PROCEEDINGS
International Conference
Asosiasi Pendidikan Teknologi dan Kejuruan Indonesia (APTEKINDO) 2018

Theme:
"Revitalization of Technical and Vocational Education to Face Industrial Revolution 4.0"

Steering Committee:
Prof. Dr. Warsono, M.S. (Universitas Negeri Surabaya)
Dr. Sc.agr. Yuni Sri Rahayu, M.Si. (Universitas Negeri Surabaya)
Dr. Ketut Prasetyo, M.S. (Universitas Negeri Surabaya)
Prof. Dr. Djodjok Soepardjo, M.Litt. (Universitas Negeri Surabaya)
Prof. Dr. Ekohariadi, M.Pd. (Universitas Negeri Surabaya)
Prof. Dr. Muchlas Samani, M.Pd.(Universitas Negeri Surabaya)
Prof. Dr. Harun Sitompul, M.Pd. (Universitas Negeri Medan)
Dr. Fahmi Rizal, M.Pd., M.T. (Universitas Negeri Padang)
Ernawati, Ph.D. (Universitas Negeri Padang)
Dr. Agus Duddung, M.Pd. (Universitas Negeri Jakarta)
Prof. Dr. M. Syaom Barliana (Universitas Pendidikan Indonesia)
Dr. Widarto, M.Pd. (Universitas Negeri Yogyakarta)
Dr. Nur Qudus, M.T. (Universitas Negeri Semarang)
Prof. Dr. Joko Nurkamto, M.Pd. (Universitas Negeri Surakarta)
Dr. Andoko, S.T., M.T. (Universitas Negeri Malang)
Dr. I Gede Sudirta, S.Pd., M.Pd. (Universitas Pendidikan Ganesha)
Prof. Dr. Muh. Yahya, M.Eng. (Universitas Negeri Makassar)
Prof. Dr. Herry Sumual, M.Si. (Universitas Negeri Manado)
Moh. Hidayat Konioy, S.T., M.Kom. (Universitas Negeri Gorontalo)
Dr. Debroa, M.Pd. (Universitas Palangka Raya)
Dr. Made Pasa, M.Pd. (Universitas Nusa Cendana)
Dra. Yuli Heirina, M.Pd. (Universitas Syiah Kuala)
Prof. Dr. Drs. Ir. H. Kusnan, S.E., M.T., M.M. (Universitas Negeri Surabaya, Indonesia)
Prof. Dr. Ir. Aisyah Endah Palupi, M.Pd. (Universitas Negeri Surabaya, Indonesia)

Organizing Committee
Drs. Tri Wrahatnolo, M.T., M.Pd.
Dra. Juhrah Singke, M.Si.
Puput Wanarti Rusimamto, S.T., M.T.
Rina Harimurti, S.Pd., M.T.
Hendra Wahyu Cahyaka, S.T., M.T.
Drs. Budihardjo Achmadi H., M.Pd.
Wiyl Yustanti, S.Si., M.Kom.
I Made Suartana, S.Kom., M.Kom.
Dodik Arwin Dermawan, S.ST., S.T., M.T.
Mahendra Widyartono, S.T., M.T.
Rifqi Firmansyah, S.T., M.T.
Wahyu Dwi Kurniawan, S.Pd., M.Pd.
Reza Rahmadian, S.ST., M.Eng.
Ricky Eka Putra, S. Kom., M.Kom.
Imami Arum Tri Rahayu, S.Pd., M.Pd.
Amalia Ruhana, S.P., M.Ph.
Choirul Anna Nur Afifah, S.Pd, M.Si.
Yuyun Irawati, S.Pd., M.Pd.
Dwi Fatrianto, S.Kom, M.Kom.
Rahardian Bisma, S.Kom, M.Kom.
Ibnu Febri Kurniawan, S.Kom, M.Kom.
Widi Aribowo, S.T., M.T.
Yeni Anistyasari, S.Pd, M.Kom.

Editor:
Arie Wardhono, ST., M.MT., MT., Ph.D.
Dr. Lilik Anifah, S.T., M.T
Dr. Mutimmatul Faidah, M. Ag.

Reviewer:
Prof. Dr. Ekohariadi, M.Pd. (Universitas Negeri Surabaya)
Prof. Dr. Suparji, S. Pd., M.Pd. (Universitas Negeri Surabaya)
Dr. Mochamad Cholik, M.Pd. (Universitas Negeri Surabaya)
Dr. Eng. Asep Bayu Dani Nandiayanto, S.T., M.Eng. (Universitas Pendidikan Indonesia)
Dr. Ana, M.Pd. (Universitas Pendidikan Indonesia)
Prof. Dr. Henita Rahmayanti, M.Si. (Universitas Negeri Jakarta)
Dr. Eng. Agus Setiawawan, M.Si. (Universitas Pendidikan Indonesia)
Prof. Herman Dwi Surjono, M.Sc., Ph.D. (Universitas Negeri Yogyakarta)
Dr. Putu Sudira, M.P. (Universitas Negeri Yogyakarta)
Dr. Dwi Widjionarko (Universitas Negeri Semarang)
Dr. Eko Supraptono (Universitas Negeri Semarang)
Prof. Dr. Amat Mukadis (Universitas Negeri Malang)
Prof. Dr. Waras Kamdi (Universitas Negeri Malang)
Prof. Dr. Gufran D. Dirawan, E.MD. (Universitas Negeri Makasar)
Prof. Dr. Sapto Haryoko, M.Pd. (Universitas Negeri Makasar)
Prof. Dr. Nizwardi Jalimus M.Ed. (Universitas Negeri Padang, Indonesia)
Prof. Dr. Efendi Napitupulu, M.Pd. (Universitas Negeri Medan, Indonesia)
Prof. Dr. Sumarno, M.Pd. (Universitas Negeri Medan, Indonesia)
Prof. Dr. Sanggarm R.I. Manalu, M.Pd. (Universitas Palangkaraya)
Prof. Dr. Muh. Nur (Universitas Negeri Surabaya, Indonesia)
Prof. Dr. Munoto, M.Pd. (Universitas Negeri Surabaya, Indonesia)
Prof. Dr. Ismet Basuki, M.Pd. (Universitas Negeri Surabaya, Indonesia)
Dr. M. Bruri Triyono, M.Pd. (Universitas Negeri Yogyakarta)
Prof. Dr. Supari Muslim, M.Pd. (Universitas Negeri Surabaya, Indonesia)
Prof. Dr. Luthfiyah Nurlaela, M.Pd. (Universitas Negeri Surabaya)
Prof. Dr. E. Titiek Winanti, MS. (Universitas Negeri Surabaya)
Prof. Dr. Ir. I Wayan Susila, M.T. (Universitas Negeri Surabaya)
Prof. Dr. Bambang Suprianto, MT. (Universitas Negeri Surabaya)
Dr. Rita Ismawati, M.Kes. (Universitas Negeri Surabaya)
Dr. Mutiimmamatul Faidah, M.Pd.(Universitas Negeri Surabaya)
Khairuddin, S.T., M.T., Ph.D. (Universitas Negeri Yogyakarta)
Dr. Sri Handayani, M.Kes. (Universitas Negeri Surabaya)
Dr. Maspiyah, M.Kes. (Universitas Negeri Surabaya)
Arie Wardono, M.MT., MT., Ph.D. (Universitas Negeri Surabaya)
Dr. Nanik Estidarsani, M.Pd. (Universitas Negeri Surabaya)
Dr. Lilik Anifah, MT. (Universitas Negeri Surabaya)
Dr. Ratna Wardani, MT. (Universitas Negeri Yogyakarta)
Dr. I.G.P. Asto B., MT. (Universitas Negeri Surabaya)
Yeni Anistyasa, S.Pd., M.Kom. (Universitas Negeri Surabaya)
I Made Suartana, S.Kom., M.Kom. (Universitas Negeri Surabaya)
Dr. Meini Sondang, M.Pd. (Universitas Negeri Surabaya)
Dr. Patchul Arifin, MT. (Universitas Negeri Yogyakarta)
Dr. H. Hakken Elmunsyah, ST., MT. (Universitas Negeri Malang)
Aji Prasetya Wibawa, S.T., M.M.T., Ph.D. (Universitas Negeri Malang)
Eppy Yundra, MT., Ph.D. (Universitas Negeri Surabaya)
Unit Three Kartini, MT., Ph.D. (Universitas Negeri Surabaya)
Dr. Euis Ismayati, M.Pd. (Universitas Negeri Surabaya)
Dr. Tri Rijanto, M.Pd., MT. (Universitas Negeri Surabaya)
Rooselyna Ekawati, Ph.D. (Universitas Negeri Surabaya)
Dr. Elly Matul Imah, MT. (Universitas Negeri Surabaya)
Syafi’ul Anam, Ph.D. (Universitas Negeri Surabaya)
Dr. Muhaji, M.Pd. (Universitas Negeri Surabaya)
Dr. Thedorus Wiyanto, M.Pd. (Universitas Negeri Surabaya)
Dr. Djoko Suwito, M.Pd. (Universitas Negeri Surabaya)
Dr. I Made Arsana, MT. (Universitas Negeri Surabaya)
Dr. Grummy A. Wallandouw, M.Pd. (Universitas Negeri Surabaya)
Dr. Suryanto, M.Pd. (Universitas Negeri Surabaya)
PREFACE

All praises be to Allah SWT, so that the 2018 International Conference of Asosiasi Pendidikan Teknologi dan Kejuruan Indonesia (APTEKINDO) could be held in Surabaya during 11-14 July 2018. APTEKINDO International Conference is conducted biennially in which this year host is Faculty of Engineering, State University of Surabaya. Therewere sixteen colleges attending this year Conference, most of which were former Institutes of Teacher’s Education (LPTK).

This year theme is “Revitalization of Technical and Vocational Education to Face Industrial Revolution 4.0” aimed to respond to the development and acceleration of the industrial revolution 4.0 that has become the most discussed issues in many countries. Industrial revolution connects machines with internet systems. In regard to facing such phenomena, Indonesian government through the Ministry of Industry has launched "Making Indonesia 4.0", of which the program focuses on industries that are driving the development of the industrial revolution 4.0 such as food and beverages, electronics, automotive, textiles and chemicals. To achieve better results of the program actualization, vocational education helps to prepare compatible and competitive workers for the areas of the aforementioned industries. Henceforth, numbers of Conferences, conventions, and meetings among Indonesian practitioners in FPTK / FT-JPTK need to be held to initiate ideas in strengthening the role of LPTK within industrial revolution 4.0 era.

The Conference’s proceedings contain 121 research papers and ideas that are relevant to the following nine sub-themes: Technical and Vocational Teacher Competencies, Technical and Vocational Education Curricula, Technical and Vocational Education Models, Technical and Vocational Education Evaluation, Technical and Vocational Education Policy, Public-private Partnership in Technical and Vocational Education, Technical and Vocational Education Management, Technopreneurship, and Competencies Certification.

Finally, all the committees send their gratitude to the participating speakers and all parties who support the run of the Conference. They also apologize for any inconvenience and wish a better undertaking event next year.
WELCOMING SPEECH RECTOR UNESA

Conference and Convention
Asosiasi Pendidikan Teknologi dan Kejuruan Indonesia (Aptekindo) 2018
Rich Palace Hotel Surabaya, 11-14 Juli 2018

Assalamu’alaikum Warahmatullahi Wabarakatuh.

Respectable Head of Universities, members of APTEKINDO
Distinguished Keynote speakers
Honorable authors, and fellow participants of APTEKINDO Conference and Convention 2018

Alhamdulillah, first of all, let us express our gratitude to Allah SWT because of his grace and blessings, we are able to attend this international Conference and convention of the Indonesia Association of Technology and Vocational Education or Asosiasi Pendidikan Teknologi dan Kejuruan Indonesia (APTEKINDO) held in Surabaya, 11-14 July 2018.

This international and national Conference is conducted biennially as a routine agenda held by Association of Technology and Vocational Education or Asosiasi Pendidikan Teknologi dan Kejuruan Indonesia (APTEKINDO), which consists of 16 different universities throughout Indonesia. We would like to thank for the opportunity given to Universitas Negeri Surabaya for hosting this year event.

In the raise of industrial revolution, Conferences, gatherings, and sharing of knowledge play an important meaning in supporting the acceleration of innovative science and technology. Therefore, this Conference’s theme is “Revitalization of Technical and Vocational Education to Face Industrial Revolution 4.0”. This is an interesting and challenging topic not only for academic researchers but also for stakeholders and industry owners.

Ladies and gentlemen,
Since 2011, the industrial sector has been integrated with the online system known as industrial revolution 4.0. The first industrial revolution was marked by the use of steam engines to replace human and animal power. The second stage of the revolution was marked by the utilization of electrical power and the concept of mass production. Furthermore, the application of automation technology brought the industrial revolution to its third stage. Tremendous revolution happened when information and communication technology was introduced and fully utilized in industrial area, of which the condition brought the world in the fourth stage of the industrial revolution. The utilization of this technology changed not only the production process, but also across the industrial chains that result in a new digital-based business model which can achieve higher efficiency and better quality in industrial products. The consequences of this revolution are the increase of production efficiency as well as changes in the employment prerequisite. There is an increasing demand for new manpower, whilst the machines are replacing the role of workers. This condition leads to the importance of a new and more advanced method of preparing human resources that are ready to compete in the industrial revolution.
Ladies and gentlemen, in regard to prepare Indonesian human resource in facing the era of media convergence, there are at least two aspects that need our attention, namely the quality of human resources in accordance with the requirement of the digital-based industry and the equal distribution of qualified human resources especially in suburban and urban areas. Both aspects could be meant as a challenge and an opportunity for the higher education especially technology and vocational education to innovate and harmonize curriculum that connects with the industry. Thus, this Conferences becomes a perfect momentum for technology and vocational education to join and strengthen steps in preparing graduates that are ready to compete in the industrial revolution 4.0. Therefore, by starting with "Bismillahirrahmanirrahim" The Conference and Convention of Association of Technology and Vocational Education or APTEKINDO 2018, is officially started"

Ladies and gentlemen, we would like to thank the keynote speakers who are willing to attend and share knowledge in today's Conference:
1. Prof. Dr. Muhadjir Effendy, MAP, Minister of Education and Culture, Republic of Indonesia
3. Prof. Dr. Wenny Rahayu, La Trobe University Victoria (Australia)

We also would like to thank the authors and all participants of the convention who have participated and contributed to sharing the knowledge and ideas. Hopefully, what we share and get here today can give benefits and contribute to improve a competitive atmosphere in Indonesia, Aamiin YRA.

Surabaya, July 2018
Universitas Negeri Surabaya
Rektor,

Prof. Dr. Warsono, M.S.
International Conference Asosiasi Pendidikan Teknologi dan Kejuruan Indonesia (APTEKINDO) 2018

WELCOME SPEECH BY THE DEAN OF FACULTY OF ENGINEERING
at the International Conference and National Convention of
Asosiasi Pendidikan Teknologi dan Kejuruan Indonesia (APTEKINDO) 2018
Rich Palace Hotel, 12 July 2018

Assalamu’alaikum Warahmatullahi Wabarakatuh.

His Excellency, Rector of Universitas Negeri Surabaya
Respectable the Head of Universities as the members of APTEKINDO
Distinguished Keynote Speakers
Honorable authors and Participants

Alhamdulillahihirobbil alamiin. Thanks God. First of all, let us express our gratitude to Allah SWT because of his grace and blessings we are able to attend the 9th International Conference and convention of Asosiasi Pendidikan Teknologi dan Kejuruan Indonesia (APTEKINDO) and the 19th workshop of the Technology and Vocational Education for FPTK/FT/FTK-JPTK in Indonesia. It is an honor for us, the Faculty of Engineering, Universitas Negeri Surabaya, to host this year’s Conference and convention.

On behalf of Asosiasi Pendidikan Teknologi dan Kejuruan Indonesia (APTEKINDO), we would like to welcome keynote speakers, authors, delegates and participants from technology and vocational education to the city of heroes, Surabaya.

Today, we meet in Surabaya to attend a biennial agenda named APTEKINDO International Conference and Convention and National Workshop of the FPTK/FT/FTK-JPTK. Following the mandate from the 2016 APTEKINDO Convention in Medan, this year’s Conference is held in Surabaya hosted by the Faculty of Engineering, Universitas Negeri Surabaya.

Ladies and Gentlemen, the theme of this year’s Conference is "Revitalization of Technical and Vocational Education to Face Industrial Revolution 4.0". The theme is chosen due to the fact that we have to quickly respond and act accordingly to the effects of the industrial revolution on vocational education. Well-programmed and structured efforts should be undertaken to ensure if technology and vocational education can produce globally competitive graduates especially for industrial revolution era.

Numbers of important topics for technology and vocational education are discussed in this Conference. These topics include Technical and Vocational Teacher Competencies, Technical and Vocational Education Curricula, Technical and Vocational Education Models, Technical and Vocational Education Evaluation, Technical and Vocational Education Policy, Public-private Partnership in Technical and Vocational Education, Technical and Vocational Education Management, Technopreneurship, and Competence Certification.

Today’s Conference has several outcomes. The accepted articles will be submitted for proceeding publication indexed by Atlantic Press. Meanwhile, the rejected articles by Atlantic Press will be published in the International Proceedings with International Standard Book Number (ISBN). Moreover, the articles written in Bahasa Indonesia will be published in the National Proceedings with ISBN.
Ladies and Gentleman, this meeting must be meaningful as a venue to communicate among researchers, academics, and members of FPTK / FT / FTK-JPTK from different universities as well as from related industries. By this regular Conference and convention, we can make a strong communication network and create innovative breakthrough and substantial blueprint of different aspects such as institutional quality, field study, and curriculum. We hope that this forum plays an important role in developing technology and vocational education to face the industrial revolution 4.0.

Finally, we would like to thank the organizing committee led by Mr. Tri Wrahmatnolo, M.Pd., M.T., who gave an extraordinary support. Moreover, we would like to express our appreciation and gratitude to the members of steering committee from various regions in Indonesia, delegates, SC and OC members, sponsors, as well as personal or institutional support that make this event well-organized. I apologize if there are shortcomings from my part.

Good luck with the Conference of Indonesian Association of Technology and Vocational Education, APTEKINDO 2018, and wish the best improvement for technology and vocational education in Indonesia. Thank you.

Wassalamu’alaikum Warahmatullahi Wabarakatuh
CHAIRMAN'S SPEECH

at the International Conference and National Convention of
Asosiasi Pendidikan Teknologi dan Kejuruan Indonesia (APTEKINDO) 2018
Rich Palace Hotel, 11-14 July 2018

Assalamu’alaikum Warahmatullahi Wabarakatuh.

His Excellency, Rector of Universitas Negeri Surabaya,
Respectable the Head of Universities, members of Aptekindo, Keynote speakers, Authors, and fellow
participants of Aptekindo Conference and convention 2018.

Alhamdulillah, no words could represent the feelings but the gratitude of the presence of Allah SWT,
for His blessings, so that we can attend APTEKINDO Conference with the theme "Revitalization of Technical and Vocational Education to Face Industrial Revolution 4.0".

In this pleased occasion, we would like to welcome all keynote speakers, authors, and participants of
the Conference to this city of heroes, the city of heroic histories, Surabaya. We would like also to
welcome to APTEKINDO 2018 Conference and convention held at the Rich Palace Hotel Surabaya,
11-14 July 2018.

The theme of this year Conference is "Revitalization of Technical and Vocational Education to Face Industrial Revolution 4.0". This theme is chosen to respond to the development and acceleration of industrial revolution 4.0 that has been impactful in various countries. This industrial revolution has connected the utilization of machines to an internet system. To face such phenomena, Indonesian government through the Ministry of Industry has launched a program called "Making Indonesia 4.0". Currently, the government is focusing on industries that support the development of the industrial revolution such as food and beverage, electronics industry, automotive, textile and clothing, and chemical industries.

In addition, vocational education plays an important role in preparing competent and competitive human resources. That is, Faculty of Technical and Vocational Education or Fakultas Pendidikan Teknik dan Kejuruan (FPTK) in Indonesia aims to compile excellent ideas and vision, which later could be shared through Conferences, conventions or meetings, and also be useful to encounter industrial revolution 4.0.

Today's Conference will present competent keynote speakers in the field of technology and vocational education, who are:
1. Prof. Dr. Muhadjir Effendy, MAP. Minister of Education and Culture, Republic of Indonesia
3. Prof. Dr. Wenny Rahayu, La Trobe University Victoria (Australia)
In addition, I would like to point out that there are 602 participants from 17 different universities participating in today’s Conference involving:

1. Universitas Palangka Raya  
2. Universitas Gorontalo  
3. Universitas Islam Negeri Ar Raniry Aceh  
4. Universitas Negeri Solo  
5. Universitas Negeri Menado  
6. Universitas Pendidikan Ganesha  
7. Universitas Nusa Cendana  
8. Universitas Malang  
9. Universitas Negeri Jakarta  
10. Universitas Negeri Padang  
11. Universitas Negeri Yogyakarta  
12. Universitas Pendidikan Indonesia  
13. Universitas Negeri Makassar  
14. Universitas Negeri Semarang  
15. Universitas Negeri Medan  
16. Universitas Negeri Surabaya  
17. Universitas PGRI Adi Buana Surabaya  

There are 491 articles submitted to this Conferences covering papers and posters. 76 articles were accepted to Atlantic Press, 156 articles published in international proceedings with ISBN, dan 129 articles published in the national proceedings with ISBN. All articles will be available for an online access through the Atlantis Press official website and through APTEKINDO 2018 website.

Today's Conference is actually held with the helps and good cooperation of various parties. Therefore, we would like to express our gratitude to the Minister of Research, Technology and Higher Education, Rector of Universitas Negeri Surabaya, keynote speakers, participants, sponsors, and other stakeholders for the supports. We also send our highest appreciation to the committees who have worked hard to succeed this Conference.

At last, we hope that all participants get benefits and knowledge that can contribute to reinforce vocational education and technology in facing the industrial revolution 4.0. WELCOME TO APTEKINDO CONFERENCE AND CONVENTION 2018, Thank you.
PROCEEDINGS
International Conference
Asosiasi Pendidikan Teknologi dan Kejuruan Indonesia
(APTEKINDO) 2018

Theme:
"Revitalization of Technical and Vocational Education to Face
Industrial Revolution 4.0"

Surabaya, 11-14 July 2018

Speakers:

Prof. Dr. Muhadjir Effendy, MAP.
Minister of Education and Culture, Republic of Indonesia

Michael Freiherr von Ungern – Sternberg
Extraordinary and Plenipotentiary Ambassador of the Federal Republic of Germany to
Indonesia, ASEAN and Timor-Leste (Jerman)

Prof. Dr. Wenny Rahayu
Head of School of Engineering and Mathematical Sciences
La Trobe University Victoria (Australia)

Prof. Dr. Muchlas Samani, M.Pd.
Rector of Universitas Negeri Surabaya period 2010-2014 (Indonesia)
VOCATIONAL SECONDARY SCHOOL STUDENTS (SMK) NEGERI 8 MEDAN
Siti Wahidah
Universitas Negeri Medan

11 TEACHING FACTORY BASED LEARNING PARADIGM IN VOCATIONAL HIGHER EDUCATION ON THE ERA OF INDUSTRY 4.0
Ahmad Dardiri, Imam Alfiyanto, Mardji, Hadi Wasito, Sutrisno
Universitas Negeri Malang

12 THE VALIDITY OF ENTREPRENEURSHIP MODULE-BASED PRODUCTS IN VOCATIONAL EDUCATION
Asmar Yulastri, Syaiful Islami, Ganefri
Universitas Negeri Padang

13 IMPROVEMENT OF ACADEMIC SERVICES WITH SELF SERVICE APPLICATION BASED ON SHORT MESSAGE SERVICE USING BREADTH-FIRST SEARCH ALGORITHM
Mustika Nuramalia Handayani, Arrafi Diena Amalia, and Sri Handayani
Universitas Pendidikan Indonesia

14 "THE EDUCATIONAL MOBILE GAME AS AN EFFECTIVE MULTIMEDIA TO IMPROVE STUDENTS’ ACHIEVEMENT IN ENGLISH LEARNING"
M Wahyudin Wachid, Subiyanto, Tatyantoro Andrasto
Universitas Negeri Semarang

15 "DEVELOPMENT OF MAKE-UP FANTASY VIDEO OF EDUCATIONAL PROGRAM FOR MAKE-UP EDUCATION"
Rohana Aritonang, Dina Ampera
Universitas Negeri Medan

16 THE ROLE OF BLENDED MOBILE LEARNING IN ALGEBRA
Lipur Sugiyanta, Moch. Sukardjo
Universitas Negeri Jakarta

Sub Theme 3: Technology and Vocational Education Model (TVEModel)

1 APPLICATION OF COOPERATIVE LEARNING MODELS OF TYPE JIGSAW TO IMPROVE STUDENT LEARNING RESULT IN SMK
Patang Makkunessa, Nurlinda, Lahming
Universitas Negeri Makassar

2 THE EFFECT OF INDIRECT INSTRUCTION STRATEGY ON STUDENT LEARNING OUTCOMES OF SMK WITH HIGH AND LOW ACHIEVEMENT MOTIVATION
Edy Suprapto
Universitas Nusa Cendana

3 CREATING THE ENVIRONMENTAL ATTITUDE BY WORKSHOP ACTIVITIES IN CONSTRUCTION ENGINEERING EDUCATION
NurilatPertiwi, Panennungi
Universitas Negeri Makassar

4 EFFECTIVENESS OF USING PROBLEM-BASED LEARNING MODEL ON ELECTRONIC LEARNING PROGRAM ELECTRONICS ANALOG AND DIGITAL OF INFORMATICS AND COMPUTER ENGINEERING EDUCATION UNM
Mustari Lamado, Satria Gunawan Zain

xvi
The Role of Blended Mobile Learning in Algebra

Lipur Sugiyanta¹, Moch. Sukardjo²
¹Study Program of Pendidikan Informatika, Fakultas Teknik,
²Study Program of Pendidikan Vokasional Teknik Elektronika, Fakultas Teknik
Universitas Negeri Jakarta
lipur@unj.ac.id

Abstract—Although the population of Internet users in Indonesia reached 83.7 million people or number 6 in the world, the potential utilization of smartphones in secondary school learning in Indonesia is still minimum. E-Learning makes learning much more interactive than learning (only) in the classroom, but the limitations of device access lead to the ease of time and place in support of less than optimal learning. M-Learning (Mobile Learning) offers increased access flexibility and social interaction as a supplement and learning complement for students. With so much potential of m-Learning as an alternative learning, until now not much information about the use of cell phones as a medium of learning. In addition, there is still very little effort in the development of widely accessible m-Learning content. This is what drives research and content development / m-Learning applications and evaluation of their application in the formal education environment. Algebra has been applied to the 2013 curriculum in the academic year 2016-2017. The potential of utilizing a smartphone to increase interest and mastery of Mathematics is quite large. The ability of Algebra helps students in understanding Mathematics, especially good analytical skills as a basis for understanding other mathematical material concepts. This study was conducted using a combination of SDLC/Prototype application development methods, surveys, and observations on student learning outcomes. The results of the analysis to be achieved is the occurrence of changes (increase) interest in Algebra lessons. Using t-tests, the calculated data with degrees of freedom (df) 34 was obtained t_calculated = 0.832 and t_table = 1.690. At the significance level of 0.05, this indicates that blended m-learning showed an effective integration of mobile technology into teaching and learning in school. For Algebra 7th grade, the transformation of the existing curriculum into a modified blended m-learning learning model was more appropriate with inquiry-based one. However, implementation of blended m-learning was dependent on the successful interactions among macro level and micro level (the principal, the parents, the technical support personnel and the key users—teachers and students). The crucial issues identified in macro levels are social area, infrastructure, and learning design. Creating readiness is crucial because participation is important to improve the sustainability.

Keywords: blended m-Learning, learning motivation, Algebra

I. INTRODUCTION

Education by applying the distance learning is more likely in the form of education in the future. The materials tend to combine conventional learning materials with blended learning methods. Blended learning methods refer to a combination of conventional learning (face to face) with information technology-based learning. In Indonesia, Blended Learning does not replace the conventional learning in the classroom (face to face), but it reinforces the learning model through the educational technology. Blended Learning focuses primarily on students. Students must be independent at certain times. The learning atmosphere requires students to play an active role in their learning. They are encouraged to obtain enrichment materials with their own efforts and initiatives. Thus, the learning becomes more flexible and not rigid.

In general, blended learning is implemented in the form of: 1) integration / integration of traditional learning with application-based approach (on-line web and mobile application); 2) a combination of media and equipment (eg smartphones) used in learning environments, and 3) a combination of teaching and learning approaches regardless of the technology used. In this study, blended learning is interpreted as the integration of face-to-face learning and learning methods using smartphone devices. The term used in this study is Blended Mobile Learning (blended m-learning). Blended m-learning consists of several tools: learning materials, software, instructional planning, learning media, and smartphone devices. The learning process did not limit in the classroom, but students can continue at home and even start learning earlier from home.

Many blended m-learning initiatives have been conducted worldwide. Seamless Learning Model using mobile devices demonstrated increased student achievement, thus providing the opportunity to study an innovation as it scales up, to more classes and more subjects. However, few of these researches have produced any lasting outcomes. Long-term sustainability resulted from continuous adaptation to changing conditions. Frameworks are therefore required to avoid sustainability pitfalls. The framework defines the life-cycle of a blended m-learning and identifies the critical points of scalability and sustainability during the development processes.

The resulted framework could reduce the complexity of blended m-learning and improve the outcomes of mobile learning initiatives in terms of lasting usable results. This framework was analyzed from eight scientific publications that have been presented at different international conferences. Five of the them explore the field of mobile learning and its practice while the other three publications define the life-cycle of a mobile learning initiative and identifies the emphasizing the concepts of scalability and...
sustainability during the development process (as the basis for the proposed framework, how it has been developed, and the motivations behind its creation). [4]

This framework will be examined in junior high school 7th grade in Mathematics at SMPN 77 Jakarta Pusat. 7th grade of SMPN 77 has implemented 2013 curriculum and has been using a scientific approach. However, the implementation of mathematics with a scientific approach still difficult. This is caused by the participation of students in learning are poor. Mathematics for junior high school (SMP/MTs) is directed to encourage students to have math skills, able to formulate problems, and solve simple problems. Math skills are part of the life skills that students must possess especially in the reasoning, communication, and problem solving encountered in students’ daily lives. [5]

Therefore, Blended m-learning is potentially developed for Mathematics subjects. There are some materials which is essential in mathematics in 2013 curriculum, e.g. Algebra. Algebra should be mastered by the students before the material of linear equations and linear inequality of one variable were delivered. The scope of algebra includes: variables, coefficients, constants, similar tribes to its operations (addition, subtraction, multiplication, and division). Students have not received these materials in Elementary School yet.

Related Research

The “Framework for sustainable mobile learning in schools” that [6] was developed in the context of an Australian school. This research was different from the most previous studies of mobile learning which are short-term, access to technical support and pedagogy are predetermined through sponsorship. Therefore, longevity of these research beyond the funding period is usually unclear. The school introduced and sustained the mLearn programme using personal digital assistants (PDAs) with school’s allocated resources to internally fund the programme. A set of 20 PDAs was purchased for a group of volunteer teachers to explore in the 7 months prior to the new school year when the programme would be implemented. It followed by the expansion of the infrastructure to adopt PDAs usage with the purchase and installation of wireless hubs and access ports—a total of three hubs and 25 access ports. The volunteer teachers trialled the use of the PDAs in their classrooms. An mLearn programme coordinator was appointed, who was also the e-learning coordinator of the school. Manuals were also produced for learning how to set the PDAs up and the use of their general features such as managing the wireless connectivity (Internet Explorer and Bluetooth), synchronisation, using Outlook, Office Mobile and other applications (eg, remote display, VsPainter and a scientific calculator), included step-by-step instructions on how to use mobile applications such as the eBook reader, quiz-making and text-to-speech software and how to create podcasts. Fifty-seven of the students and 25 teachers participated in the research. This research preparation took sixth months and the implementation of the mLearn programme required seventh to 18th months.

The study indicates that management and leadership are perhaps the most important part of sustaining the mLearn programme, i.e. the choice of device and its suppliers, liaison with the university researchers to administer the questionnaires and organising interviews with staff and students, and the interaction with parents and school’s council. Sustainability at the pedagogical level involves the roles of teachers in facilitating learning with mobile devices and considering the informal learning of how mobile devices facilitate and connects with the formal aspects of learning. Pedagogical sustainability was possible with PDAs but dependent on the teacher’s capabilities and limitations of the PDA, the available applications and how to integrate them into the teaching. This framework worked as fully mobile learning initiative and had been proven that mobile devices are suited for bridging formal and informal learning that will enhance its pedagogical sustainability, nevertheless the issues in the formal setting need to be addressed adequately and teachers need to develop understanding of the pedagogical uses of the devices before taking the use of mobile devices to the next level in informal settings.

[7] updated an analytic self-regulated learning (SRL) model of mobile learning as a conceptual framework for designing and analyzing mobile learning also the plans for scaling-up. Updated SRL notion of self-regulation as theore (Figure 2.1). This research was performed on a primary school in Singapore.

![Fig 1. SRL model for Mobile Learning][8]

The center of the model refers to the students’ characteristics that function as internal driving forces initiating and sustaining a self-regulated mobile learning process. The key personal factors include domain knowledge, prior experiences, motivation, and metacognitive awareness, epistemological beliefs, and so on. Mobile learning activities are mediated by mobile technologies and devices, which presumably function as social, cognitive, and metacognitive tools. It was not only focus on the social and cognitive functions but also the metacognitive function. With appropriate learning design, the mobile technology facilitated the transformation of
classroom learning activities into a more student-centered, personalized, and social learning process for the students where they need to process and associate their experiences, or the information received in the informal contexts with the knowledge that they have acquired or constructed in the classroom. Mobile learning advocates continuous learning by the students inside and outside of the classroom.

At that school, the research had moved successfully from serving 80 students (2 teachers) to serving 320 students (6 teachers). The critical important factors had learned, e.g., that SLM can be an effective pedagogical model in supporting students as they engage in inquiry-based learning. To scale-up, the issue is no longer one of efficacy but one of infrastructure — how do we take an innovation that was hand-crafted and make it more rugged, more robust, more stand-alone, more transparent in 1:1, 24x7 basis. Other dimensions comprised this scale-up were:

- Mobilized curricula (to lead students to self-directed learning and to bridging informal learning spaces),
- Teacher facilitation skills,
- Teacher readiness, and
- Student readiness including hardware and software training.

In [1], the use of Blended Learning in Indonesian Language Learning at SD InsanAmanah was conducted in the classroom. Observations made on student motivation and activity and students' learning ability. This was blended learning alternative using website. Learning begins with apperception activities by inviting all students to access (logging in first) the website http://elearning.insanamanah.sch.id and then students begin to open the lesson material and work on. The student's enthusiastic starts from the beginning of the lesson. Students' passion is also visible when online questions is marked with right answer.

Sustainability to improve motivation and ability to learn in SD InsanAmanah was depending on these supporting factors; i.e.:

- great student enthusiasm for learning with Blended Learning;
- the percentage of students which has Internet access;
- school facilities that support Internet access;
- variety of online assignment to makes students more independent;
- innovative and interactive learning process so that students feel enjoy learning compared when learning is done conventionally; and
- good cooperation and responsiveness from the principal and other teachers.

The other proposed framework [4] consists of a life-cycle that divides an initiative into four stages: Idea, Trial, Project, and Release. The purpose and key activities of each stage are summarized in Table 2.1. Each stage is divided into four Areas of concern: Technology, Learning, Social, and Organization. These represent the four major groups of stakeholders as well as the four main sources of risks. The four areas are linked together and depend on each other. A change to one will affect the others. To propagate changes, the concept of Equilibrium is used to reason about the state of a stage. If a stage is in equilibrium, all changes have propagated, and the effects of this propagation have been dealt with (or at least considered). Equilibrium is reached for a stage when there is no longer a need for reaction and adjustment.

<table>
<thead>
<tr>
<th>Table 1. Result of Adjusted Development Framework</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stage</strong></td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>1 Ideas</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>2 Trial</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>3 Project</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>4 Release</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

To reduce the complexity introduced by the areas of concern and the propagating changes, the concept of Focus is used. During each stage of the evolution, one (or at most a few) area of concern is in focus. The area in focus represents the area where the development is currently the most active, and where the direct changes will occur. The
other areas are only changed through propagated effects of a change to the area in focus. Thus, focus provides a means to reduce complexity and a way to introduce a sequential workflow to the framework. Figure 2.2 depicts the framework and the major concepts.

The major role of the framework is to guide the development practices not to tie down the models, methods, and tools, which follows while the framework is in use. Hence, the framework is to be a work and communication platform and provide a theoretical take on the information systems development occurring in mobile learning. Here, Sustainability defined as the measure of how well the initiative result fits the intended setting. An initiative is sustainable, if the Release stage is sustainable.

The authors’ former result research (updated) framework[9] was summarized in Table 2.2 (yellow marked indicated the modification done). The framework was created with a focus on Engagement activities, lesson plan, and its supporting materials.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Purpose</th>
<th>Outcome</th>
<th>Key Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Ideas</td>
<td>Establish soundness of the idea</td>
<td>Plan of how to go ahead</td>
<td>Investigate technology</td>
</tr>
<tr>
<td></td>
<td>Establish technical platform</td>
<td></td>
<td>Surveys</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Investigate migration/blended scenario</td>
</tr>
<tr>
<td>2 Trial</td>
<td>Test the idea</td>
<td>Information about what works and what does not</td>
<td>Produce learning materials</td>
</tr>
<tr>
<td></td>
<td>Elaborate learning</td>
<td>the Considerations made on what needs to change to move ahead</td>
<td>Offer the learning material</td>
</tr>
<tr>
<td></td>
<td>Small testing</td>
<td></td>
<td>Measure how well it is received</td>
</tr>
<tr>
<td>3 Project</td>
<td>Spend launch/display</td>
<td>Expand beyond initiators</td>
<td>Similar to trial but larger scale</td>
</tr>
<tr>
<td></td>
<td>Large testing</td>
<td>Information on how the material is received, both in terms of students and</td>
<td>Report to funding organization</td>
</tr>
</tbody>
</table>

Table 2. Result of (adjusted) Development Framework

The product for adjusted framework were four Lesson Plan (RPP. Rencana Pelaksanaan Pembelajaran) units in the first semester of Algebra emphasized on engagement and exploration. Before, during and after first cycle for RPP unit, we reflected upon the lessons and apply such understanding to inform the design of the next RPP unit (iterative as shown at Fig. 3.1). This was to facilitate the students’ gradual changes in their habits towards learning seamlessly. For example, while the earlier activities involve the students expressing their understanding using MLE or capturing artifacts of the classroom and insert them to the RPP.[7]

The designed RPP was developed with the use of software apps on the Moodle MLE (Mobile Learning Environment) that runs on an Android operating system. The Moodle MLE enables teachers to create courses easily via its online learning management system and it enables students to easily personalize their learning experiences. Moodle MLE supports teachers in creating complete, coordinated, curriculum-based lessons that employ multiple media and applications (e.g., video, images, documents, animations, and the like) also multiple activities. All types of files can be uploaded and accessed through Moodle, but the student needs to have the correct software to be able to open them. There are 14 different types of activities in the standard Moodle, e.g., Assignments, Chat, Choice, Feedback, Forum, Quiz, and Survey.

II. METHOD

To design sustainable blended m-learning classroom in practices, we took research approaches to address simple problems in real classroom of Mathematics 7th grade in collaboration with teachers. We serve as meso-level actors to reconceptualize pedagogic discourse[7] and help the school students and teachers interpret curricula of blended mobile learning and actualize them into teaching and learning practices. In that level, we set classroom situation between individual activities, small and larger groups to make up the school’s learning ecology exciting.

The iterative cycle of research involving four linked phases, illustrated in Figure 3.1[9]. Field studies and
survey research have been planned, to obtain the empirical data of student’s mobile device. The analysis of preliminary survey helps to increase the competence and self-help ability in the field of students’ adaptation on mobile learning.

Concerning the curricular commitment, Blended Mobile Learning uses of the 5E Instructional Model [10]. This 5E model consists of the following phases: engagement, exploration, explanation, elaboration, and evaluation. The model is used in sequence of learning activities in Mathemetic 7th. This blended m-learning design is focused to provide opportunities for the student during the engagement phase of 5E model by using Mobile Learning Environment (MLE). In the Engagement phase, the teacher usually motivates the students by doing some video demonstration and posting some inquiry questions. These products already done in [9].

The site of research is domained https://lipursukardjo.moodlecloud.com/MoodleCloud supports the most recent versions of browsers (Google Chrome, Firefox, Safari, and Internet Explorer). To access MoodleCloud sites on mobile devices, students should install the Moodle Mobile app. The latest version of our Moodle Mobile app for Android (Moodle Mobile 3.3.2, release date 29 September 2017) can be obtained from the Google Play Store (recommended). Moodle Mobile was hosted on 27 July 2017. The research was conducted in SMPN 77 Jakarta Pusat, 1 classes (each 35 students) and 1 teachers.

The research focused mostly on the perception of teachers and students and the interactions between them and with the mobile devices. These aspects were elicited both quantitatively and qualitatively as shown in Table 3.1. The pre- and post-questionnaires contained a similar set of 5-point Likert-scale (strongly agree to strongly disagree) statements designed to elicit the students’ and teachers’ views of the technical and learning/teaching aspects of using mobile device in the classroom. Twenty questions taken from [6] are common and still relevant to both the students and teachers’ pre- and post-questionnaires. More detailed responses were elicited through the open questions shown in Table 3.2 [6]. The open questions in the pre-questionnaires probed for expectations. The post-questionnaires probed for achievements or issues that had been encountered.
Table 4. Open Questions in Students’ and Teachers’ Pre- and Post-Questionnaires

<table>
<thead>
<tr>
<th>Questions</th>
<th>Students</th>
<th>Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>are (list four to five) . . .</td>
<td>(list four to five) . . .</td>
<td>The things that worry me most about the program are . . .</td>
</tr>
<tr>
<td>The things that I have used my smartphone for are (list four to five) . . .</td>
<td>The things that I have used my smartphone for are (list four to five): Your sense of how it (use of smartphone) went . . .</td>
<td></td>
</tr>
<tr>
<td>The worst things about using my smartphone are (list four to five) . . .</td>
<td>The two subjects where my smartphone has helped me learn the most are . . .</td>
<td></td>
</tr>
<tr>
<td>The two subjects where my smartphone has helped me learn the most are . . .</td>
<td>The things that worry me about the programs are . . .</td>
<td></td>
</tr>
<tr>
<td>What recommendations, if any, would you make for the smartphone program at the school?</td>
<td>What recommendations, if any, would you make for the smartphone program at the school?</td>
<td></td>
</tr>
</tbody>
</table>

Using SPSS, we performed analysis of quantitative data from the pre- and post-questionnaire responses of teachers and students at the start of the blended m-learning and about 2 months later. Means, standard deviations and Cronbach’s alpha values (for reliability or consistency of responses) were also calculated. Qualitative data (responses from open questions and interviews) were also analysed and then coded.

III. RESULTS AND ANALYSIS

At the SMPN 77 Jakarta, we have set 35 students (1 teacher) as instructional model object. As result of preliminary survey, video material is the most suitable/popular media for students. Students can replay on certain parts to see a more focused picture. This is difficult to achieve when video is delivered through media such as television. It is suitable to teach the material and faster to deliver messages than text media.

The teachers’ challenges faced prior to blended m-learning in school assessment, raised these concerns:

- They are not sure if the designed lesson plans in the right way. Some teachers expressed doubts on the students’ ability for doing self-directed learning.
- Some teachers expressed that they needed help in developing and practicing questioning skills in the classroom.
- Students’ smartphones were varied.
- Some regulations need to be reviewed.

Preliminary results were appropriate with conducive macro-environment for enable contextualized classroom-based work and interactions among students and teacher.

In the following sections, we present the data relating to the students’ and teachers’ thinking at the start of the blended m-learning and 2 months evaluation to look for factors that did (or did not) sustain blended m-learning within the SRL model of mobile learning.

IV. RESULTS AND DISCUSSION

The instruments of perception of students (as shown in Table 3.1) had been tested its reliability using Alpha Cronbach’s approach. The calculation result for 35 questionnaires was 0.949. This means that the instrument is consistent to be used to obtain data with reliable results (reliable).

Paired sample t-tests, using SPSS, were performed to analyse the quantitative data from the pre- and post-
questionnaire responses of students at the start of the blended m-learning and about 2 months later. Means and standard deviations were also calculated.

Table 5. Five-Point Likert Scale Students’ Questionnaire Statements

<table>
<thead>
<tr>
<th>Questions</th>
<th>Pre-questionnaire (start of blended m-learning) mean (SD)</th>
<th>Post-questionnaire (2 months later) mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical aspects of using Smartphones</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. I know how to use a smartphone</td>
<td>3.0857 (0.5621)</td>
<td>4.1429 (0.6482)</td>
</tr>
<tr>
<td>4. Smartphones are easy to use</td>
<td>3.1714 (0.3824)</td>
<td>4.1429 (0.6011)</td>
</tr>
<tr>
<td>7. I need special training to use a smartphone</td>
<td>2.6000 (0.7746)</td>
<td>1.6571 (0.4816)</td>
</tr>
<tr>
<td>15. Writing with a smartphone is easier than writing by hand on paper</td>
<td>3.1143 (0.3228)</td>
<td>2.6571 (0.4816)</td>
</tr>
<tr>
<td>16. The screen on the smartphone makes it difficult to do my school work</td>
<td>2.9714 (0.6177)</td>
<td>3.0857 (0.3735)</td>
</tr>
<tr>
<td>17. It is easy to access the Internet with smartphones</td>
<td>3.3714 (0.4902)</td>
<td>3.6571 (0.7648)</td>
</tr>
<tr>
<td>18. With a smartphone it is very easy to change what I have written</td>
<td>3.4286 (0.5021)</td>
<td>3.6000 (0.4971)</td>
</tr>
<tr>
<td>19. With a smartphone, it is easy to send messages to my friends.</td>
<td>3.2000 (0.4728)</td>
<td>2.6571 (0.4816)</td>
</tr>
<tr>
<td>Learning with smartphones</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Smartphones help me learn my subjects better</td>
<td>3.2286 (0.4260)</td>
<td>2.8286 (0.3824)</td>
</tr>
<tr>
<td>3. I like using technology for learning</td>
<td>3.9714 (0.6177)</td>
<td>4.5429 (0.6108)</td>
</tr>
<tr>
<td>5. Smartphones make learning easier</td>
<td>3.5714 (0.6081)</td>
<td>4.5143 (0.5071)</td>
</tr>
<tr>
<td>6. I am excited about using a smartphone</td>
<td>4.4571 (0.6108)</td>
<td>4.7714 (0.4260)</td>
</tr>
<tr>
<td>8. Smartphones make learning fun.</td>
<td>3.8857 (0.7960)</td>
<td>4.4286 (0.5576)</td>
</tr>
<tr>
<td>9. I learn better with technology</td>
<td>3.9714 (0.8220)</td>
<td>4.5143 (0.5071)</td>
</tr>
</tbody>
</table>

Table 4.1 (paired statistics data) showed the students’ mean ratings for most of the statements relating to the effectiveness of blended m-learning was 3.456 (pre) and 3.19 (post). The students’ standard deviation ratings for most of the statements was 0.705 and 0.797. The students’ mean ratings for most of the statements relating to the effectiveness decreased between the start of the programme and 2 months later. The four of eight statements showed increases in mean values relate to the technical aspects of using the smartphones (items 1, 4, 16, 17, 18). The two significant increases are indications that the smartphones were found to be easy to use (item 4) and that the students had come to know how to use the smartphones better (item 1). The two non-significant increases relate to the size of the smartphones making it difficult for them to do their school work (item 16) and that it was easy to access the Internet with smartphones (item 17) and also it was easy to change what the students had written on the smartphones even though they disagreed that writing with a smartphone was easier than writing on paper (item 18). The students’ perceptions of the ease of accessing the Internet and sending messages to their friends increased.

From the learning perspective, apart from the statement "I like using technology for learning" (item 3), the ratings on all the statements relating to learning with the smartphones increased significantly. The students became
more excited about using the smartphones (item 6), they felt that the smartphones did help them learn better (item 1) or was the learning made easier (item 5), more interesting (item 12) or fun (item 8). The smartphones did not enable them to do their school work anytime, anywhere (item 10) nor did they help the students organise their time better (item 13). Overall, there was a significant optimistic in the students’ beliefs that they learned better with technology (item 9) even though they maintained that they liked using technology for learning (item 3).

Responses from the above table using t-tests are calculated with degrees of freedom (df) 34, then obtained t_{calc} = 0.832 and t_{table} = 1.690. At the significance level of 0.05, this indicates that the correlation between the effectiveness of class (interactions between students and teachers and with the mobile devices) before and after the practice of blended m-learning was closed and high. Thus, blended m-learning could improve the effectiveness of learning with confidence level of 95%.

![T-test calculation](image)

To the open questions, more use of the smartphones: 30 students responded to the “recommendation” question. The remaining recommendations were technical aspects, e.g., improving Internet access and purchasing more robust smartphones. Other technical problems were found, e.g., major frustrations in terms of the technical aspects of the smartphones, as indicated by 75% of the responses for the first open question included the lack of reliability of the Internet, the device lagging and/or crashing frequently, smallness of the screen and the limited capacities of some of the software.

The above data showed that socio-technical platform system for mobile learning are intertwined and manifested in the interactions between the various stakeholders and between students-teacher and the mobile devices. It involved three systems: the social, the personal and the technical [4]. Technology is the hardware and software used, Learning includes the pedagogy and teaching goals, while Social includes how students and teachers use and interact using the technology.

In terms of learning, there was clearly a desire to improve their technology skills for better teaching and to better engage their students. Developed inquiry-based learning features were equipped with learning media such as:

- a summary of the subject matter;
- learning videos created according to Engagement, Exploration and Explanation phase targets (drama, speech, poetry reading, etc.)
- animation;
- images from various sources on the internet to aid the learning process; and
- various interactive quiz questions with various models such as: multiple choice, short field, true false, matching, and TTS.

The four Lesson Plan (RPP: Rencana Pelaksanaan Pembelajaran) units in the first semester of Algebra were emphasized on engagement and exploration. Before, during, and after first cycle for RPP, teachers reflected upon the lessons and apply such understanding to inform the design of the next RPP (as shown at Fig. 4.4). This was to facilitate the students’ gradual changes in their habits towards learning seamlessly. For example, the earlier activities involve the students expressing their understanding using MLE should inserted to the RPP [7].

12.75
• Design student-centered learning activities (to promote engagement and self-directed learning),
• Incorporate different learning modalities (to personalize learning),
• Facilitate social knowledge building (to promote collaborative learning),
• Ensure that the teacher plays the role of facilitator (to move away from didactic teaching),
• Provide an environment to integrate all learning activities (students have a hub to launch or continue their learning activities),
• Assess formatively (through the learning activities, students can receive feedback for their own ideas from peers or the teacher),
• Extending classroom learning activities beyond school hours and premises (to support the notion of seamless learning).

The Crucial's of Blended m-Learning

Analysis results were in accordance with the research approach from [7] that recognizes the micro, meso, and macro levels of educational systems [12]. The Social area is first crucial in a macro level because the area of social is an effective pedagogical aspect of blended m-learning model. Teachers and students' participation needed to improve the sustainability. This creating readiness comprises these multiple dimensions:
• Teacher facilitation skills,
• Teacher readiness,
• Student facilitation skills, and
• Student readiness.

Second crucial issue is infrastructure - how do we provide blended m-learning supports and Internet access and make it more reliable and more stand-alone. This included technology infrastructure, e.g. WiFi and 3G/4G Connectivity; availability of mobile devices in 1:1. There were other technical issues related to device robustness, software limitations, wireless reliability and Internet accessibility, although problems seemed to be expressed more strongly by the students than the teachers.

Third crucial issue in macro level was the design of the learning in the mobilized curricula. Blended m-Learning curricula involves the roles of teachers in facilitating learning with mobile devices to support achieving the goals of the blended m-learning.

IV. CONCLUSION

Blended m-learning acted as an enabler of new teaching learning activities supported by mobile technologies. The research implemented an adjusted framework for adoption of blended m-learning by schools in formal learning of SMPN 77 7th grade. This adjusted framework demonstrated how to practice successful implementation of early mobile learning sustainability through blended m-learning.

We reuse the instruments to gain students and teachers perception data on blended m-learning. The reliability of the instrument was 0.98 (tested with alpha Cronbach). This was very reliable. Using t-tests, the calculated data with degrees of freedom (df) 34 was obtained $t_{calculated} = 0.832$ and $t_{table} = 1.690$. At the significance level of 0.05, this indicates that blended m-learning showed an effective integration of mobile technology into teaching and learning in school. Blended m-learning has an important role to improve students' learning motivation so that it can potentially improve student learning output/outcomes. However, it was dependent on the successful interactions among macro level and micro level (the principal, the parents, the technical support personnel and key users—teachers and students). The crucial issues identified in macro levels are social area, infrastructure, and learning design. Creating readiness is crucial because participation is important to improve the sustainability. The sustainable blended m-learning is further exacerbated by the fastpace of change of digital technologies, where with every change, new possibilities are opened. At the pedagogical level, blended m-learning involved the roles of teachers in facilitating learning with mobile devices to support achieving the goals of the subjects.

For Algebra 7th grade, blended m-learning could be an alternative for learning Algebra at 7th level of Junior High School. The transformation of the existing curriculum into a modified blended m-learning learning model was more appropriate with inquiry-based one.

References


