptual background used.

1. General Characteristics of the Studies

Analysis has shown that of the 560 total articles, 189 have single and 160 have two authors. In other words, same as the previous study 63 percent of the articles were written by either one or two authors. Although the majority of the articles were from those collectivistic cultures, such as Turkey, Malaysia and Taiwan, this result might seem interesting. Most probably it may be explained with the academic culture of these countries, where academicians are usually evaluated by individualistic measures. On the other hand, still if we consider the percent of articles with two or more authors (66 percent), it can be concluded that among researchers of educational technology there is a tendency toward teamwork as observed in analysis of the publications in the similar international journals of educational technology (Bozkaya et al., 2012).

A similar result with the previous study was about the educational level and the target population of the studies published in TOJET. Around 70 percent of the articles conducted with participation of higher education students. Working with higher education settings and students does not require as strict regulation as other groups and education levels, easy accessibility and controllability might be the main drivers of this tendency. This result is, also, very consistent with the results of other systematic reviews in the literature (Bozkurt et al., 2015; Babur, et al., 2016). Another similarity was observed regarding the domain of the field preferred: same as the former one, this study also uncovered that around half of the articles analyzed was related to social sciences. However, unlike the previous study, during 2012-2018 time period, more studies concerning language learning were conducted. This might be related to easy integration of technology into language learning.

A dissimilar result with the previous study was about country origin of the articles. In the previous study, more than half of the articles (52 percent) were from Turkey while the current study included only 27 percent from Turkey and the remaining were from almost all around the world. One may infer this result as that recognition and diffusion of the journal has increased quite well.

2. Research Themes and Issues

The study has shown that respectively different media and design-development were the themes most frequently studied during 2012-2018 time period. This is also quite similar to the findings of the previous study. In a great number of these media studies, the researchers sought to identify the participants' knowledge, skills, and attitudes about the media used as well as learners' satisfaction and achievement levels in these implementations. Additionally, in many studies, the researchers tried to reveal the relationship between these variables and the participants' age, gender, learning strategies and motivation. Along with these media studies, there were quite a number of studies in which design and development of artifact or programs that intended to increase the effectiveness, efficacy and appeal of the learning processes in various settings were also conducted. This result is

also consistent with the related previous reviews in the literature (Kılıç-Çakmak at al., 2016; Zawacki-Richter & Latchem, 2018; Marin et al., 2018). On the other hand, unlike the previous study, the current one presented that the studies focused on evaluation aspect of the field has shown a significant increase in 2012-2018 time period.

In terms of theoretical or conceptual background of the studies, a similar result was found that constructivism was frequently used to establish a theoretical base in these studies. It supports the previous studies: For instance, Bozkurt et al. (2015) analyzed 861 research articles published in various journals and found the constructivist approach and related theories as the most frequently used background in the studies. Since a big majority of the articles focused on Web or Internet-based learning environments and these environments support two of the major offerings of the constructivism, interactive and collaborative learning, one might easily infer this result as a natural consequence.

Moreover, the analysis has shown that in terms of technologies focused, the studies during 2012-2018 mostly dealt with respectively Web 2.0 tools and Web-based learning environments. In the previous study, the computer-based learning was the top technology used in a big majority of the studies conducted during 2008-2011 and Web-based learning environments was the second. So, it seems Web-based learning environments kept its position and another Web-based technology, Web 2.0 tools replaced the computer-based learning. One can easily relate this result with the the advancement in technology, especially widespread diffusion and development of Web 2.0 tools. In fact, the figures show that the quality and quantity of Web 2.0 tools have been increased dramatically during 2013-2016. This development created a great interest in integrating these tools into educational settings. Allowing easy interaction among learners, and learners and other stakeholders (instructors, experts, etc.), fostering teamwork, and advancing access to the information anytime anywhere the users want are listed among the major drivers of the raise of Web 2.0 tools. This raise grasped the attention of the educators and maybe that was why there were quite a number of studies in the field focused on use of Web 2.0 tools. A similar inference was indicated by Baydas et al. (2015) and Bodily et al. (2019). Especially in these references the authors noted that 2013-2016 time period was the time use of the online tools heavily examined in various educational settings.

3. Research Method and Design

The study has revealed no significant difference in research methods employed in the studies of education technology during 2008-2011 and 2012-2018 time periods. The current review similar the previous one presented that quantitative method was the one mostly preferred during both time periods. In the other studies, respectively qualitative and mixed methods were employed. This result was also similar to the previous systematic review of research studies, such as Kılıç-Çakmak et al. (2015, 2016), Baydas et al. (2015), and Perez-Sanagustin et al. (2017). This may be related to the familiarity of the researchers with the quantitative methods and widely acceptance of the quantitative methods over others.

In terms of research designs preferred in the reviewed articles, a very similar situation displayed in the previous study as well as the literature (Babur et al.,2016; Bozkurt et al., 2015; Durak et al., 2017) was observed: survey (descriptive) design in the quantitative studies, and case study in the qualitative studies were the most frequently employed designs. Survey designs, especially cross-sectional surveys, usually utilize questionnaires to ask about a particular topic at one point in time, require considerably less time and effort to collect data. This must be considered as natural since in almost all fields of social sciences survey method is the most popular method due to its versatility, efficiency, and generalizability (Check & Schutt, 2012). On the other hand, case studies are considered as studies that require systematic in-depth investigation of an event or case with multiple data collection tools and methods (Chmiliar, 2013). Since a big majority of the studies in the field of educational technology consists of integration of a technology into an educational setting, it is a must to investigate this integration with all dimensions and stakeholders. So, case study seems one of the appropriate designs fits well into the educational technology studies. This might be why the considerable amount of qualitative studies employed the design.

In terms of data collection tools, questionnaires and interviews were identified as the most commonly used instruments in the studies reviewed in this study. Similar to other results, this trend was same as in the previous study. In other words, the same trend of using questionnaires and interviews in educational technology research has not significantly change and was going on during 2012-2018 time period. Kılıç-Çakmak et al. (2016) also observed the same result in their reviews. The questionnaires require considerably less time, money, and effort to collect data, especially after the advancement in online tools. This might be one reason for preference of this tool. Interviews, on the other hand, help researchers explain, better understand, and explore research subjects' opinions, behavior, experiences, phenomenon. They do allow to collect non-verbal data, too. Also, most of the

qualitative designs require some sort of interviews. So, the advantages and nature of qualitative inquiries might be shown as the main rationale for the result observed in the current study.

The majority of the studies reviewed has also large number of participants same results as the one observed in the previous study. This might be explained with the number of quantitative studies. Since this method requires researchers to reach at least certain number of participants, the articles reviewed had to have large number of participants. In short, no significant change observed in terms of the number of participants reached in the reviewed articles.

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Saudi Teachers' Perceptions Regarding Adopting Digital Games in Teaching Practice

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ABSTRACT
This study applied a qualitative approach to shed light on computer teachers' perception of video games and the barriers toward integrating these games into their teaching. The data were gathered through face-to-face interviews with 22 Saudi teachers from the Eastern Province of Saudi Arabia. The results show that teachers in Saudi schools hold a positive attitude toward adopting video games and they realize the importance of adopting new technologies; however, they do not use them for teaching purposes. As far as barriers to adopting video game are concerned, lack of facilitating conditions, low awareness of the potential for video games in learning, and the lack of video games that are suited to Saudi peculiarities and curricula are the most perceived barriers among teachers.

INTRODUCTION
Nowadays students have become part of a "digital generation" (Van Eck, 2006); they already know how to use different technologies and computer applications. They are looking for fun and enjoyable ways to learn that may be harder to achieve in traditional schools (Van Eck, 2006). One way to make the learning process more enjoyable and engaging is to adopt video games in teaching and learning (Su & Cheng, 2013; Papadakis, 2018). Digital games have become very prevalent among children and youth, and they spend a considerable amount of time using them (Subrahmanyam & Greenfield, 2008).Several studies have demonstrated the importance of using video games to improve students' engagement, academic achievement, motivation, and critical thinking (Eseryel, Law, Ifenthaler, Ge, & Miller, 2014; Su, & Cheng, 2013; Tham, & Tham, 2014; Tokac, Novak, & Thompson, 2019; Watson, Yang, & Ruggiero, 2013). Since the popularity of video games among 21st generation's lives and the potential benefits of integrating them in teaching, Saudi educational system might employ this technique for teaching and learning (Alqurashi & Williams, 2017). However, it is confounding that teachers do not embrace video games in their teaching practices (Papadakis, 2018, Papadakis & Kalogiannakis,2017). For the purpose of this study, the researchers seek to highlight the Saudi teachers' perceptions towards video games and also highlight the most common barriers in Saudi educational system that limits of the role of using such tools. At this stage of the research, a video game is defined as "a game played by electronically manipulating images displayed on a television screen" (Video Game, 2019, p.1).

LITERATURE
In the 21st century, well-designed games can be used as a medium to foster learning. Dikkers (2015) indicated that teachers adopting new media determined the degree to which it gets used and if the games are one such medium, then "it stands to reason that some of those games (media if adopted by teachers) can be effective and powerful learning experiences" (p.10). He also stated that well-designed games, if employed as media by teachers, "can tell powerful stories, challenge the mind, and convey the thinking of the designers" (p.10).

The relative importance of using digital games in teaching derives from their key role in enhancing students' motivation. Motivation is a crucial factor that affects learning outcomes (Asgari & Kaufman, 2009). Students in traditional classrooms have lower motivation than students in digital game-based learning classes (Prensky, 2007; Papadakis, 2018). Asgari and Kaufman (2009) stated that using games plays a significant role in making the learning process enjoyable and more engaging and this, in turn, increases students' motivation. According to Tokac et al. (2019), students who used video games for learning had better achievement and more motivation than their counterparts in traditional classrooms. According to Papadakis and Kalogiannakis (2017) and Tham and Tham (2014), game-based learning can be utilized as an efficient pedagogical approach to motivate and engage students; however, it is important to ensure that the selected educational game enriches students' experiences, increases student motivation, and immerses students in learning.

In addition, using video games in teaching can improve students' achievements and establish a positive attitude toward curricula (Papadakis, 2018). In software engineering classes, students achieved deeper learning when they used 3D game-based learning systems compared to students that used traditional methods (Su & Cheng 2013, Tokac et al., 2019). The researchers attributed this learning improvement to the students' enhanced motivation and immersion in the learning activities when using 3D game-based learning systems. The findings showed high satisfaction and confidence rates for students, as well as improved learner curiosity and immersion in learning activities (Su & Cheng, 2013).

Furthermore, using video games supports other 21st-century learning skills, such as creativity and problem-solving. Video games spark learners' creativity and give them the opportunity to find and organize information, solve problems, and evaluate solutions (Miller & Doering, 2014; Hwang, Hung, & Chen, 2014; Prensky, 2007). According to Squire (2005), digital games offer complex holistic problems for players, and this, in turn, increases the players' creativity and problem-solving skills. Moreover, players in digital games are active participants, while readers or viewers are passive observers (MediaJuice, 2014). The role of readers or viewers is just watching; they cannot make any decisions that will change the ending. In a game, the ending is a reward, particularly when the player reaches the desired goals (MediaJuice, 2014).

Educational video games have a significant impact on students' learning attitudes and achievements regardless of their age or gender. Cheng, Lou, Kuo, and Shih (2013) investigated the ability of elementary school students to accept and use digital game-based learning (DGBL) in their learning environment. The results of this investigation showed that using DGBL is suitable for both genders. In addition, the 4th-grade students' "perceived ease of use," "perceived usefulness," "attitudes toward use," and "intention to use" revealed high correlations.

In addition, Akinsola and Animasahun (2007) highlighted the impact of using a simulation-game environment on the achievements and attitudes of high school students regarding math courses. They found that students had poor achievement when using traditional teaching approaches. Using the simulation-game environment increased the students' achievement and led to a positive attitude regarding math subjects.

At the college level, using DGBL for learning can also improve students' achievement. To illustrate this, Afari, Aldridge, Fraser, and Khine (2013) conducted a study to highlight students' perceptions toward mathematics by using video games at the college level in UAE. The results showed that students were involved in these experiences and such learning tools had a significant positive impact on their math enjoyment, academic efficacy, and achieved learning outcomes.

Although using educational video games could play a vital role in motivating students (Papastergiou, 2009; Papadakis, 2018) and improving students' performance (Su & Cheng, 2013), the adoption of video games for learning has not been prevalent in schools as of yet (Alquarshi, 2016, Koh, Yeo, Wadhwa, & Lim, 2011). The lack of use of educational video games in classrooms is due to the presence of obstacles and challenges. According to Baek (2008), there are six factors that prevent teachers from using educational digital games in their classrooms. The main difficulty teachers indicated was the inflexibility of some subjects or curricula. It is hard to find a game that is suitable for such lesson objectives. The potential negative effects of video games on students' vision and behavior constitute another challenge preventing teachers from using video games. Furthermore, some teachers avoid using video games because some students are not yet ready to deal with video games. Some teachers feel they do not have enough supportive materials, such as reference materials. Moreover, time constraints do not allow teachers to use games. Having a busy, fixed schedule and a heavy curriculum constrains the use of video games. Lastly, schools have limited budgets, therefore they cannot provide the requirements for using educational video games, such as computers and connectivity.

Wu (2015) divided the difficulties that hinder the adoption of video games into internal and external difficulties. The internal difficulties were composed of the lack of self-efficacy, the difficulty of assessing student learning, and the difficulty of choosing video games that were suitable for the subject matter. The external challenges included inconsistency between the use of digital games and the curricula, the negative perceptions some administrators had about DGBL, the lack of facilitating technology and professional development, short class periods, and the poor quality of the digital games that existed in the market.

THE PURPOSE OF THE STUDY

The main purpose of this qualitative study was to identify Saudi teachers' perceptions regarding adopting video games for learning. It investigated the barriers that concern teachers regarding the adoption of DGBL in Eastern Province schools in Saudi Arabia.

THE SIGNIFICANCE OF THE STUDY

This study will enrich the Saudi educational research field. There has been little research thus far examining the barriers to adopting game-based learning in classrooms (Alqurashi, 2016). This study could benefit teachers, school leaders, and policymakers. As far as teachers are concerned, this study is the teachers' voice toward school leaders and policymakers. It presents the obstacles toward the adoption of digital game-based learning in classrooms. Participation in this study may also help teachers in conducting their own research. In addition, interviewing teachers may help them evaluate their current teaching practices.

Furthermore, this study might help policymakers identify the main reasons that prevent Saudi teachers from using digital games in classrooms, allowing them to take actions that will increase the incorporation of educational video games in classrooms. These actions may include the allocation of funds or the creation of policies.

This study will play an important role in raising school leaders' awareness regarding adopting digital games in teaching and revealing to what extent their teachers perceive its benefits for learning. Thus, school leaders should take actions such as arranging teacher training to enhance the adoption of DGBL.

RESEARCH QUESTIONS

This study attempts to address the following questions:

A. What are teachers' perceptions regarding using video games for educational purposes?
B. What are the barriers to the adoption of digital games in Saudi schools from Saudi teachers' perspectives?

METHODOLOGY

Research Design

This was an exploratory study aimed at identifying Saudi teachers' perceptions of adopting video games for learning as well as revealing the difficulties teachers might face when they intend to embrace video games in their teaching.

Instrument and Data Collection

The interview questions were self-designed based on the literature. Then the questions were modified by four experts in the field. A pilot test was conducted in order to validate the research instrument. The researchers conducted an interview with two participants from the target population. After this interview, the researchers made some changes to the interview questions. The final version of the interview contained eleven questions. The researchers used a one-to-one structured interview. The researchers used the Arabic language to conduct the interviews, as per the participants' preference. Each interview lasted for 10–20 minutes.

Sample

The population of this study was gathered from Saudi teachers in public Eastern Province schools in Saudi Arabia. All the subjects were males 25–50 years old. The researchers used a convenience sample combined with snowball sampling. This study included 22 Saudi teachers in the Eastern Province of Saudi Arabia during the 2018–2019 academic year. These teachers taught computer courses in middle and high schools. No personally identifiable information (like respondents' names, house address, or ages) was collected, as per some participants' requests.

Data Analysis Procedures

All interviews were transcribed using InqScribe software. Then the researchers read through each interview transcript separately and highlighted the most significant information in order to divide the transcript into information segments that were related to the first research question. The researchers coded these segments using in vivo codes, codes from the social sciences, and/or codes from the researchers that best described these segments. The researchers then read separately through each interview transcript and highlighted the most significant information in order to divide the transcript into information segments related to the second research question. These segments were then coded by the researchers using in vivo, social studies, and/or researcher-sourced codes that best described the information segments. A number of codes were identified. Similar codes were then grouped and categorized into three themes.

The Validity of the Results

After the researchers finished coding the data and coming up with three themes, they needed to confirm that these themes and results were accurate and corresponded to the participant's intentions. They used member

checking to establish credibility. The researchers emailed the theme table and findings to the participants to test the accuracy and credibility of the data and received confirmations from all participants. They also emailed the codes to a friend who spoke both English and Arabic language to double-check the translation.

FINDINGS AND DISCUSSION

To answer the first question, what are the teachers' perceptions about using video games for educational purposes, the researchers analyzed the interviewees' responses to the first three interview questions, which were:
A. What do you think about using games in general to support your teaching?
B. What is your opinion about using digital games (i.e., *Minecraft*) as a teaching and learning tool?
C. Do you think teachers and school leaders believe in the importance of using video games for educational purposes?

Generally speaking, all participants agreed that video games were useful for enhancing student learning and enriching the learning environment. Video games can be useful for learning since students today are part of the digital generation and they are already involved in the world of digital games. According to participants, nowadays a large number of Saudi students use video games on their tablets, computers, smartphones, or game consoles; thus, why don't teachers leverage this for the benefit of students learning? Indeed, adopting video games is considered a smart move by teachers to reach students where they already are, as was said by participant A.

Participants stated that many potentials could be associated with using video games. To illustrate this, according to the participants, adopting video games in teaching could make the learning environment more enjoyable, practical, interactive, and competitive than a traditional learning environment and consequently make students more engaged, immersed, and thrilled to achieve better learning.

According to participant E, "using digital video games can assist teachers to draw students' attention and consolidate information in students' minds, unlike lecturing." Further, participant B stated that "there is no question that video games can play a vital role in fostering 21st century learning skills such as problem-solving, creativity, and collaboration," as well as "video games simulate what students' might face in their real lives," as stated by participant K. Participant G indicated that "Adopting video games could assist teachers to explain sophisticated topics and also students might acquire some implicit skills that are implied in some well-designed games." Participant U affirmed the role of video games in teaching programming concepts; he said, "video games such as scratch video games for learning purpose helps students learn program commands, logical sequence of programs, information structure, problem-solving, and teamwork skills in an enjoyable way." Although all the interviewees perceived the benefits of integrating video games into teaching, interestingly, none of them had ever used them in their teaching. This result is consistent with Noraddin and Kian's (2014) study, which found that teachers in Malaysia had a positive attitude toward the use of video games to support their teaching; however, more than 70% of participants had never used video games for educational purposes. Further, in a Saudi context, Alquarshis' (2016) reported that Saudi teachers had positive attitudes toward using video games to enhance students' motivation, engagement, thinking skills, and achievements. Noraddin and Kian (2014) also found that teachers held favorable attitudes. However, Alquarshi (2016) could not confirm that video games could improve teaching strategies or teacher performance.

With respect to the respondents' colleagues' and administrators' beliefs about using video games for learning as reported by the interviewees, the majority of respondents (19 out of 22) stated that their colleagues and administrators had not absorbed the notion of using of video games for educational purposes yet. One of the interviewees stated that "using digital game might make the educational process unserious and waste students time without educational benefits"; another stated that "integrating video game in teaching can be a more distraction of students than attraction." According to the interviewees, there are some teachers who realize the benefit of using video games for learning; however, they are a little worried about the possible negative consequences that might be associated with using video games, such as addiction and distraction. This result is in conflict with a study conducted by Noraddin and Kian (2014). Noraddin and Kian concluded that the teaching discipline had no impact on teachers' attitudes toward adopting video games in their teaching.

Five participants attributed this lack of awareness of the significance of video games to the dominance of traditional teaching methods in Saudi classrooms. Some teachers and school leaders are not familiar with millennial and Z generation needs and expectations. Those teachers have been taught the traditional methods and resist any changes that conflict with their personal beliefs. Another reason for not seeing the importance of digital games is that "some leaders think video games are not serious and they can be only used for fun," as stated by participant J.

In order to answer the second research question regarding barriers that could prevent teachers from adopting video games in their teaching, three major themes were identified based on the participants' answers. The biggest concerns about the adoption of video games revolved around three fundamental factors—facilitating resources, lack of awareness, and game issues.

The First Theme: Lack of facilitating conditions

The first theme is the lack of facilitating conditions. "Facilitating conditions are defined as the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system" (Venkatesh, Morris, Davis & Davis, 2003, p.453). There are many conditions that could facilitate the integration of digital games in Saudi classrooms. Based on the participants' responses, this theme included two main codes—facilitating technology and facilitating resources.

Facilitating technology illustrated that schools have to be equipped with the necessary technologies to use digital games, such as internet connectivity, computers, and tablets. This result is in agreement with other studies (Alquarshi, 2016; Baek, 2008, Wu, 2015). Based on the participants' responses, there was a consensus that their schools are not equipped to adopt video games. The schools needed a lot of development in terms of internet connectivity, computers, video games, and technical support. One participant said, "There are some computers in schools and the number of these computers does not exceed 20 computers. However, each classroom has approximately 30 students." Another teacher reported that "the computers that are currently used in schools are not able to run digital games because running some digital games required availability of specific features, such as screens with high resolution and computer with big ram size." In addition to the lack of computers in the lab, ten participants mentioned that the schools didn't have adequate access to the internet to take advantage of the full potential of adopting video games, such as communication and collaboration. This result is in agreement with other studies' findings (Alqurashi, 2016; Beak, 2008; Koh et al., 2011; Wu, 2015).

Time formed another challenge for the teachers. Interviewees mentioned that the duration of each lesson in Saudi schools is 45 minutes, and this short time is not enough to employ video games, especially when the curricula are heavy. Koh et al. (2011) concluded that having insufficient time to embrace video games in the curriculum was the greatest obstacle that impeded Singapore teachers from integrating video games into teaching. This result is in agreement with the results found by Wu (2015) and Alquarshi (2016).

The second code was facilitating resources. These included the materials, plans, policies, and manuals that are required to incorporate digital games effectively in classrooms. This result is in agreement with other studies' findings (Alqurashi, 2016; Beak, 2008; Koh et al., 2011). In Saudi classrooms, there are neither mechanisms nor policies for the adoption of video games, as some participants mentioned. Participant Q stated that "The biggest issue we have in Saudi Arabia regarding using educational digital games is the absence of planning." Other teachers said, "If Saudi Ministry of education would provide simple manuals about how to use video games, the number of teachers who used digital games in classrooms definitely will grow." Some participants mentioned the importance of having specific policies tailored for adopting video games in classrooms when they talked about the possibility of addiction, bullying, blackmail, and misbehavior. Having clear policies from the educational authorities is a significant factor that affects the use of video games in the curriculum (Koh et al., 2011).

Facilitating resources also included financial and technical support, which are considered other obstacles to the adoption of video games by Saudi teachers. The interviewees stated that there are neither adequate financial allocation for the use of educational games nor adequate technical support to provide assistance for teachers who want to use and subscribe to educational video games. This finding is consistent with prior studies that found financial issues to be a significant factor that prevents teachers from integrating video games into teaching (Alqurashi, 2016; Wu, 2015). According to Watson, Yang, and Ruggiero (2013, p.236), "Teachers should be provided more technical assistance and financial support for purchasing computers and suitable games."

The Second Theme: Lack of awareness

According to the participants, school leaders and teachers need to learn about the importance of using digital games in the classroom first and then learn how to use video games effectively to enhance their teaching. This theme included two major codes—lack of awareness and training.

Lack of awareness meant that Saudi teachers and school leaders did not believe that digital games are capable of improving student learning. According to participant C, "many Saudi administrators, particularly school leaders or teachers, are from the old generation, think using digital games is a waste of students time. Teachers can use it only for entertainment, not for education." Alquarshi (2016) found that a lack of awareness of the benefits of educational video games was a reason not to adopt video games among Saudi teachers. Also, Baek (2008, p.

671) stated that “an effort should be made to raise awareness among teachers and parents of the positive educational benefits of gaming.”

Awareness could be raised by providing professional development regarding the effectiveness and integration of digital games into teaching. According to the participants, some teachers might realize the importance of video games, however, they do not have the required skills to purposefully and effectively introduce them into their teaching. All of the participants indicated that the Saudi Ministry of Education should provide workshops and training for teachers, and consequently they expected the number of Saudi teachers who used video games in classrooms would increase. Participant Q said, “I have met some teachers who are computer illiterate and they do not know how to run computers rather than integrating video games.” This result confirmed Wu (2015) and Alqurashi’s (2016) findings that the lack of professional development was the biggest challenge that prevented teachers from using video games (Alqurashi, 2016).

The third theme: Game Issues

The last theme revolved around different issues related to video games, including language, consistency, and assessing student learning. For example, the majority of well-known video games use English for instructions and interfaces. However, the formal language in Saudi Arabia is Arabic, which means students and teachers who do not understand English will not be able to properly use such games. Participant Q said, “I read about *Minecraft* and I know it is adopted in western country schools because of capacity in supporting student skills. However, my students can't understand English language; therefore, I will not be able to adopt *Minecraft.*” Participant U said, “there are some video games with Arabic interface; however, there are not common among students and are poorly designed.”

Game consistency referred to the alignment between digital video games, the Saudi curricula, and Saudi societal peculiarities. Participants mentioned that many digital games are common among students, but these games can’t serve the curriculum in any way. This finding is supported by previous studies (Alquarshi, 2016; Kirriemuir & McFarlane, 2004; Koh et al., 2011; Watson et al., 2013; Wu, 2015). According to participant C, “there are difficulties related to the games themselves in terms of their relevance to nature and the requirements of educational levels and consistency with what are in Saudi education policy.” In addition, some participants said that some well-designed games conflict with Saudi culture and religion because of certain women, pictures, and music.

The last obstacle that hindered the use of video games by teachers in Saudi Arabia from the interviewees’ perspectives is the difficulty of assessing students’ learning when they play educational video games. This result is in agreement with Wu’s (2015) study. Having an assessment element in the games used in the classroom would assist teachers in monitoring their students' progression and evaluating their skills (Borji & Khaldi, 2015). This assessment element in games could include criteria such as a progress indicator and player tracking. According to participants B &C, any video game should have an assessment section in order to evaluate the progression of learning that in turn helps students to achieve the learning goals. On the other hand, participant A stated that “teachers need to learn how to measure learning process managed by such tools.”

CONCLUSION

This study aimed to investigate Saudi teachers’—particularly computer teachers’—perceptions of the benefits of using video games in their teaching. The results show that computer teachers perceive the benefits of embracing video games in teaching. However, they stated that their colleagues who teach other subjects had a low awareness of the benefits of using video games for learning. Interestingly, none of the interviewees had ever employed video games for teaching purposes. This study also identified the difficulties that prevent Saudi teachers from adopting video games from computer teachers’ perspectives. These challenges are attributed to the lack of facilitating conditions, low awareness of video games’ potential for learning, and the lack of video games that suit Saudi peculiarities and curricula.

IMPLICATIONS

Saudi educational authorities could begin initiatives to encourage teachers to adopt technological innovation in their teaching, such as video games. The Saudi Ministry of Education could provide incentives for teachers who adopt technological innovations in their teaching.

According to the interviewees, teachers emphasized that policymakers, school leaders, and teachers needed to assemble incorporate guidelines, materials, and plans regarding the implementation of video games for learning. Teachers could suggest a list of video games to be used in each subject based on their experiences, with manuals that showed clear instructions about the method of use, the purpose of use, and the target audience of the game.

Further, the Saudi Ministry of Education should enact rules and policies to control the use of video games in classrooms.

According to the interviewees, there are no video games that align with the Saudi community's peculiarities or the prescribed outcomes of the Saudi curricula. As such, the Saudi Ministry of Education could create a partnership with pioneer companies specializing in game design so that the Saudi Ministry could ask for tailored games that aligned with Saudi culture and curricula. Also, there should be teams of specialists in different areas (science, social studies, psychology, and religion) who suggest effective video games teachers may use in the classroom and who evaluate the consistency of the video games with course outcomes and the community's religious, social, and cultural values. From the researchers' perspectives, Saudi authorities should rethink the ability of the current educational system to embrace technological innovations in general and encourage the integration of DGBL in particular.

According to the participants, there are teachers who do not know how to integrate video games effectively into their teaching. In order to use educational video games effectively in Saudi classrooms, the Saudi Ministry of Education should provide courses, training, and workshops for teachers to assist them in selecting, designing, and using effective games. Also, holding seminars and conferences that discuss technological innovations and share successful experiences of adopting video game would remove skeptics' doubts and increase the use of educational games in Saudi schools (Koh et al., 2011). Since there is little research written in Arabic that sheds light on the use of video games for learning, the Saudi Ministry of Education could support researchers in conducting more research to identify technological innovations that might enhance student learning and sharing the results of these studies among teachers.

FUTURE RESEARCH

For future research, the researchers suggest conducting the same study with females only and comparing the results of this study and the future one to better understand the influence of gender. Also, changing the population and conducting studies in different sites using different research methods, such as qualitative or mixed methods, would give us a deeper understanding of these obstacles, and the results would assist the policymakers in overcoming these obstacles.

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Using the Number Line and Educreations in a Second Grade Classroom: A Collaborative Action Research Project

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ABSTRACT
The inquiry-oriented and cyclic process of action research can lead to the innovative use of technology and instructional strategies to improve teaching practice, particularly for beginning teachers. This action research project examined the impact of the number line and Educreations on second-grade students' verbal and written explanations of three-digit addition and subtraction operations using whole numbers. Pre- and post-surveys were implemented to examine how the second-graders worked on the given three-digit addition and subtraction problems. The students' perceived value of using the number line indicated that the majority of the students found the number line helpful. Classroom observations and the students' use of the number line and Educreations indicated that student skills for solving and explaining the process of addition and subtraction methods increased as demonstrated in the post- assessment and the student videos.
Keywords: Number Line, Educreations, Action Research

INTRODUCTION
Children need to be competent in the four operations of whole numbers to enable them to understand rational numbers (Behr & Post, 1992) and related mathematical knowledge and skills. The U.S. National Mathematics Advisory Panel (2008) recommends the use of the number line model to help provide learners a key link between conceptual and procedural knowledge. The conceptual understanding of place value and the number line can help support the acquisition of more advanced mathematical competencies. Technology tools such as Educreations can support student learning and mathematical understanding as well as supporting the teacher as a formative assessment tool. This present study describes a collaborative action research project that took place in an urban K-12 classroom.

LITERATURE REVIEW
The Number Line
Research "points to the value of using visual representations of mathematics concepts for supporting the development of students' mathematics understanding" (Woods, Geller, & Basaraba, 2018, p. 230). A critical precursor for mathematical competence is the ability to mentally generate and understand the number line structure (Case, 1996). "A number line is a visual representation that illustrates the order and magnitude of numbers" (Woods, Geller, & Basaraba, 2018, p. 230). It follows an analogical format allowing for automatic and efficient processing of numerical values (Newcombe, 2002). Children's ability to accurately place numerals on the number line is predictive of their later mathematics achievement (Geary, 2011; Siegler & Booth, 2004).

Siegler and Booth (2004) found that kindergarten, first and second-graders' number line estimations correlated strongly with their math achievement test scores: "Individual differences in number-line estimation correlated strongly with math achievement test scores, improved estimation accuracy proved attributable to increased linearity of estimates, and exposure to relevant experience tended to improve estimation accuracy" (p. 428). The researchers stated that "the smaller a child's percent absolute error of estimates, the higher was that child's achievement scores" within each grade (p. 434).

Other studies (e.g., Siegler & Opfer, 2003; De Smedt, Verschaffel & Ghesquière, 2009) indicated that kindergarten and first-grade performance in arithmetic tasks using the number line is related to achievement in grades 1 and 2 respectively. In a longitudinal study, Halberda, Mazzocco, and Feigenson (2008) found that performance on a non-symbolic number comparison task in grade 9 was retrospectively predictive for mathematics achievement in each year from kindergarten to grade 6. Research regarding children's ability to place fractions on the number line strongly correlates with their math achievement (Hamdan & Gunderson, 2017). Hamdan and Gunderson (2017) found that the number line training with second and third-graders led to the transfer of an untrained fraction magnitude comparison task when compared to area model training.

Using the number line helps children "develop greater flexibility in mental arithmetic as they actively construct mathematical meaning, number sense, and understandings of number relationships" (Frykholm, 2010, p. 4). "Research suggests that visual representations, like a number line, support students' development of number sense by helping them create a mental representation of the order and magnitude of numbers" (Woods, Geller, & Basaraba, 2018, p. 229). The use of representations such as diagrams may be easier for children who tend to represent numbers on the structurally similar number line than for children who tend to represent numbers verbally or as digits (Schneider, Grabner & Paetsch, 2009).

The number line is used "to support reasoning about the operations of addition and subtraction as children construct representations of additive compositions (e.g., 50 + 23) or decompositions (73 - 23)", and using the number line helps students "develop qualitative understanding of numerical value in relation to lengths along the line" (Saxe, Diakow, & Gearhart, 2013, p. 344). It "allows students to engage more consistently in the problem as they jump along the number line in ways that resonate with their intuitions, and "they are able to better keep track of the steps they are taking, leading to a decrease in the memory load otherwise necessary to solve the problem" (Frykholm, 2010, p. 7).

The number line is a way to visualize the concepts for students to understand what place value is. Using the number line can help learners understand the foundations of place value and how manipulating numbers can change it. Place value is the quantity represented by the position of a digit relative to the decimal ("Place-Value Concepts," 2015, p. 2). Children's understanding of "place-value structure constitutes a building block for later arithmetic skills" (Dietrich, Huber, Dackermann, Moeller & Fischer, 2016, p. 502). The number line approach as an instructional strategy to explain the process of addition and subtraction can help clear up the misunderstanding of the standard algorithm the students may have.

"The influence of conceptual knowledge on students' mathematical competence is straightforward… it enables the learner to see relations between different pieces of knowledge…" (Schneider, Grabner & Paetsch, 2009, p. 361) which also can help with problem-solving strategies and transfer strategies between related types of problems. Conceptual knowledge is "knowledge of the core rules and principles as well as of their interrelations in a domain" (Goldstone & Kersten, 2003; Hiebert, 1986; Rittle-Johnson, Siegler, & Alibali, 2001, as cited in Schneider, Grabner & Paetsch, 2009, p. 360). Using the number line as an instructional method can help students develop mathematical models in the process of their conceptual learning.

Gravemeijer (1999) suggests exposing the students progressively developing models. First, as models of a realistic situation, second as models to represent computation strategies, and third as mathematical tools to think with when solving problems. "Models that emerge from the students' activities, supported by classroom interaction, are explicitly used to lead to higher levels of mathematical thinking" (Fosnot, 2007, p. 8). "The number line may be a particularly effective representation for fraction learning because its properties sign with the desired mental representation and take advantage of pre-existing spatial-numeric biases" (Hamdan & Gunderson, 2017, p. 587).

Educreations

Educational applications have gained the attention of K-12 teachers for classroom use in order to motivate students and support their learning. "With a growing emphasis on performance-based assessment, digital tools are needed to ensure students are provided with opportunities for explaining their knowledge and ideas in a variety of ways" (Johns, Troncale, Trucks, Calhoun, & Alvidrez, 2017, p. 56). According to Johns et al. (2017):

Educreations (https://www.educreations.com) is an app that serves as an interactive whiteboard and screencasting tool through which users can add videos, voice-overs, images, and annotations to instructional presentations in an effort to explain a concept or idea. The virtual whiteboard includes a variety of ink colors for students to draw or annotate. The app is easy to use and allows both teachers and students to create videos, craft presentations, and illustrate ideas (p. 56).

Students can use the Educreations app "to write out the strategies they use to solve math problems, take pictures of their manipulatives, and record their voices explaining the process" (Hillman, 2014, para. 2). The app allows the students to save their work and help review and reflect on their thinking. Educators can share videos with the students' parents or in their e-portfolio work (Hillman, 2014). In science and math classrooms, students can use the Educreations app to create a video explaining the steps of a science experiment or solving a math problem (Johns et al., 2017).

Particularly mathematics and language classrooms have found value educational value in screencasting tools

such as “Explain Everything and Educreations to support mathematical understanding” (Prescott & Damian, 2018, p. 286). "In the language arts classroom, students can use the Educreations app to create a digital story using pictures, videos, and narrations that demonstrate their thinking in a creative way" (Johns et al., 2017, p. 57). In an English as a Second Language classroom, Educreations videos were used to "introduce students to English vocabulary that facilitates the mapping of new lexical items onto their existing conceptual framework in Arabic" (Jackson III, 2015, p. 6). In a first-grade classroom, the app was adopted to support children's narrative of the literature using drawings, audio and video (Möller & Ferguson, 2017):

Educreations is an ideal way to capture students’ extended responses not only as finished visual products but also as rich processes. The app recordings preserve the in-time thinking behind the visual response as it simultaneously records individual narration or dialogue/discussion and the evolving visual response image (p. 58).

In this action research project, several number line apps were considered to use for supporting student learning and practice of addition and subtraction. The classroom teacher/action researcher chose the Educreations app for the student practice with the number line, and addition and subtraction methods. Her review of the educational apps concluded that Educreations included features that best fit for her students’ and the classroom activities she had planned to implement. According to her, the app was easy to learn and use, and the availability of screencasting features of this tool offered opportunities for increased learning for her class.

Action Research

Classroom action research provides a path of learning for instructional practice through a series of reflective stages that facilitate the development of progressive problem solving (Bereiter & Scardamalia, 1993). Action research is “a spiral process that includes problem investigation, taking action and fact-finding about the result of action” (Ghazala, 2008, p. 46). The purpose of action research is “for practitioners to investigate and improve their practices" (Hendricks, 2006, p. 3). This research method seeks to solve an instructional problem using a systematic inquiry approach that includes reflexivity and focus on the practical to improve teaching and learning.

Action research is teacher-initiated and teacher-directed with the end goal of improving practice and ultimately improving schools (Sagor, 2000). The practitioner “develops a plan, implements the plans (acts), systematically observes the results of the actions, and then reflects on the results” (Putman & Rock, 2018, p. 7). A key feature of action research is its cyclical or spiral nature. The cyclical process “serves as a formative assessment that results in modifications or revisions to the original plan as necessitated by what the data revealed, leading the researcher successively closer to t e objective of the research” (Putman & Rock, 2018, p. 5). This cyclic nature of action research can lead to creative and innovative development of instructional strategies and techniques to improve teaching. The process helps the teacher understand him/herself, the students, the learning context and the action steps for improvement of their practice (Putman & Rock, 2018).

The action research process has been tackled by many scholars. Kurt Lewin is considered to be the first scholar who has conceptualized and coined the term “action research.” His paradigm for action research began with an objective to reach, then proceeded in a spiral of stages of analysis, fact-finding, conceptualization, planning, execution; then a repetition of the whole cycle; indeed, a spiral of such circles (Lewin, 1946).
Stringer ‘s (2007) “Action Research Helix” includes looking, thinking, acting phases that continually lead to the next action process and repeated over time. Riel’s (2019) model includes identifying a problem studying and planning, taking action, collecting and analyzing evidence, and reflecting. Similar to other models, this model also continues with the next cycle in a repeated process. Others’ such as Bullough and Gitlin’s (1995) three-phase process included:

- Phase 1: Identify and write up a concern or issue; collect baseline data. In light of the data, reconsider and reformulate the issue and write a question.
- Phase 2: Write and implement an action plan; gather data; analyze data.
- Phase 3: Assess the plan in the light of the data analysis (p. 181).

Sagor (2000) developed a seven-step inquiry process for action research (pp. 3-4): 1) selecting a focus, 2) clarifying theories, 3) identifying the research questions, 4) collecting data, 5) analyzing data, 7) reporting results, 7) taking informed action.“ Whitehead and McNiff’s (2006) research cycle of “action-reflection” consists of five disciplined and systematic steps: observe, reflect, act, evaluate, modify, and move in new directions.

Hendricks’ model includes “Reflect, Act, Evaluate, Reflect, Act, Evaluate” (Putman & Rock, 2018). The action

research models proposed emphasize the cyclic and systematic approach to introducing innovations in teaching and learning that can ultimately lead to curriculum improvement. Engaging in classroom action research can support beginning teachers to help develop expertise in their teaching. Collaborative action research becomes a tool beginning teachers can use to inform and improve practice and engage in ongoing expertise development (Sternberg,1998, as cited in Mitchell, Reilly, & Logue, 2009).

The Project

Action research project was initiated in the College of Education at a Midwestern higher education institution. The project directors worked with K-12 schools to identify teachers who would be interested in conducting action research in their classrooms. After the call for proposals were made to the teachers, university faculty and teachers worked in pairs to conduct action research in the teachers' classrooms. Faculty's responsibility was to help guide the teachers with their action research projects. The action project directors provided guidelines and timelines for the teachers and the faculty via email or face-to-face meetings. At the end of the project timeline, action researchers shared their projects with the K-12 and higher education institutions in a poster session organized at this Midwestern college of education.

As a new teacher in her second year of the teaching profession, this classroom teacher was interested in implementing a different strategy other than the standard algorithm when working on three-digit addition and subtraction operations of whole numbers. Her curriculum included teaching the students three-digit addition and subtraction using whole numbers. Her observations led her to think that the majority of the class seemed to have a lack of understanding of the foundations of the place value and how manipulating numbers can change it.

Conceptual understanding of students' arithmetic operations is key to helping students achieve better with their addition and subtraction methods. The number line as a visual representation of numbers can help students' develop a foundation and conceptual understanding of place value; thus, help them successfully work on arithmetic problems. The action research project provided an opportunity to examine the impact of the number line and Educreations on students' verbal and written explanations of addition and subtraction methods.

The action project took place in a second-grade classroom (ages 7-9) at a Midwestern urban school. "... action research is usually conducted in a unique setting with a comparatively small sample (for example, one classroom, one school)" (Sagor, 2007, p. 156). Fifteen and seventeen students participated in the study using the empty number line for addition and subtraction operations respectively. The school administration supported and encouraged the teachers to use educational technology in their classroom. The classroom teacher was technology savvy and incorporated iPads and other technology into her teaching frequently. The students had not used the Educreations program prior to this study; however, they were comfortable using their iPads and technology applications available to them.

The following Common Core Standard was used for this lesson in this second-grade classroom:
CCSS.Math.Content.2.NBT.B.7: Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds. ("Common Core", 2017, para. 1).

Prior to the introduction of Educreations, the following instructional strategies were implemented with the number line for teaching 3-digit addition and subtraction operations.

- Addition: The students start with a 3-digit number on the number line. The students then decompose the second addend. After decomposition, they add on the number line by place value (hundreds, then tens, then ones).
- Subtraction: The students start with a 3-digit number on the number line. The students then decompose the subtrahend. After decomposition, they subtract on the number line by place value (hundreds, then tens, then ones).

The project included pre- and post-assessment results and written explanation of how the students solved the given three-digit addition and subtraction problems, Google forms questionnaire about their perceived value of using the number line, and the instructor observation and reflection of the student-made Educreations videos. The second-graders were given pre- and post-assessments prior to and after the introduction of the number line for addition and subtraction operations respectively. The post-assessments took place two weeks after the pre-assessments. The assessments included the students solve and write out how they've worked on the given three-digit addition and subtraction questions. The traditional paper-and-pencil method was used for all the pre- and post-assessments. The class received the same addition and subtraction questions. The students were not

prompted to use any particular strategy solving the problem. The assessment results were compared examining whether or not the students gave the correct answer and that they had the correct explanation of the process in solving the given problems.

During the Educreations assessment, the students were prompted to draw the number line and write on the app's whiteboard while they verbally explain their method for finding the answer. The length of the videos averaged around one minute. These self-made videos served several purposes: as a formative classroom assessment tool, a reflection tool for this action research study, and supporting conceptual learning through the students' own explanations of the process. The classroom teacher watched the students' use of the Educreations and how they solved their given addition and subtraction question. In addition, at the end of the classroom activities related to the topic, a Google forms questionnaire was distributed to the students inquiring about their perceived value of using the number line with three-digit addition and subtraction problems.

FINDINGS AND DISCUSSION

The classroom assessments and observations suggest that using the number line as an instructional method along with the students' self-made videos using Educreations improved student knowledge and skills working on three-digit addition and subtraction operations. The addition pre-assessment found that 5 out of 15 students got the right answer while 2 students could explain how they solved the question correctly. In the subtraction pre-assessment, 13 out of 17 students got the correct answer, but only one student could explain the process. It was found that on both pre-assessments, the students did not write much about how they solved the given problems. The addition post-assessment showed that all the students got the right answer and all could explain the process correctly. In the subtraction post-assessment, all the students gave the right answer, but 13 could explain the process correctly.

When solving the pre- and post-assessment questions, the students were not prompted to use the number line to explain the process of adding and subtracting three-digit problems. It was found that even though not all the students used the number line in the post-assessment, they were able to correctly explain their process of solving three-digit addition and subtraction operations. The post-assessment responses showed that the students were able to describe in-depth about the actual value of the place value.

During the students' assessment of their use of Educreations with the number line, each student was given a different addition or subtraction problem to solve using the number line and the Educreations app (Figure 1). Close attention was given to the questions so that the difficulty level did not vary. The students drew the number line on Educreations using their classroom iPads and solved their addition or subtraction problems explaining their thought process verbally and marking and writing on the app whiteboard. Teacher observations noted that the students did not experience any difficulty drawing and writing on the app whiteboard while verbally explaining how they solved the given problem.

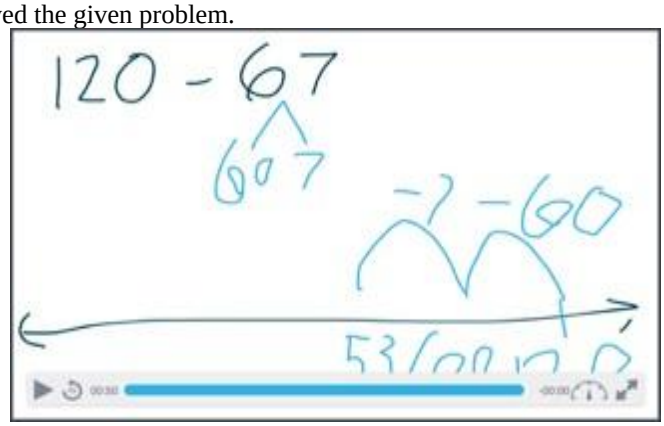

Figure 1. Using the number line to explain a subtraction problem with Educreations.

As expected, the students did better on addition compared to subtraction questions. The Educreations videos allowed the second-graders to concretely put into practice visualizing the number line, the place value, and how addition and subtraction problems can be solved. It's important to note that on the traditional paper and pencil assessments, the students did not do much explaining of their given math operations. On the contrary, when using Educreations. they gave more in-depth information through their drawings and markings on the number line and narration of the process they took for their addition and subtraction operations. It was also observed that the students used correct terminology for the mathematics operations using the number line. Teacher

observations of the Educreations videos gave the teacher richer information and perspective into the students' conceptual understanding or areas the teacher need to scaffold further into the future lessons.

In order to assess the students' perceived value of the number line for solving addition and subtraction problems, a Google forms questionnaire was implemented. The responses showed that 75% of the students marked "Yes" when asked: "Does the number line help you with addition?". 56.3% of the students marked "Yes" to the question but about subtraction. 18.8% versus 31.3% of the participants responded "No" for the help of the number line as an instructional strategy to solve addition and subtraction problems respectively.

The second-graders were asked two additional questions: "Why do you like or not like the number line?" and "What have you learned from the number line?". The responses included that they liked using the number line because it helps them count faster, it's fun to use, it's easy, and it takes a long time but it helps with finding the right answers. For example, two of the responses were: "It is easy and you break the numbers apart and then you add them." "I like the numberline because it makes it easier to answer by breaking it down and you can go down by tens, fiftys [fifties], hundreds."

The students who didn't like using the number line responded: "I like base ten better.", and "I don't like the numberline because I usually don't get the right answer." These responses indicate that the students in majority liked the number line for addition problems, but not particularly for subtraction problems as they find subtraction to be harder. This was confirmed by the percentage of students who marked "Yes" to the question when asked if they liked using the number line for addition and subtraction operations. 75% of the students liked using the number line for addition problems whereas 56.3% liked using it for subtraction questions. For example, one student wrote: "It is hard to subtract. I like that it [the number line] can help you add by going forward by hundreds and tens." The finding that subtraction is more difficult than addition is consistent with previous research as it's related to children's cognitive development at this age. "Counting down requires an ability to count backward while keeping track of the number of backward steps. The demands of the simultaneous processes help to explain the difficulty of subtraction relative to addition" (Baroody, 1984, p. 203).

Regarding the students' perceived value of using the number line, the students reported that the number line helped them understand about place value and the reasons for using the number line in addition and subtraction operations. Their responses included "I learned [that] the numberline shows you how to take away by place value.", "I learned that you add using hundreds, tens, and ones.", and "I learned how to subtract by counting backward by place value.". Other responses included "It can be hard or easy and we add using place value.", "That you can count back and count forward.", "How to count up faster and add faster.", and "It takes a lot of practice." These findings indicate that the use of the number line increased student use of terms such as place value.

The Educreations videos not only supported and reinforced student learning but also enabled the instructor to use the videos as a formative assessment tool for assessing their process of working on three-digit addition and subtraction operations. In addition, the students' self-made videos helped the classroom instructor identify strengths and weaknesses of the students' understanding of math operations with addition and subtraction problems. This shows that technology can be incorporated seamlessly into the in a variety of ways benefiting the teacher and the students mutually.

CONCLUSION

This project showed that using the number line as an instructional strategy increased this group of second-graders' conceptual understanding of place value and their ability to solve three-digit addition and subtraction problems. Schnorr & Painter (n.d.) emphasizes the importance of bringing an authentic context to research by integrating theory with practice and expanding awareness of school/teacher needs and goals.Student use of Educreations supported the number line as an instructional strategy teaching three-digit addition and subtraction which was demonstrated in the students' verbal and visual explanations of their conceptual understanding of the number line, place value and the process of solving the given problems. The number line and Educreations together can help students develop a well-grounded foundation for their conceptual understanding of the number system, place value, addition and subtraction, and early algebra.

Action research provides a venue for teacher inquiry and improvement of instruction in small scale such as in a classroom environment. The data this classroom teacher has collected through this project is valuable to improve her teaching and student learning. In the meantime, action research as a cyclical research model opens up possibilities for greater impact in a larger context. Richard Sagor (2000) emphasizes the importance of action research in creating change in schools:

If we are to meet the needs of a diverse population and help public education meet its moral goal of providing equal opportunity, then we need to break the tyranny of central tendency and discover an array of instructional techniques appropriate for even the smallest subpopulation of learners. To accomplish this, we need a teaching force armed with data that they can use to make the pursuit of continuous improvement a normal part of school life (p. 43).

RECOMMENDATIONS

The Educreations videos helped this new teacher as a formative assessment tool to check student learning and where the students may have difficulty solving the given problems and their use of the number line. Further research can extend this action project to higher grade classrooms following up whether the use of the number line strategy helps improve students' mathematical skills related such as multiplication, division, decimals, and fractions. An experimental study examining the use of the number line versus the number line along with Educreations videos would be helpful to see the impact of Educreations on the student learning and achievement of arithmetic tasks.

Reflecting further on this project, while the study has limitations, this exploratory collaborative action research project mutually benefited the K-12 and teacher education faculty. The classroom teacher plans to continue exploring the use of the number line and Educreations to enhance the students' learning of addition and subtraction and transfer of skills to mathematical procedures and problem-solving skills. This project showed that action research is a useful method for teachers to incorporate and explore instructional strategies as well as technology tools. Due to the developments in educational technology and particularly for new teachers, whether used as a formal research process or as a guideline, the cyclic model of action research can provide benefits for improving teaching practice.

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