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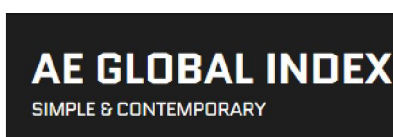
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We wish you success in your studies.

Cordially,

01<sup>st</sup> January, 2019

Editor

Prof. Dr. Zeki Kaya, Gazi University, Ankara- Turkey

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## TECHNOLOGY INFORMATION AND COMMUNICATION EDUCATION

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### Abstract

The earth changes rapidly via technology. Modern strategists designed a style based on technology and technology became the main component of modern era. Technology is the indispensable component of modern age and it is used almost in all areas of the world from daily life to education recently. Some people are not aware of the importance of technology in education but they also can not to avoid to use technology. Technology is the necessity of contemporary works and it is the way of modern methods especially in education. Technology eases life and also all business and provides people many different facilities and also extra time. Technology is the most essential element in that education due to the future face. The future is exactly based on technology and information and communication technologies determine the way of future. Therefore many developed countries use technology in information and communication education.

**Keywords:** Technology, information, communication, education, modern age.

### INTRODUCTION

There is only a few educational organizations that do not use technology. Modern educational methods naturally require technology use due to modern conjuncture and modern conditions. Technology is sometimes used to have fun or to spend time but it provide to work efficient and to teach easily (Wilson vd., 2014: 169). Many business and organization use technology to work and to produce and people also use technology to survive. Educational organizations generally use technology to teach the best.

Information and communication are two important business of modern age and both are based on modern technology. Almost all new technologies are concerned with information and communication. In a way, information and communication technology are the base of modern age and the future (Hansen vd., 2012: 228). Therefore, information and communication technology require to use technology in education and many educational organizations use technology to teach information and communication in the world.

In developing countries where higher education is fraught with serious challenges at multiple levels, there is increasing pressure to ensure that technological possibilities are viewed in the context of educational needs. The use of ICT in education lends itself to more student-centred learning settings and often this creates some tensions for some teachers and students (Sarkar, 2012: 37). According to the United Nations Educational, Scientific and Cultural Organization (UNESCO), ICT "can contribute to achieving universal education worldwide, through the delivery of education and training of teachers, improved professional skills, better conditions for lifelong learning, and the potential to reach people that are outside the formal education process." In the United Nations Millennium Development Goals, ICT is highlighted as the means to reach the underserved, to listen and learn from their experience. Online education is essential for students whose physical presence in class is impeded because of work or family responsibilities, geographical limitations, health issues, or other constraints. Although face-to-face interaction in a classroom setting seems to be preferred among education professionals, the numbers of online universities and online courses offered by on-campus universities have risen in the past 10 years. In order to develop successful online programs, however, it is necessary to understand what the specific ICT needs of an institution are (Joshi vd., 2013:). ICT develops day by day recently and teachers and students try much to adapt recent technologies.



Information and communication Technologies can be understood as a tool or technique for extending human capacity. In this sense, ICTs extend our human capability to perceive, understand and communicate. The portable phone enables us to communicate from wherever we are, to others, who are thousands of kilometres away; television permits us to see what is happening on the other side of the globe, almost as it happens; and the Web supports instant Access to, and exchange of, information, opinions and shared interests (Adu and Olatundun 2013). The most popular technology of the modern era is internet and internet takes people to a fantastic World that people want to reach there.

In the field of formal education, ICTs are increasingly deployed as tools to extend the learner's capacity to perceive, understand and communicate, as seen in the increase in online learning programs and the use of the computer as a learning support tool in the classroom. Although, universities were certainly leaders in engineering the internet and interoperable computer systems to connect researchers for e-mail and data exchange, the use of ICTs for education and training has lagged behind other sectors in society (Moodly & E.O. Adu, 2014: 199). ICT provide people and students very many facilities.

There is a technology trend in the world and everybody tries to own firstly information and communication technology. Information and communication technology are not only useful, but enjoyable too. People communicate and have different informations via communication and information technology, but it is not certain that they use technology correctly or not.

### **IMPORTANCE OF COMMUNICATION**

Communication is a spiritual need and people can not live without communication in the world. Communication is the nutrition is spirit and people provide many use for their spirit via communication (Goodier ve Eisenberg, 2006: 61). Besides physical needs, communication is an indispensable necessity for people.

People have to communicate to tell themselves and to understand others. Communication is concerned with opinion, feelings, knowledge and also culture (Morreale, Pearson, 2008: 236). Communication is also a social action and requirement. Communication determines situation of a society and perace in society and power of society. Communication provides healthy organizations in the society and communication also creates social character (Tench and Moreno, 2017: 122). Human development is owed to communication becuase of development character of communication.

Communication is the process of transmitting information and common understanding from one person to another. The elements of the communication process are the sender, encoding the message, transmitting the message through a medium, receiving the message, decoding the message, feedback, and noise (Lunenburg, 2010: 10). Communication is an action that equipes people with knowledge and approaches.

Communication can be defined as the exchange of an information, thought and emotion between indivudals of groups; in other words, communication plays a fundamental role in balancing individual and organizational objectives. Communication is the activity of conveying information. Communication has been derived from the Latin word "communis", meaning to share (Agarwal and Garg, 2012: 42). In a way, communication is the development of human and success of people.

Communication is the exchange of ideas, feelings, or attitudes between two or more people. People communicate continuously in many complex ways. People speak, scowl, write, preach, touch, smile, sit, stand, cry, stare; all of these behaviors communicate an idea. Whether people communicate the intended message or not depends on their effective use of communication skills (greyowl.com, 2004, 5). Many communication ways provide people many different facilities and peaceful life ambience.

Many formal or informal schools have improved the methods of communication in the past. All communities have attached importance to communication because of its vital value. All people need communication to solve their problems and to live in peace (Morreale, 2014: 352). The recent developments forced people communication and information and communication technology and people mostly began to use communication technology. Communication became the most vital component of social life and also global developments especially in 21st century (Klotsche, 2009: 324). People need to communicate and also need to fun by communicating.

The development of the communications system is an integral part of the development of the nation as a whole, communication systems being part of a nation's social institutions. Moreover, each social institution has a task of contributing to the development of the nation and all other social institutions. It is a complex and interdependent relationship. While the mass media, therefore, are developed by society, they in turn help to develop that society and to promote its aspirations. The aspirations of the people include the democratization of society and the media have an especially critical role to play in this (Chimutengwend, 1988:43). Any society need communication to develope and to adapt global conditions.

Communication is naturally concerned with technology in modern age. The most important aspect of infusing technology in the curriculum is pedagogy. When implementing the pedagogical competencies for infusing tech- nology, the local context and the individual approach of the teacher linked with that of their subject discipline must be paramount. Teachers move through stages as they adopt ICTs. Initially, the teacher adopting technology applies it simply as a substitute for current teaching practice where technology is not used (e.g., teacher lecture becomes electronic presentation supporting lecture, students writing papers by hand become students writing papers using a word processor, course syllabus on paper becomes course syllabus online). The adaptation of ICTs by teachers should (and does) challenge and support changes in teaching practice, building upon individual pedagogic expertise. As teachers' pedagogical practices with new Technologies continue to develop, and organizational support and access to ICTs grow, it becomes possible to move beyond the adaptation of ICT applications that fit with existing practice (Unesco, 2002: 42). ICT looks the future of the world and all recent organizations set on ICT.

## **DEVELOPMENT OF INFORMATION AND COMMUNICATION TECHNOLOGIES in EDUCATION**

Education is not only teaching technical knowledge but convey students an universal approach and facilities. Educational methods changed after Industrial Revolution and traditional ways were left. Modern approaches and methods were begun to use instead or traditional methods recently (Upasana, 2014: 159). Technological facilities are especially used in education to teach easily and to tell clearly.

It is estimated that there are thousands of schools and departments providing communication training all over the world (Eid and Dakroury, 2016: 27). Schools and departments providing communication training have to use advanced technology for contemporary conditions anymore (Wilson and others, 2014: 1863). Modern education exactly requires advanced technology.

Information and communication technology are used in many educational organizations in the world recently and many organizations have also technology commitee and advisers due to modern conditions (assembly.wales, 2001: 10). The new ICT applications may destroy more jobs than they create; the gap between rich and poor may widen; and the huge capital investments required to strengthen national capabilities for using ICTs could divert resources from other activities that could have greater development impact (Mansell, 1999: 46). Information and communcation technologies have many facilities to tell and to teach.

Education is the backbone of a nation. Despite knowing this, a huge number of people of least developed countries are far beyond the reach of higher education. One of the key reasons may be the poor economic condition of those countries (Hoque and Alam, 2010: 97). Though many countries are aware of education for future and governments do their best for education and to develop communication in society.

Information and communication technology (ICT) is a major challenge to educational system in modern age. Reading, writing, and arithmetic were the first tools that required a formal and protracted education system. Up to that time, the body and mind tools could be learned through informal education and apprentice systems. After that time, we began to have formal schools that have many of the characteristics of today's schools. The past 5,000 years have seen a huge growth in the number of students receiving formal education and the length of that formal education (Moursund, 2005: 26). Methods and approaches of education have changed in many times and technological facilities have also changed in education.

The idea that teaching and learning can successfully take place through the application of electronic communication facilities between teachers and students is one which had generated, sometimes, hope and dismay and at other times, excitement and fear. Hope that many more learners can be reached at a more convenient pace that had erstwhile been the case, dismay that the infrastructures necessary for deploying an effective ICT platform is lacking in low-income countries (Olakulehin, 2007: 137). Underdeveloped countries are also aware of ICT Technologies and try to own them recently.

In developed countries, the use of ICTs in education is no longer considered an experimental enterprise. While research and experimentation continues, the use of ICTs in education has become mainstream, largely irrespective of social, economic, or geographical factors. In Canada, ICT is utilized everywhere in education—to some degree and in some form, in schools at all levels, from coast to coast to coast, including the in the high Arctic.

Developed countries have evolved their own set of international standards for design, delivery, and evaluation. ICT applications have been tried in hundreds of educational environments, at every level. Certainly there have been some failures and some partial successes, but there have been many clear successes, and few would question the value of utilizing ICTs for education, when properly applied (Loxley, 2004: 54). Modern education is almost concerned with technology and is not lead unless ITC Technology.

"An evaluation of the infrastructure, planning and use of information and communications technology in teaching and learning was conducted by the Inspectorate in primary and post-primary schools during the school year 2005/06. The objectives of the evaluation were: To examine the extent to which ICT was used in primary and post-primary schools, to evaluate the impact of ICT on teaching and learning, to assess the ICT skills of students at selected points in the education system and to obtain their views on their experience of ICT in their schooling to obtain the views of principals and teachers on their ICT skills and their opinions of the impact and future role of ICT in education, to make recommendations for policy development regarding ICT in schools".

The survey found that the most popular teaching mode in which ICT was used was whole-class teaching in a dedicated computer room (implemented by 39% of all teachers). In such instances all students would generally have individual access to a computer. The survey revealed that this mode was employed most frequently by teachers of Business Studies, Mathematics, and English. The next most frequent teaching mode (32%) involved group activity in a dedicated computer room; this was followed by whole-class teaching in a general or specialist classroom (30%).<sup>76</sup> It is noteworthy that the SCR in a school had a negligible effect on the use of ICT in any of these settings. It can be concluded, therefore, that teachers' willingness to use ICT is at least as important as the availability

of ICT equipment (Inspectorate, 2008: 159). ICT naturally eases work of teachers and provides students to learn faster than traditional methods.

Widespread deployment of information and communication technology (ICT)-based infrastructure in higher education (HE), such as local area networks, wireless networks and cloud computing services and virtual learning environments (VLEs), has enabled experimentation in the use of ICTs to support the provision of teaching, learning and assessment, and to create innovative pedagogies. This infrastructure includes server equipment and networks that support the VLE platforms housing educational content, tools and applications within learning systems, and also hosted separately on ICT devices. Increased experimentation has raised many questions about how ICTs are adopted and deployed in Higher Education (Caird and Lane, 2015: 69). Technology provide a base to students for future of education.

Future is based on the strategy and strategy determines the owner of the power (Owens, 2014: 41). ICT has impacted on the quality and quantity of teaching, learning, and research in traditional and distance education institutions. In concrete terms, ICT can enhance teaching and learning through its dynamic, interactive, and engaging content; and it can provide real opportunities for individualised instruction. Information and communication technology has the potential to accelerate, enrich, and deepen skills; motivate and engage students in learning; helps to relate school experiences to work practices; helps to create economic viability for tomorrow's workers; contributes to radical changes in school; strengthens teaching, and provides opportunities for connection between the school and the world (Modasiru, 2005: 319). ITC has a vital importance for the future of anyone for short.

## CONCLUSION

Modern era came suddenly and brought man different components into life of people. Tools, technics and approaches changed and people began to live in diferent styles from the past. Technology had sovereignty on people and on life and people did not spend time without technology. Technology had important role from daily life to business world.

Information and communication became the most important components of modern business World and modern education. Information and communication education are cared all over the world and almost all educational organizations had information and communication departments. Because economical base of modern world is based on information and communication.

Information and communication education is very important and technology has to be used in information and comunication education. New generations and young people use information and communication technology, but it is not possible to say that they use correctly. All they and all people need information and communication technology education. Perople firstly need technology education before to have technology.

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Sedat Cereci is professor Communication Faculty in Mustafa Kemal University .Studied radio and television broadcasting at Communication Faculty in the Universtiy of Istanbul between 1982 and 1986. He studied on documentary film at doctorate process at the University of Istanbul between 1988 and 1992. He works at magazines and at newspapers as journalist and as redactor and works at Yuzuncu Yil University as professor and teaches radio and television broadcasting. Wrote many essays, participated in conferences and in symposiums all over the world, worked in international projects, wrote for magazines and for websites. He was assigned as Dean of Fine Arts Faculty at Batman University in 2010 and arranged a multilingual film festival in Batman. He studied classical Turkish music, composed songs in different forms and produced radio programs at TRT Istanbul Radio. He

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## REFERENCES

Agarwal, S. and Garg, A. (2012). The Importance of Communication within Organizations: A Research on Two Hotels in Uttarakhand. *IOSR Journal of Business and Management*, 3 (2): 40-49.

Assembly.Wales (2001). Information and Communication Technology in Education. Final Report, <http://www.assembly.wales/Laid%20Documents/Education%20and%20Lifelong%20Learning%20Committee%20Final%20Report%20Information%20and%20Communication%20Technology%20in%20Education-06032001-24015/bus-GUIDE%203AA60E120003E66A0000498300000000-English.pdf>. 14.05.2018.

Caird, S. and Lane, A. (2015). Conceptualising the Role of Information and Communication Technologies in the Design of Higher Education Teaching Models Used in the UK. *British Journal of Educational Technology*, 46 (1): 58–70.

Chimutengwend, C. C. (1988). The Role of Communication Education in the Development and Democratization of African Society. *Africa Media Review*, 2 (2): 29-45.

Eid, M. and Dakroury, A. (2016). *Basics in Communication and Media Studies*. Canada: Pearson.

Goodier, B. C. ve Eisenberg, E. M. (2006). Seeking the Spirit: Communication and the (Re)Development of a "Spiritual" Organization, *Communication Studies*, 57 (1): 47-65.

GreyOwl (2004). The Importance of Communication.  
[http://www.greyowl.com/articles/comm\\_article.pdf](http://www.greyowl.com/articles/comm_article.pdf). 14.05.2018.

Hansen, N. and Vinne, N. and Postmes, T. (2012). Information and Communication Technology and Cultural Change How ICT Changes Self-Construal and Values. *Social Psychology*, 43 (4): 222–231.

Hoque, S. M. S. and Alam, S. M. (2010). The Role of Information and Communication Technologies (ICTs) in Delivering Higher Education – A Case of Bangladesh. *International Education Studies*, 3 (2): 97-106.

Inspectorate (2008). *ICT in Schools*. Dublin: Evaluation Support and Research Unit Inspectorate Department of Education and Science.

Joshi, A. and Meza, J. and Costa, S. and Perin, D. M. P. and Trout. K. and Rayamajih, A. (2013). The Role of Information and Communication Technology in Community Outreach, Academic and Research Collaboration, and Education and Support Services (IT-CARES). Perspectives in Health Information Management, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3797554/>. 14.05.2018.

Klotsche, J. M. (2009). The Importance of Communication in Today's World. *The Speech Teacher*, 11 (4): 322.326.

- Loxley, W. (2004). *Information and Communication Technologies in Education*. Mandaluyong: Asian Development Bank.
- Lunenburg, F. C. (2010). Communication: The Process, Barriers, and Improving Effectiveness. *Schooling*, 1 (1): 1-11.
- Mansell, R. (1999). Information and Communication Technologies for Development: Assessing the Potential and the risks. *Telecommunications Policy*, 23 (1): 35-50.
- Modasiru, O. Y. (2005). Information and Communication Technology and Education: Analysing the Nigerian National Policy for Information Technology. *International Education Journal*, 6 (3): 316-321.
- Moodly, A.L. and Adu, E.O. (2014). Information and Communication Technology (ICT) in Education for Sustainable Development (ESD): Quality Teaching and Learning Outcomes. *Journal of Communication*, 5 (2): 197-202.
- Morreale, S. P. and Pearson, J. (2008). Why Communication Education is Important: The Centrality of the Discipline in the 21st Century. *Communication Education*, 57 (2): 224-240.
- Morreale, S. and Backlund, B. and Sparks, L. (2014). Communication Education and Instructional Communication: Genesis and Evolution as Fields of Inquiry. *Communication Education*, 63 (4): 344-354.
- Moursund, D. (2005). *Introduction to Information and Communication Technology in Education*. Oregon: Oregon University Press.
- Olakulehin, F. K. (2007). Information and Communication Technologies in Teacher Training and Professional Development in Nigeria. *Turkish Online Journal of Distance Education-TOJDE*, (8): 133-142.
- Owens, B. (2014). *The Rise of Distributed Power*. Massachusetts: General Electric Company.
- Sarkar, S. (2012). The Role of Information and Communication Technology (ICT) in Higher Education for the 21st Century. *The Science Probe*, 1 (1): 30-40.
- Tench, R. and Moreno, A. (2017). Re-fuelling the Talent Tank. A Qualitative Study of Key Deficiencies, Future Needs, and Life-Long Learning Needs of Communication Management Professionals in Europe. *Communication & Society*, 30 (3): 109-127.
- Unesco (2002). *Information and Communication Technologies in Teacher Education*. Paris: UNESCO.
- Upasana, K. M. (2014). A Comparative Study of Traditional Education & E. Education with Special Reference to India. *International Journal of Research in Business Management*, 2 (5): 149-162.
- Wilson, K. B. and Tete-Mensah, I. and Boateng, K. (2014). Information and Communication Technology Use in Higher Education: Perspectives from Students. *European Scientific Journal*, 10 (19): 1857- 7431.



## **VIRTUAL LABORATORY BASED ON INQUIRY IN CHEMICAL EQUILIBRIUM AS LEARNING INNOVATIONS**

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### **Abstract**

This study aims to develop and determine the feasibility of inquiry-based virtual laboratory media on chemical equilibrium. The development model used in the research was R&D which adopted the phase from Borg and Gall. Phase Borg and Gall used until 5, research and information collecting, planning, developing a preliminary form of product, preliminary field testing, and main product revision. The instruments in this study were questionnaires used to obtain input data for products, and quantitative scores as the value of media feasibility. The results of this study are inquiry-based virtual chemistry laboratory media on chemical equilibrium. Ideality presentations from the results of media assessments by chemistry teachers were 82.50%, peer reviewers were 87.50%, and students ratings were 82.50%. Overall the value of the feasibility of this media presentation was 83% with a very good category. Therefore, the inquiry-based virtual laboratory is worthy of being used as a learning media for high school students.

**Keywords:** Virtual laboratory, inquiry, chemical-equilibrium, media development.

### **INTRODUCTION**

At present, the development of technology has entered the world of education. Technological developments increasingly encourage efforts to renew the use of technological results in the learning process. This is in accordance with 21st Century which shows that classroom learning using IT-based media is feasible (Lee, 2016). Technology can provide a valuable opportunity to practice new learning techniques (Rajendran, Veilumuthu, & Divya, 2010). Through technology, an educator can improve the quality of education, by opening wide open access to science and information technology (Rusman, 2012). Teachers can adapt teaching methods that are trending to incorporate media into activities in the classroom (Rajendran, Veilumuthu, & Divya, 2010). Utilizing technological developments in the learning process especially computer technology can make it easier for teachers to explain learning material that is far from students' reasoning. In addition, the use of technology and the internet can be done well by students. Students spend more time using digital media in their daily lives (Lee, 2016).

Chemical learning is a complex and abstract process of learning chemistry. Tresna (1998) states that the purpose of chemistry learning is to obtain a long-lasting understanding of the information obtained, problem-solving skills and have the skills to use tools and materials in the laboratory. However, not all students can easily obtain an understanding of the chemical material delivered by the teacher. One of the chemicals that is considered difficult by students and requires high understanding is chemical equilibrium. Chemical equilibrium is one of the material that is considered difficult by students (Solomonidou & Stavridou, 2001), because of its abstract character and the demand for material mastery in large numbers (Pardo & Portoles, 1995) so students at all levels still experience misconceptions (Demircioglu, Demircioglu, & Yadigaroglu, 2013).

In chemical equilibrium material, there are theories about chemical reactions that require practicum because the resulting reactions are related to distinctive color changes (Leal & Leal, 2013). Treagust,

Tyson, and Bucat (1999) say that one of the learning methods proposed to teach better chemical equilibrium is practicum. Laboratories have a very important role in the process of learning chemistry, but not all schools have adequate laboratory facilities. Schools that have laboratories are still not optimal because the availability of laboratory technicians and laboratory staff is still lacking. Based on observations that have been made on 6 schools in Yogyakarta, Indonesia, there are still many limitations that are often experienced by teachers when doing practical activities, including not all schools have laboratory staff who can help teachers, security in practicing activities, limited equipment available in the laboratory, and available materials exceed the deadline for use so they are not suitable.

Teachers can take advantage of the development of information technology in overcoming problems in the classroom. Herga, Cagran, and Dinevski (2016) say that to overcome the above limitations, practicum can be done using a virtual laboratory. Virtual laboratory media is a series of laboratory tools and materials packaged in the form of interactive multimedia-based computer software. This device is operated by a computer and makes the activities in the laboratory as if the user is in the real laboratory.

Virtual laboratories bring many benefits. One of them is students can do dangerous experiments without endangering themselves or others and affordable simulations (Herga, Cagran & Dinevski, 2016). The development of virtual laboratories is expected to be able to solve teacher problems when it is difficult to carry out actual lab work because of the limitations. Multimedia-based learning in the form of virtual laboratories can generally make the learning process more interesting, more interactive, and the teaching and learning process can be done anywhere and anytime. The multimedia display of an experiment helps students reach higher cognitive levels, and reduces the level of abstractness normally encountered when conducting experiments in chemical laboratories (Kirscher & Huisman, 1998; Ambusaidi, Musawi, Al-Balushi, & Al-Balushi, 2018). Previous research conducted by Tuysuz (2010) showed that the use of virtual laboratories increased the level of achievement and had a positive impact on students' attitudes towards chemistry subjects.

Several factors that influence the effectiveness of the learning process are teacher factors, student factors, learning material, media, methods, and learning models. In this study, virtual laboratory media can be combined with learning models. The content of the virtual laboratory is not only equipment for practical activities but there is a syntax of the learning model in it so that it is more focused on conducting the learning process. One student-oriented learning model is the inquiry learning model. Minner (2010) says the teaching strategy that actively involves students in the learning process is through scientific inquiry because it is more likely to increase conceptual understanding. The learning process using the inquiry model involves all students' ability to search and investigate systematically, critically, and analytically. Inquiry learning model directly involves students to think, ask questions, conduct exploration and experiment activities so that students are able to present solutions or ideas that are logical and scientific (Coffman, 2009). Inquiry-based teaching makes learning active by involving students in the learning process and allowing students to learn the contents themselves (Oliver, 2007; Prince & Felder, 2007).

## **METHODS**

### **Research Design**

This study used R&D development model adopted from Borg and Gall. The procedure of development research carried out involves 5 stages, namely research and information collecting, planning, developing the preliminary form of a product, preliminary field testing, and main product revision.

### **Data Collection**

Data collection from 5 stages of development research procedures. First, research and information collecting was the phase of research needs analysis, namely field observations to obtain information about the implementation of the learning process in the classroom, the study of literature relating to



research, in addition to reviewing the curriculum, syllabus, learning resources and teaching materials. Second, planning was the phase of collecting materials and references for making inquiry-based virtual laboratory media products covering the phase of product design and learning design. Third, developing the preliminary form of a product was the phase of combining all the components that have been designed, the products that have been finished are then reviewed by two experts, namely media experts and matter experts. Media experts was lecturer who have experience in the field of research in the development of learning media. Aspects assessed by expert judgement of media were aspects of visual audio display and software engineering. There were 14 indicators for visual and audio aspects and software engineering. Matter experts was lecturer who experts and master the material in the field of chemistry, especially those related to chemical equilibrium. There were 14 items for the learning and material aspects. The instrument used was a questionnaire with 4 scales which was modification of the Likert scales.

Besides being validated by media experts and matter experts, this learning media was also validated or given further evaluation by 7 high school chemistry teachers and 12 peer reviewers in terms of matter and media. Evaluation of media feasibility by teachers and peer reviewers consists of 4 aspects of assessment, namely visual and audio, software engineering, learning, and material. Fourth, the preliminary field testing was a test phase for media readability by 20 students. Fifth, playing product revision is an improvement of learning media based on the results of input and assessment from students after a trial was conducted at the school.

## FINDINGS

An inquiry-based virtual laboratory is a series of laboratory tools and materials packaged in the form of interactive multimedia-based computer software. In this virtual laboratory media, there are 4 chemical equilibrium practicum, namely reversible and irreversible reactions, the effect of concentration, temperature, and volume on the shift in equilibrium direction. In virtual laboratory media, there is a syntax of inquiry learning models. The syntax of the inquiry learning model applied in the media were adapted from the results of the synthesis of inquiry steps according to Lou, Blanchard, and Kennedy (2018); Zulfiani and Herlanti (2018); Kambeyo (2017); Wenning (2007); Lukac (2015); Wu and Hsieh (2006); Mumba, Chabalengula and Wise (2007); and the National Research Council (1996). The results of the synthesis of inquiry phase in the media were the introduction which contains problems related to chemical equilibrium, then students are asked to formulate the problem, write the hypothesis of the questions that have been made, design an experiment, conduct experiments, answer questions and give conclusions. The final part of the practicum steps was chemical equilibrium matter which discusses practicum activities that have been carried out. In addition, there are evaluation questions regarding the practice of chemical equilibrium in the form of multiple choice questions. Students can work on evaluation questions after doing practical activities. Virtual laboratory media based inquiry can be seen in Figure 1, 2, 3, and 4.

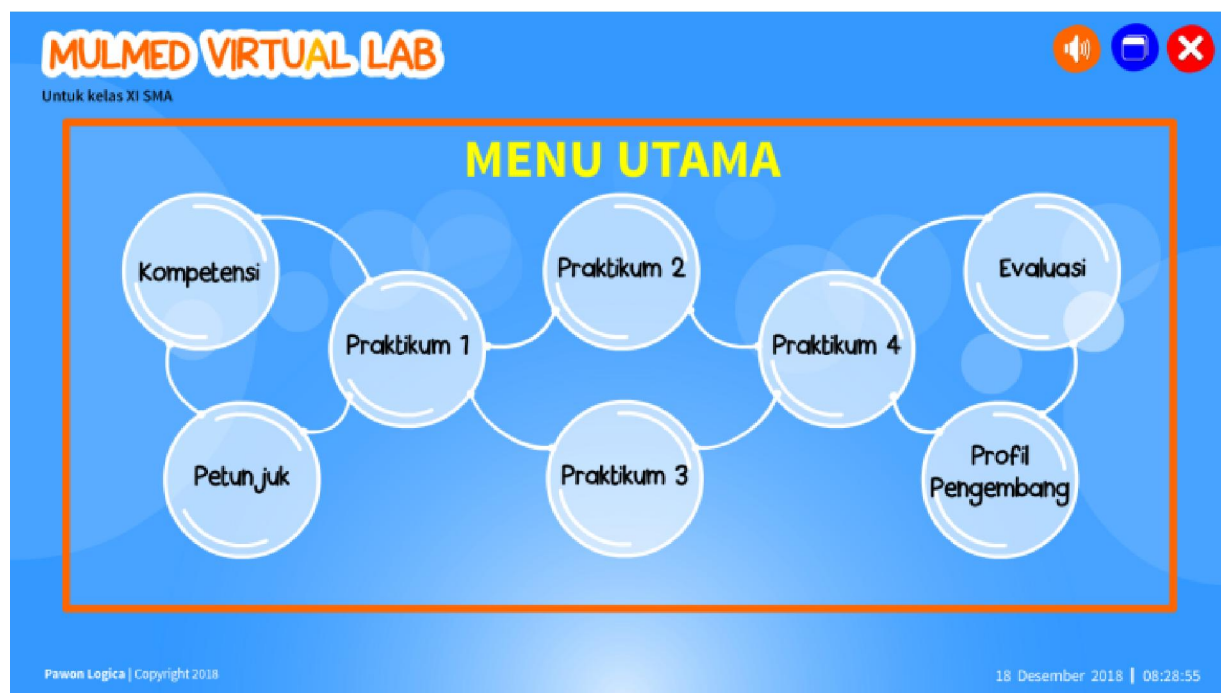


Figure 1: Menu of virtual laboratory media based inquiry

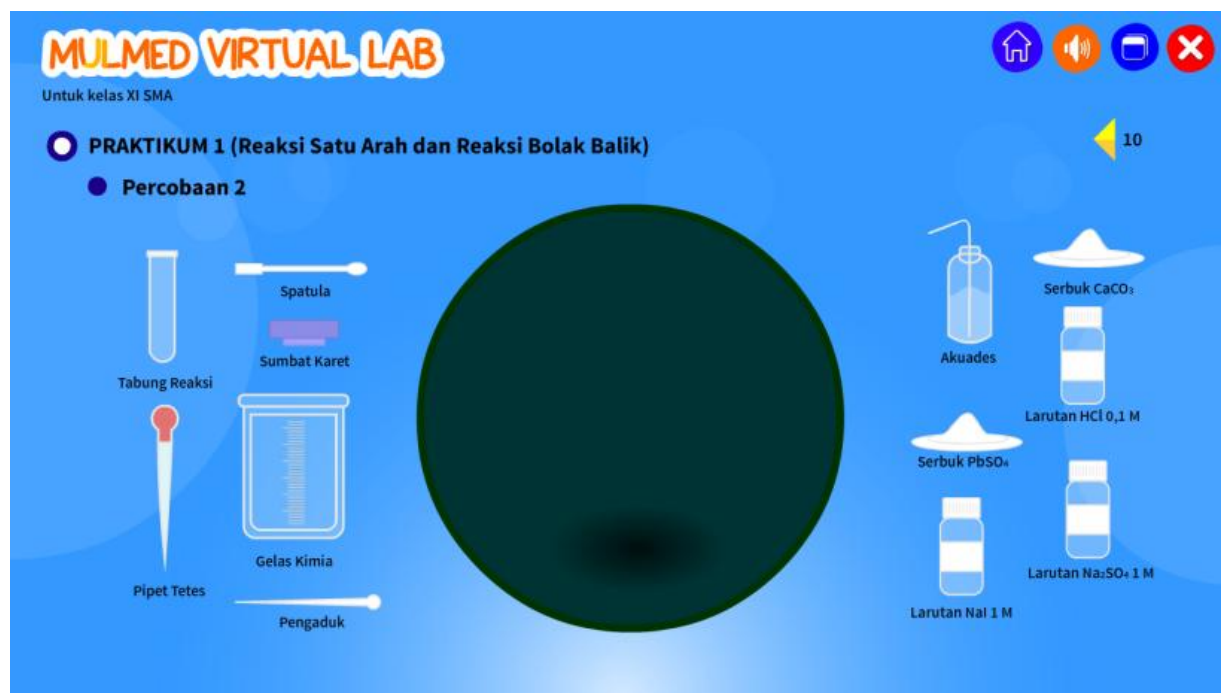


Figure 2: Practicum place activities

**MULMED VIRTUAL LAB**  
Untuk kelas XI SMA

**PRAKTIKUM 1 (Reaksi Satu Arah dan Reaksi Bolak Balik)**

**Materi**

Reaksi kimia dapat digolongkan menjadi reaksi bolak balik (reaksi reversible) dan reaksi satu arah (reaksi irreversible). Reaksi bolak-balik merupakan reaksi yang dapat berlangsung dua arah, yang menyatakan gabungan antara reaksi maju dan reaksi balik. Pada reaksi ini hasil reaksinya dapat berubah kembali menjadi pereaksinya. Reaksi bolak balik dapat juga disebut reaksi dua arah, reaksi dapat balik, atau reaksi kesetimbangan karena membentuk suatu kesetimbangan. Contohnya, pada reaksi timbal (II) sulfat padat yang berwarna putih bila direaksikan dengan larutan natrium iodida akan membentuk endapan timbal (II) iodida yang berwarna kuning dengan reaksi sebagai berikut.

$$\text{PbI}_2 (\text{s}) + \text{Na}_2\text{SO}_4 (\text{aq}) \rightarrow \text{PbSO}_4 (\text{s}) + 2\text{NaI} (\text{aq})$$

Figure 3: Chemistry equilibrium material

**MULMED VIRTUAL LAB**  
Untuk kelas XI SMA

**EVALUASI**

**Praktikum 1**

Nama : daniel  
Kelas : 11 Absen : 1

Bacalah soal dengan seksama dan perhatikan setiap perintah yang tertera di pertanyaan, Pilihlah jawaban dengan klik jawaban (a), (b), (c), (d) dan (e) ! Selamat Mengerjakan

1. Ciri-ciri suatu reaksi adalah sebagai berikut :

- Reaksi ditulis dengan satu anak panah ( $\rightarrow$ ).
- Reaksi berlangsung dari kiri ke kanan.
- Zat hasil reaksi tidak dapat dikembalikan seperti zat mula-mula.
- Reaksi baru berhenti apabila salah satu atau semua reaktan habis

Berdasarkan pernyataan tersebut maka reaksi tersebut merupakan reaksi ....

a Satu arah (reversible)  
b Bolak balik  
c Kesetimbangan  
d Satu arah (irreversible)  
e Kimia

TIMER 27

Figure 4: Evaluation questions

### Developing the preliminary form of a product

Based on the research that has been done, the average score obtained from the assessment of expert lecturers, chemistry teachers, peer reviewers, and students is then compared with the media validation category according to the ideal assessment criteria (Azwar, 2015) described in Table 1.

Table 1: Quality of Validation Media

No	Score Range (i)	Quality
1	$\bar{X} > Mi + 1,5 SBi$	Excellent
2	$Mi + 0,5 SBi < \bar{X} \leq Mi + 1,5 SBi$	Good
3	$Mi - 0,5 SBi < \bar{X} \leq Mi + 0,5 SBi$	Fair
4	$Mi - 1,5 SBi < \bar{X} \leq Mi - 0,5 SBi$	Poor
5	$\bar{X} \leq Mi - 1,5 Sbi$	Very Poor

Note:  $\bar{X}$  = average score;  $Mi = \frac{1}{2}$  (ideal max score + ideal min score);  $SBi = \frac{x}{2}$  (ideal max score + ideal min score)

### Media eligibility assessments from Lecturers

Table .: Media eligibility assessment by expert lecturer

No	Aspects	Score	Quality
1	Learning	3,8	Excellent
2	Material	3	Good
3	Visual and audio	3	Good
4	Software engineering	3,2	Good

Media eligibility assessments by members lecturers can be seen in Table 2. Based on the assessment of the expert presentation matter the learning aspect was 95% with a score of 3.8 while the aspect of the presentation matter was 75% with a score of 3. The results of the assessment from the matter experts for the learning aspects included excellent categories while the matter aspects included good categories. This can be seen from the input of matter experts regarding some additional improvements to the matter in the media.

The assessment of media experts for visual and audio aspects obtained a present value of 75% with a score of 3 while for the aspects of software engineering the presentation value was 80% with a score of 3.2. The results of the assessment from media experts for visual and audio aspects and software engineering were included in the good category. Inputs obtained from media experts were the background colors that were made more varied, the addition of background sound so as not to be monotonous, the use of laboratory tools and materials when practicum was something that needs to be improved, correcting sentences that were too long in the introduction.

### Media eligibility assessments from chemistry teachers and peer reviewers

Table 3: Media eligibility assessment by chemist teacher and peer reviewers

No	Aspects	Chemistry teachers	Peer reviewers	Quality
1	Learning	3,4	3,55	Excellent
2	Material	3,3	3,4	Excellent
3	The visual and audio	3,3	3,45	Excellent
4	The software engineering	3,25	3,5	Excellent
<b>Total Scores</b>		3,3	3,5	Excellent

Assessment by chemistry teachers and peer reviewers can be seen in Table 3. Based on the assessment of media feasibility that has been carried out by the chemistry teacher as many as 7 people, the assessment score for the learning aspect was 3.4 with a presentation of 85%. Matter aspects obtained an assessment score of 3.3 with a presentation of 82.5%. The visual and audio aspects of the score obtained were 3.3 with a presentation of 82.5% and aspects of software engineering were 3.25 with a presentation of 81.25%. The total scores obtained for inquiry-based virtual chemistry laboratory media from chemistry teachers by 3.3 with a presentation of 82.5% and an excellent category. While the media assessment from peer reviewers as many as 12 people

obtained an assessment score for the learning aspect of 3.55 with 88.75% presentation. The matter aspect of the assessment score obtained was 3.4 with a presentation of 85%. The scores for the visual and audio aspects obtained were 3.45 with a presentation of 86.25% and the last score for the software engineering aspect was 3.5 with a total 87.50%. Overall presentation for the media assessment conducted by peer reviewers of 3.5 with a presentation of 87.50% and an excellent category.

#### Evaluation of media readability

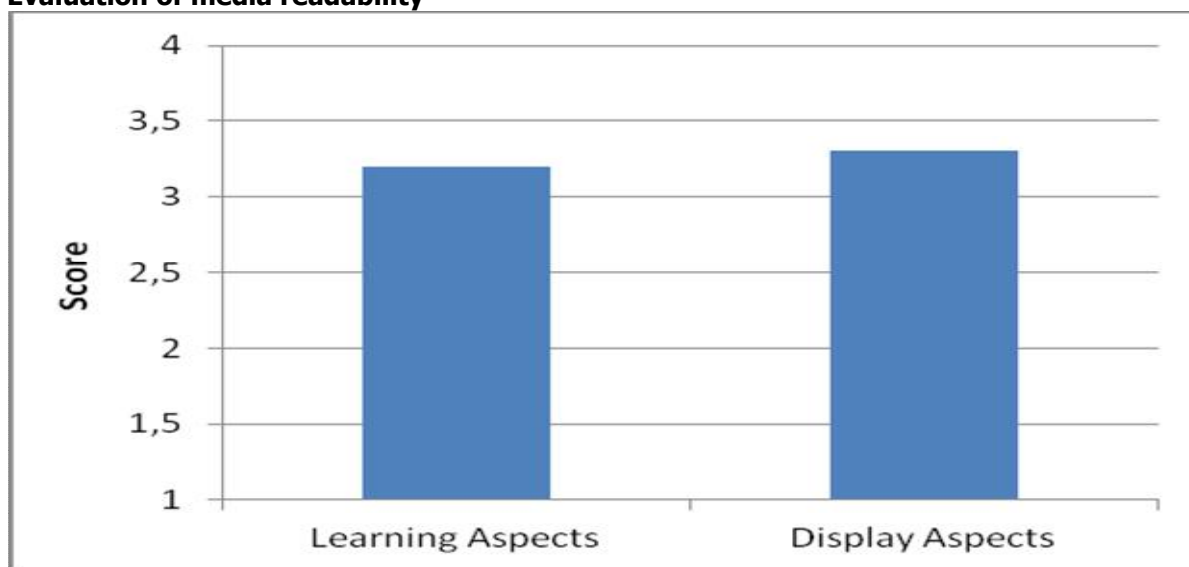


Figure 5: media readability by students

Inquiry-based virtual laboratory media that has been assessed and given input by matter experts, media experts, chemistry teachers, and peer reviewers was then revised. After the media was revised, the media was applied in schools to see students' assessment of the readability of the media. Evaluation of media readability by students can be seen in Figure 5. Based on the results of the assessment of media readability by students for aspects of learning obtained a score of 3.2 with 80% presentation while for the display aspect obtained a score of 3.33 with presentation 83.25%. The total score obtained from the assessment of media readability by students was 3.3 with presentations 82.50% and excellent categories.

A graph obtained for the total score of media assessment obtained from chemistry teachers, peer reviewers, and students can be seen in Figure 6.



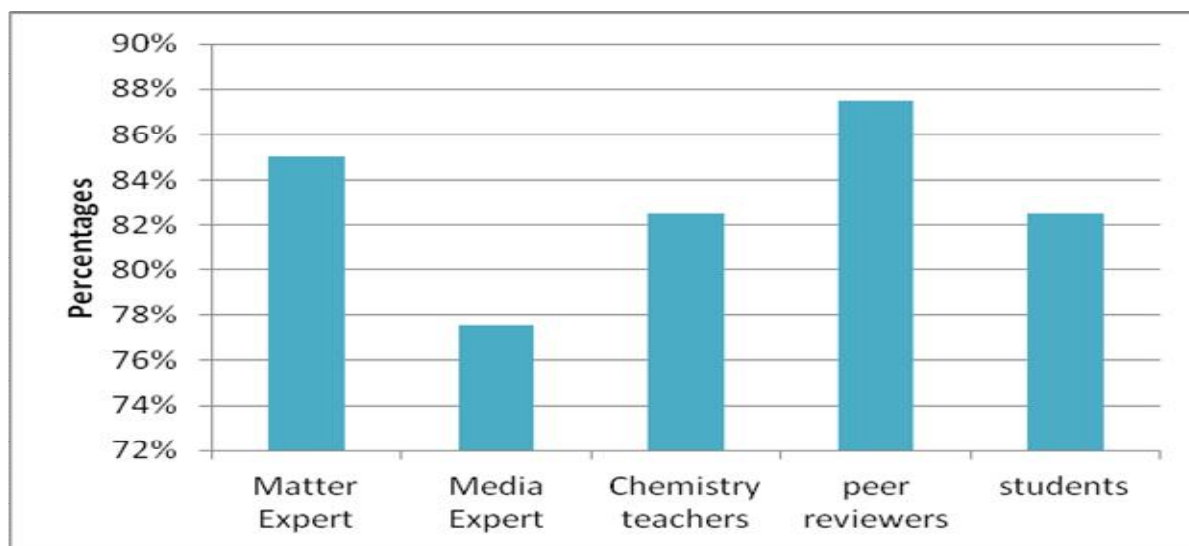


Figure 6: The total score of media assessment

Media scores provided by chemistry teachers, peer reviewers, and students then calculated the percentage ideal to find out the overall inquiry-based virtual chemistry laboratory media assessment. The formula for calculating ideal percentages is

$$\text{Ideal percentage} = \frac{\text{research score}}{\text{ideal maximum score}} \times 100\%$$

The ideal presentation for the inquiry-based virtual chemistry laboratory media as a whole was 83% so that it included an excellent category. Based on the results of the study, the inquiry-based virtual laboratory media is worthy of being used as one of the learning media for chemistry equilibrium in senior high school.

## DISCUSSION AND CONCLUSION

The development research that has been carried out obtained an inquiry-based virtual chemical laboratory media product. An assessment carried out by media experts, matter experts, chemistry teachers, peer reviewers and students obtained an overall ideal percentage of 83% which included an excellent category. The results of this study indicate that the inquiry-based virtual chemistry laboratory media developed can be used as one of the learning media for chemistry equilibrium in senior high school.

The use of technology-based media is able to make students more interested in the learning process. In addition, the use of technology for a short period of time in educational programs will make students get more benefits in the long term (Pekdag, 2010). Teachers who integrate ICT into the classroom learning process will attract students' attention because they rarely find these tools in their routine lives (Cereci, 2018). Technology can help teachers to deliver subject matter that is more diverse than using conventional methods. The limitations felt by the teacher in delivering the material can be overcome, one of them is by using technology.

Chemistry learning cannot be separated from practicum, but there are still teachers who cannot do lab work because of limitations in the laboratory. Therefore, teachers can use technology to overcome these problems. Virtual laboratory is one solution that can be done. The development of inquiry-based virtual laboratory media that has been developed can be used by teachers in conducting practicum in class so that it can facilitate teachers in carrying out the learning process. Students think that in the learning process using virtual laboratories, the animations used can help them better understand and remember the information obtained (Ambusaidi et al., 2018). Previous research by Bakar, Zaman, Kamalrudin, Jusoff, and Khamis (2013) regarding the development of

multimedia virtual reality laboratories for chemistry (VLab-Chem), the results of the study showed the level of learning achievement of students using Vlab-Chem was higher than with study groups that use conventional approaches. In addition, research from Bortnik, Stozhko, Pervukhina, Tchernysheva, and Belysheva (2017) shows that the virtual learning approach has the potential to improve the research skills and practices of students in analytical chemistry studies.

Inquiry-based virtual laboratories provide opportunities for students to construct material concepts especially chemical equilibrium through virtual simulation and practicum activities. Learning using inquiry-based virtual laboratories fosters confidence, develops the ability to think creatively and think critically in students (Junaidi, Gani, & Mursal, 2016). Practicum by using inquiry learning model makes students think more openly and critically. Students collect data when conducting research activities, conducting observations and testing data by practicing. Inquiry based science teaching is more interesting and motivates the students (Gibson and Chase, 2002).

The use of various methods, models, or media in the learning process is able to make students not easily bored in learning. However, the teacher must be able to choose the right teaching method for each subject matter delivered so that it is more easily understood by students. Combining different methods can develop students' understanding chemical subjects, especially chemical equilibrium so that they can help change their misconceptions (Demircioglu, 2013). The use of information, communication, and technology can be a good opportunity for chemical education programs, making it an effective tool for developing new methods and techniques in educational programs (Pekdag, 2010).

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## REFERENCES

- Ambusaidi, A., Musawi A.A., Al-Balushi, S., & Al-Balushi, K. (2018). The impact of virtual Lab learning experiences on 9<sup>th</sup> grade students' achievement and their attitudes towards science and learning by virtual Lab. *Journal of Turkish Science Education*, 15(2), 13-29. doi: 10.12973/tused.10227a.
- Azwar, S. (2015). *Penyusunan skala psikologi*. Yogyakarta: Pustaka Pelajar.
- Bakar, N., Zaman, H.B., Kamalrudin, M., Jusoff, K., & Khamis, N. (2013). An effective virtual laboratory approach for chemistry. *Australian Journal of Basic and Applied Sciences*, 7(3), 78-84.
- Bortnik, B., Stozhko, N., Pervukhina, I., Tchernysheva, A., & Belysheva, G. (2017). Effect of virtual analytical chemistry laboratory on enhancing student research skills and practices. *Reserach in Learning Technology*, 25, 1-20. doi: 10.25304/rlt.v25.1968.
- Cereci, S. (2018). Modern communication education: technological equipments. *International Journal on New Trends in Education and Their Implications*, 9(1), 9-16.
- Coffman, T. (2009). *Engaging students through inquiry-oriented learning and technology*. Lanham, MD: Rowman & Littlefield Education.
- Demircioglu, G., Demircioglu, H., & Yadigaroglu, M. (2013). An investigation of cemistry students teachers' understanding of chemical equilibrium. *International Journal on New Trends in Education and Their Implications*, 4 (2), 192-199.
- Gibson, H. L., & Chase, C., (2002). Longitudinal impact of an inquiry-based science program on middle school students' attitudes toward science. *Science Education*, 86(5), 693– 705.
- Herga, N.R., Cagran, B., & Dinevski, D. (2015). Virtual laboratory in the role of dynamic visualisation for better understanding of chemistry in primary school. *Eurasia Journal of Mathematics, Science, & Technology Education*, 12(3), 593-608. doi: 10.12973/eurasia.2016.1224a.
- Junaidi, Gani, A., Mursal. (2016). Model virtual laboratory berbasis inkuiri untuk meningkatkan keterampilan generik sains siswa MA. *Jurnal Pendidikan Sains Indonesia*, 4(2), 130-136.
- Kambeyo, L. (2017). The possibilities of assessing students' scientific inquiry skills abilities using an online instrument: a small-scale study in the omusati region, namibia. *European Journal of Educational Sciences*, 4(2), 1-21. doi: 10.19044/ejes.v4no2a1.
- Kirschner, P., & Huisman, W. (1998). Dry laboratories in science education: computer-based practical work. *International Journal of Science Education*, 20(6), 665-682. doi: 10.1080/0950069980200605.
- Leal, S., & Leal, J.P. (2013). One example of a chemistry e-lab experiment: chemical equilibrium reaction. *International Journal of Online Engineering*, 9 (8). doi:10.3991/ijoe.v9iS8.3380.
- Lee, A.Y.L. (2016). Media education in the school 2.0 era: teaching media literacy through laptop computers and iPads. *Global Media and China*, 1-15. doi: 10.1177/2059436416667129.
- Lou, Y., Blanchard, P., & Kennedy, E. (2015). Development and validation of a science inquiry skills assessment. *Journal of Geoscience Education*, 63(1), 73-85. doi: 10.5408/14-028.1.
- Lukac, S. (2015). Stimulation of the development of inquiry skills in teaching functions. *ICTE Journal*, 4(4), 4-18. doi: 10.1515/ijicte-2015-0016.



- Minner, D.D., Levy, A.J., & Century, J. (2010). Inquiry-based science instruction-what is it and does it matter? results from a research synthesis years 1984 to 2002. *Journal of Research in Science Teaching*, 47, 474-496. doi: 10.1002/tea.20347.
- Mumba, F., Chabalengula, V.M., & Wise, K. (2007). Analysis of new zambian high school physics syllabus and practical examinations for levels of inquiry and inquiry skills. *Eurasia Journal of Mathematics, Science & Technology Education*, 3(3). 213-220. doi: 10.12973/ejmste/75400.
- National Research Council. (1996). *National science education standards*. Washington, DC: National Academy Press.
- Oliver, R. (2007). Exploring an inquiry-based learning approach with first-year students in a large undergraduate class. *Innovations in Education and Teaching International*, 44, 3-15. doi: 10.1080/14703290601090317.
- Pardo, J.P., & Portoles, J.J.S. (1995). Students' and teachers' misapplication of Le Chatelier's principle: Implications for the teaching of chemical equilibrium. *Journal of Research in Science Teaching*, 32, 939-957. doi: 10.1002/tea.3660320906.
- Pekdag, B. (2010). Alternative methods in learning chemistry: learning with animation, simulation, video and multimedia. *Journal of Turkish Science Education*, 2(2), 111-118.
- Prince, M., & Felder, R.M. (2007). The many faces of inductive teaching and learning. *Journal of College Science Teaching*, 36, 14-20.
- Rajendran, L., Veilumuthu, R., & Divya.(2010). A study on the effectiveness of virtual lab in E-learning. *International Journal on Computer Science and Engineering*, 2(6), 2173-2175.
- Rusman. (2012). *Belajar dan pembelajaran berbasis komputer mengembangkan profesionalisme abad 21*. Bandung: Alfabeta.
- Solomonidou, C., & Stavridou, H. (2001). Design and development of a computer learning environment on the basis of students' initial conceptions and learning difficulties about chemical equilibrium. *Education and Information Technologies*, 6(1), 5-27. doi: 10.1023/A:1011359010331.
- Treagust, D.F., Tyson. L., & Bucat, R. (1999). The complexity of teaching and learning chemical equilibrium. *Journal of Chemical Education*, 76(4), 554-558. doi: 10.1021/ed076p554.
- Tresna, S. (1998). *Proses belajar mengajar kimia*. Jakarta: Depdikbud.
- Tuysuz, C. (2010). The effect of the virtual laboratory on students' achievement and attitude in chemistry. *International Online Journal of Educational Sciences*, 2(1), 37-53.
- Wenning, C.J. (2007). Assessing inquiry skills as a component of scientific literacy. *J. Phys. Tchr. Educ. Online*, 4(2), 21-24.
- Wu, H.K., & Hsieh, C. (2006). Developing sixth graders' inquiry skills to construct explanations in inquiry-based learning environments. *International Journal of Science Education*, 28 (11). 1289-1313. doi: 10.1080/09500690600621035.
- Zulfiani, Z., & Herlanti, Y. (2018). Scientific inquiry perception and ability of pre-service teachers. *Journal of Turkish Science Education*, 15(1), 128-140. doi: 10.12973/tused.10225a.

## **STUDENTS' PERCEIVED EFFECTIVENESS OF AN ONLINE COURSE DELIVERED THROUGH MOODLE**

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### **Abstract**

This study analyzed students' perceived effectiveness of an online course delivered through one of the open source course content management system, Moodle. Students' expectations, perception, comments and suggestions about Moodle were investigated in this study. This is a case study carried out 49 students who attended to "Foundation of Distance Education" course in a summer school and 29 students who attended to the same course in the following fall semester at Computer Education and Instructional Technology at Middle East Technical University. Blended learning that combines face-to-face interaction and online learning was used in the course.

In this study, both qualitative and quantitative data were gathered from the students attended to the study through questionnaire and interview. The results of the study indicated that the majority of the students had positive attitudes towards Moodle and its application.

**Keywords:** Moodle, Blended course, Web-based instruction, Collaborative learning.

### **INTRODUCTION**

Advances of information technology have affected the educational life. Throughout the past decade, many tools and media come into existence into the educational area. These technological tools and media allow instructors to give more effective online courses. Multimedia and computer network made learning easier and more convenient to use (Chang & Tung, 2008). World Wide Web provides opportunities for instructors to create well-designed, learner-centered, engaging, interactive, affordable, efficient, easily accessible, flexible, meaningful, distributed and facilitated learning environments (Khan, 2001). In addition, e-learning provide opportunities to improve teaching and learning process (Govindasamy, 2002). It is available, and offers training at anytime and anywhere to anyone. It offers training to the right person with competent technical ability or knowledge at the right time (Chang & Tung, 2008). With the help of these technologies, higher education institutions can begin to offer a number of distance-education opportunities to meet the needs of increasingly high numbers of these nontraditional students (Khan, 1997). Web-based Learning Environments supported by the Course Content Management Systems (CCMS) have become solutions for institutions, schools and universities that want to offer e-learning or supported blended-learning activities (Botturi, Mazza, & Tardini, 2007). The main advantage of the CCMS is that they are designed by the educators so that they are seen as effective tools in learning process (Flood, 2007). These tools help educators to build communities of learners and construct community of knowledge using web-based templates. (Gunawardena & McIsaac, 2003). Most of the schools, companies use CCMS technologies for their educational purposes. Moodle can be given as an example for these kinds of course content management systems.

Moodle is open source course content management system software which is aimed to help educators to create collaborative, interactive learning environment in order to support their classroom courses (Maikish, 2006). The verb Moodle stands for "Modular Object-Oriented Dynamic Learning Environment". Besides, it describes "the process of lazily meandering through something, doing things as it occurs to you to do them, an enjoyable tinkering that often leads to insight and creativity" (Cole & Foster, 2007). According to Buddie (2006), traditional learning approaches cause ineffective learning since they enhance passive transfer of knowledge from master to learner. However, Moodle provides an environment that allows the tutor to create core resources and activities which guide the students. He stated that many schools prefer Moodle due to plethora of activities it provides (Tuzi, 2007).

Moodle was created by Martin Dougiamas who has postgraduate degrees in Computer Science and Education. It has over 100 gradable activity modules and plugins (Tuzi, 2007) and designed based on a social constructivist theory. For this reason, it is learning-centered while most of the course content management systems are tool-centered. It offers a range of software modules and several features that help tutors to create online courses (Cole & Foster, 2007). Wiki, quiz, assignments, glossaries, and chats can be given as example to these features. ,

Additionally, it addresses the need for pedagogical support. It helps the tutor to create constructivist student-centered learning environments where students learn from his or her own experiences (Monahan, McArdle, & Bertolotto, 2008). Moodle offers 70 language options and each site of Moodle can host 200,000 students (Moodle, 2008). Due to all these reasons, more than 30,000 educational organizations around the world currently use Moodle in order to deliver online courses or support traditional face-to-face courses (Monahan, McArdle, & Bertolotto, 2008).

Although Moodle is becoming more popular across the universities, the effectiveness of Moodle from students' perspectives was not analyzed deeply. The main assumption of this study is that without knowing what problems students face when they use Moodle or other course management programs or the perceptions of the students towards these kinds of programs, it is very difficult to build effective online learning communities. For this reason, there is a need to investigate the students' perception towards Moodle program to take the advantages of e-learning.

The purpose of the study is to analyze the effectiveness of the Moodle program in blended learning environment blended online learning and traditional learning. The researcher tries to illustrate the effectiveness of Moodle from the students' perspectives.

The study addressed the following specific research questions;

- What are the students' perceptions about the effectiveness of Moodle in online learning environment?
  - a) What are the students' perceptions about communication through Moodle?
  - b) What are the students' perceptions about user interface, ease of access, user control, freedom in the Moodle?
  - c) What are the students' perception about diagnose, recover from errors in Moodle?
  - d) What are the students' perception of Moodle and its applications?

## METHOD

### Research Design

This study was conducted two times in a year in Summer and Fall at Middle East Technical University in Ankara, Turkey. The total number of students who were enrolled to the course was 49 in summer school and 29 in fall semester. All students were computer literate. Table 1 presents the demographic characteristics of the students.

### Procedures

Before the study started, the students were informed about the procedures of the course. Blended learning method which blended face-to-face learning with online learning was used in the course. In

the classroom, the students were offered with a face-to-face traditional lecturing of two hour lessons. The instructor discussed the main points of the week topic with the students by using lecturing methods to teach the concepts of the distance education in this face-to-face traditional learning environment.

In the online part of the course, the students used Moodle as the course web site. Students could access the Moodle in 24 hours at seven days. Each week, the instructor uploaded the new course topic and content to the course web site prepared by using Moodle application. By this, students read the necessary materials before face-to-face lecture and were prepared for the face-to-face lessons. In addition to that, instructor uploaded discussion questions to encourage the students to share their knowledge with each other and instructor. Discussion activities were conducted via the forums and wiki in asynchronous mode. Students discuss about the concepts and topics of distance education every week based on the questions posed by the instructor at the beginning of the week. By such kind of activities, students generated and expanded their knowledge. Moreover, to understand the students' knowledge, the instructor uploaded the assignments in the Moodle. Students had to do assignments and uploaded it to Moodle before the due date of the assignments. After the due date Moodle did not allow the students to upload their assignments. Furthermore, they took the quizzes that include questions related with the topic of the week in every week. The quiz was opened in two days period and the students could take the quizzes whenever they want. The results of the quiz and the scores of the students were sent to the students immediately so that they could see their performance in the quizzes without delay.

### **Data Collection**

In this study, both qualitative and quantitative data is collected from the participants. The students were given 5-point Likert type questionnaire which contains 66 items both at the end of the summer school and fall semester. The questionnaire was in English and the items in the questionnaire were prepared according to the previous research studies in this field. The items in the questionnaire were adapted from the measurement defined by Ham (2002, cited in Çetiz, 2006) and Pierrotti (1995, cited in Kavaklı, 2004). The mean values of the items were calculated separately for both summer school and fall semester.

A semi-structural interview was carried out with 10 volunteer students to get deep understanding of students' perception about the Moodle application. The questions were prepared according to the previous research done by Çetiz (2006) and they were checked by two experts in CEIT department. The questions in the interview were in Turkish. By this, the researchers aimed to make the students feel comfortable while they were expressing themselves during the interview process.

### **RESULTS**

The items in the questionnaire were categorized into 7 main topics and the data gathered through questionnaire and interviews were analyzed based on these categories.

#### **Course, Objectives and Content of the Course CEIT321 and Online Course**

The data gathered from the questionnaire showed that students' perception about the course, objectives and content of the course were positive to some extent. Most of the students in the study agreed that the objectives of the course were clear and achievable. Moreover, they thought that the course was interesting and they gained the necessary skills that were useful in their professional life. In addition, they stated that accessing online lecture notes made positive contribution to their learning. This result was expected since the students could access the lecture notes wherever and whenever they wanted by accessing Moodle via the internet. However, though most of the students thought that online lessons were not boring and they were more convenient, they were neutral or disagreed with the statement that online lectures were better learning experiences than traditional learning. This response can be explained by looking at the number of online courses that students had taken prior to the study. Most of the students did not take any online courses before. In other

words, they did not experience any online course so they may not be objective when they compare the traditional learning experiences and online learning experiences. Their responses may be changed after getting several online courses.

The results of the questionnaire showed that students had positive perceptions about Moodle. They believed that Moodle was appropriate for the course and it was a good way to learn the topics of the course. Moreover, students' perceptions about online lecture were positively increased when it was given through Moodle. The reason for this perception change is that most of the students liked Moodle. The positive perception about Moodle may cause the positive perception of students about online learning through Moodle. Nearly half of the students in the study believed that Moodle were more advantageous than traditional learning and more than half of the students recommended online course given through Moodle.

### **Communication through Moodle**

Students had positive perception about the communication opportunities that Moodle provided. Most of the participants of the study thought that Moodle provided opportunities to interact with their friends and/or their instructor.

Moore (1989) stated that learner-learner interaction and learner-instructor interaction are two essential interactions in distance education. In the researches, it is founded that the level of interaction affects the quality of the learning experience (Navarro & Shoemaker, 2000). For this reason, all the system that is used for delivering online courses have to provide opportunities for students to interact with their classmates and instructor during the learning process. To achieve this, Moodle includes several asynchronous and synchronous communication modules such as forums, discussion boards, and chat tools. Most of the students in the survey stated that these modules were easy to use and helped them a lot in their learning process. These tools not only provide opportunities to interaction, but also help students to construct their knowledge by sharing their ideas with their classmates and instructor. Clark and Mayer (2003) stated that collaborative tools such as discussion boards, forums support learning of course content and causes knowledge management function by encouraging learners to exchange their own experiences related to the course topic. Moreover, they stressed that learning through knowledge exchange is a valuable feature of online learning. When the students were asked which tools they used to communicate with their friends in the interview, all of the participants stated that they did not used chat tools of Moodle for communication. Instead of it, they used forums and wiki tools to interact with their friends. Students stressed that they did not need to use chat tools. If they encountered a problem during the learning process, they just wrote to the forum and waited for the answers. Blended learning environments may cause this situation. First of all, the students met every week with their friends and instructor. In these meeting, they could discuss about their problems they had encountered during the week. Moreover, most of the participants were in the same departments so that they had chance to communicate with their peers face to face.

### **Help and Prevention, Diagnose, Recover from Errors in Moodle**

The results of the questionnaire distributed to the students showed that there should be improvements related with the error messages and prompts in Moodle. Nielson (1994) stressed that the error messages in any system should be expressed in plain language instead of codes, it should state the problem, and constructively suggest a solution to solve the problem. However, the results showed that students were neutral about the error messages in Moodle. According to them, there were few error messages and they did not be warned about the error encountered whey they were using Moodle. Moreover, the system did not warn the user about the severity of their actions and it did not inform the students what steps they should follow to recover from the errors.

Since these systems may be used by the novice students who have basic computer knowledge, there must be plenty of error messages which indicated the cause and severity of error, and the needed steps to recover the error. Otherwise, the novice students may be distracted when they faced a



problem while they were using Moodle and it may cause the undesired events such as decrease of students' motivation to the course.

### **User Interface, Ease of Access, User Control and Freedom in the Moodle**

The students had positive perception about easement of access and freedom in the Moodle. The students' responses showed that they were able to access Moodle whenever they needed. Participants of this study thought that Moodle was easy to use and it provided opportunities to navigate easily in the system.

Çağıltay, Graham, Lim, and Craner (1999) stated that users need to clearly shown what their current location is. Moodle shows the current location of the user in every window. Moreover, they can easily jump between the pages. Although students were satisfied with the system, they had problems related with the interface of Moodle. In the interviews, the participants emphasized that there were problems with the appearance of Moodle. The system did not allow the instructor to change the color or size of the links in the system. The students said that the important links they frequently used such as wiki, forums should be highlighted to take the students attention. The system should provide opportunities to change the color and size of the links.

### **Help and Documentation**

Students had positive perception about the documentation and help function of Moodle to some extent. According to Nielson (1994) stated that the system which is used without documentation is preferable. However, he stated that sometimes it may be necessary to provide help and documentation. In these situations, the information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.

More than 70% of the students in this study thought Moodle provide necessary help and documentation for them. The responses of the students showed that most of the students did not face problems when they tried to access the materials in Moodle and they could find the necessary information whenever they needed.

### **Moodle and its Applications**

The study indicated that students' perception about Moodle and its application can be accepted as positive to some extent. Most of students in this study agreed on the applications of Moodle were helpful to gain the necessary skills in their future.

Moodle provide valuable experiences for students in their learning process. Since students can access Moodle easily whenever they want, Moodle gave the opportunities to students to study at their own rate, whenever and wherever they wanted. In the interview, one student said;

*Moodle gave student ease when they were taking a course. It was independent from the instructor and you could access the resources whenever you wanted. Because of these reasons, I recommended Moodle to other people*

Moreover, students can get feedback from many resources such as forums, wiki, quizzes in Moodle. Feedback is the necessary part of a distance learning system (Schlosser & Anderson, 1994). As stated by Çağıltay, Graham, Lim, and Craner (1999), prompt feedback is the primary principle of determining the quality of instruction.

Moodle allows students to take online quizzes. According Horton (2000), taking online quizzes has most of advantages. Online test help the instructor to show the important parts of the course to the students so that learners are motivated to focus on these parts. Moreover, it helps the instructor to understand the success of parts of the course and provide opportunities to the learner to master the certain knowledge and skills. Lynch (2002) stated that the main advantage of using a computer-marked quiz is instant feedback. According to him, that feedback can be just right and wrong marks, or it can be advice for remediation, explanations of what they did wrong, and reinforcement for what

was correct. In the interview the students said that quiz application helped them much in their learning process since they could take them whenever and wherever they wanted. They stated that they could get immediate feedback from the quiz. Moodle informed the students about their performances and showed the answers of the questions when they completed the quiz. One of the students stated that;

*Quiz was super. We could take the quizzes whenever we wanted. The questions were in order and we got immediate feedback after the quiz. It helped us a lot.*

Moodle provides opportunities for students to benefit from the advantages of wiki technologies. According to Klobas and Beesley (2006) wiki is not only a means of communicating ideas but also a resources for sharing, storing, retrieving knowledge among its members. The questionnaire distributed in this study showed that students had positive attitudes towards wiki application of Moodle. Most of the students thought that wiki was easy to access and use, and it helped them to gain the necessary skills. Moreover, in the interviews the students emphasized the benefits of wiki application. According to them wiki was one of the most important application of Moodle. They stated that it helped them to share their knowledge and gave feedback to each other.

Finally, Moodle helped the learners to manage their time in their learning process. Management of time is one of the most important skills needed for online courses. Çağıltay, Graham, Lim, and Craner (1999), states that learning results from time spending on task. Due to this reason, students need to know how to use their time well. They needed help for their time management skills. Calendar application of Moodle helps the students to develop their time management skills. Moodle includes a calendar which warns the students about the occasions of the month. Students had positive perception about the calendar application of Moodle. In the interview, they stated that calendar helped them to see what they had to do until a specific time, what event was coming next. So that they could manage their time in order to do their assignments.

## DISCUSSION & CONCLUSION

This study aimed to analyze the effectiveness of the Moodle program in blended learning environment, blended online learning and traditional learning. The researchers tried to illustrate the effectiveness of Moodle from the students' perspectives. Based on the data, the followings are concluded:

- The instructor should consider the background computer knowledge of the students who will use Moodle as the course material during the semester. As stated by the students, novice users may be confused while they are using Moodle. At the beginning of the semester, an orientation about how to use Moodle effectively should be given to the students.
- Moodle should be redesigned in order to take the students' attention. Multiple visual, textual, auditory, authentic activities should be added to improve the students' attention and enhance students learning. Instructor should add challenging activities, discussion topics, and weekly assignments in order to make the students follow the course web site and master the new concepts and skills regularly and let the students understand the concepts clearly.
- Instructor should provide discussion environments where students share and construct their knowledge. Instructor should let the students discuss about the specific content through forums or wiki to increase the knowledge of the students.

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## REFERENCES

- Botturi, L., Mazza, R., & Tardini, S. (2007). FOSLET 07- Workshop on free and open source learning environments and tools. Springer Boston.
- Buddie, D. (2006). Zalatwic-Using Moodle to accomplish things. Retrieved February 2008, 25, from Association for Learning Technology: [http://newsletter.alt.ac.uk/e\\_article000519949.cfm](http://newsletter.alt.ac.uk/e_article000519949.cfm)
- Chang, S., & Tung, F. (2008). an Empirical Investigation of Students' Behavioral Intentions to Use the Online Learning Course Websites. British Journal of Educational Technology , 39 (1).
- Clark, R. C., & Mayer, R. E. (2002). E-learning and the Science of Instruction. Jossey-Bass/Pfeiffer.
- Cole, J., & Foster, H. (2007). Using Moodle (2nd Edition b.). O'Reilly.
- Çağıltay, K., Graham, C. R., Lim, B., Craner, J., & Duffy, T. The Seven Principles of Good Practice: A Practical Approach to Evaluating Online Courses. Hacettepe University Journal of Education , 20(2), 40-50.
- Çetiz, İ. D. (2006). Students' and Instructor's Perception of a Blended Course. Unpublished Master Thesis, Middle East Technical University, Turkey.
- Flood, J. (2007). Online Learning Software-Why Pay for it? Turkish Online Journal of Distance Education-TOJDE , 8 (1).



Govindasamy, T. (2002). Successful Implementation of E-learning Pedagogical Considerations. *Internet and Higher Education* , 4, 287-299.

Gunawardena, C. N., & McIsaac, M. S. (2003). Distance Education. In Jonassen, *Handbook of Research* (2nd edition ed.). Lawrence Erlbaum Associates.

Horton, W. (2000). *Designing Web-Based Training: How to Teach Anyone, Anywhere, Anytime*. Wiley Computer Publications.

Kavaklı, H. (2004). a Course-Content Management System Development and Its Usability. Unpublished Master Thesis, Middle East Technical University, Turkey.

Khan, B. H. (1997). *Web-Based Instruction*. Educational Technology Publications.

Khan, B. H. (2001). *Web-Based Training*. Educational Technology Pubns.

Klobas, J. E., & Beesley, A. (2006). Wikis: tools for information work and collaboration. Chandos Publishing.

Lynch, M. M. (2002). *The online educator: a guide to creating the virtual classroom*. RoutledgeFalmer.

Maikish, A. (2006). Moodle: A Free, Easy, and Constructivist Online Learning Tool. *Multimedia & internet@schools* , 13 (3), 26.

Monahan, T., McArdle, G., & Bertolotto, M. (2008). Virtual reality for collaborative e-learning. *Computers & Education* , 50 (4), 1339-1353.

Moodle, (2008). Moodle Community. Retrieved March 3, 2008, from <http://moodle.org/>

Moore, M. G. (1989). Editorial: Three types of Interaction. Retrieved September 23, 2008, from concepta: [http://aris.telug.quebec.ca/Portals/598/t3\\_moore1989.pdf](http://aris.telug.quebec.ca/Portals/598/t3_moore1989.pdf)

Navaro, P., & Shoemaker, J. (2000). Policy Issues in the Teaching of Economics in Cyberspace: Research Design, Course Design, and Research Results. *Contemporary Economic Policy* , 18 (3), 359-366.

Nielson, J. (1994). Usability Inspection Methods. Conference companion on Human factors in computing systems (s. 413-414). Boston, Massachusetts, United States: ACM.

Schlosser, C. A., & Anderson, M. L. (1994). *Distance Education: Review of the Literature*. AECT Publication Sales.

Tuzi, F. (2007). Educators Can Manage Course Content With Moodle. Retrieved March 4, 2008, from Linux.com: <http://www.linux.com/articles/59729/>



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