The use of Facebook and WhatsApp application in learning process of physics to train students’ critical thinking skills

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Abstract. The purpose of this research is to describe the learning process by using Facebook and WhatsApp to train students' critical thinking skills. The research steps are: 1) analysis; 2) design; 3) development; 4) implementation; 5) evaluation. The research subjects are 40 students of Physics Department of Universitas Negeri Surabaya. This research used descriptive qualitative approach. The study The validation point, practicality, effectiveness, and critical thinking skills of students assessment use Likert scale. Learning process criteria are eligible if ≥ 60% is rated good or excellent. The results are: 1) the use of Facebook and WhatsApp can be implemented in the learning process, and the existing constraints can be overcome; 2) the assessment of students’ critical thinking skills is categorized as good and excellent. These results suggest that learning by using Facebook and WhatsApp can be used to train students’ critical thinking skills.

1. Introduction
Nowadays, the use of smartphones has threatened the existence of teachers in conventional classes when students are already bored with the learning process in the classroom [1]. Students frequently use smartphones to access today's popular social networks like Facebook and WhatsApp just for fun. WhatsApp is a free messenger application that works on various platforms like iPhone and Android phones, and this app is widely used among students to send multimedia messages like photos, videos, audio along with short messages [2]. It is unwise if teachers forbid students to bring smartphones to school because basically a result of technology is neutral.

To empower the use of smartphones by students, learning with digital communication between groups of students and between students and teachers has become popular over the past decade through various networks including Facebook and WhatsApp [3]. Basic physics which is the basic idea that arises from the application of the scientific method that examines the most basic ideas about the physical properties [4] requires a learning process that can train critical thinking skills is an attempt to ask and answer questions systematically to produce an explanation which is coherent and credible [5]. The previous study of the use of WhatsApp in learning has four main purposes: communicating with students, building a social atmosphere, creating dialogue, and encouraging students to share [6], and with a similar purpose, it is also applied in learning by using Facebook. The delivery of messages, pictures, and videos related to the explanation of physical symptoms can be a means to train students’ critical thinking skills.
Research on the use of WhatsApp in the South African University class got positive responses from students stating that it is an easy way to communicate with their teachers and all classmates, and generate useful discourse on relevant issues. In an informal environment, students can learn something authentically intimate and fun [12].

2. Methods
This Research uses Research & Development which encompassed design, development or production, implementation or delivery, and evaluations [20]. Stage analysis is the process of analyzing the need for product development, analyzing the feasibility of the product, and the terms of its development. Product development begins with the gaps that occur due to existing learning which has not been correlated to the needs, learning environment, technology, and characteristics of students. The design stage is a systematic process that starts with setting and learning objectives, designing learning scenarios, designing learning tools, designing learning materials and evaluating learning outcomes.

3. Result of analysis

3.1. Learning design validity
A product is called valid if the product can reflect the soul of knowledge (state of the art of knowledge), which can also be called the validity of the content. The validity of the use of Facebook and WhatsApp in the learning process in terms of instructional aspects and technical aspects. The instructional aspects set include learning objectives, learning scenarios, instructional materials, instructional media, learning environment, and evaluation of learning outcomes. Technical aspects set include: easy to operate, accessible, and cheap. The validation result from 3 peer lecturers towards the use of Facebook and WhatsApp in the learning process as shown in Table 1.

| Instructional: | Facebook |  |  |  |  |  |  |  |
|---------------|----------|---|---|---|---|---|---|---|
| ● learning objectives | 0 | 0 | 2 | 1 | 0 | 0 | 2 | 1 |
| ● learning scenarios | 0 | 0 | 3 | 0 | 0 | 0 | 3 | 0 |
| ● learning materials | 0 | 0 | 3 | 0 | 0 | 0 | 3 | 0 |
| ● learning Media | 0 | 0 | 1 | 2 | 0 | 0 | 1 | 2 |
| ● learning environment | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 3 |
| ● evaluation of learning outcomes | 0 | 3 | 0 | 0 | 0 | 3 | 0 |

| Technical: | Facebook |  |  |  |  |  |  |  |
|------------|----------|---|---|---|---|---|---|---|
| ● easy to operate | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 3 |
| ● easy to access | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 3 |
| ● inexpensive | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 3 |

Based on Table 1, the validator stated the instructional aspect, as well as the technical aspects, are 33.3% good and 66.7% very good. Results are shown concurrently in conceptual usage. Therefore, the developed learning design can be applied in the learning process in the classroom.
3.2. **Learning design practicality**

A product is said to be practically available to people when it is usable. The practicality of using Facebook and WhatsApp in the learning process is in terms of the implementation and technical. Technical aspect in question: easy to operate, easy to access, cheap, commonly used, no memory consuming, non-time consuming, and non-eyestrain. The instructional aspects set out: access to material search, be able to share material, full of facilitators, study anytime and anywhere, and provide a pleasant environment. Practical data are collected by using questionnaires to the Facebook class (20 students) and WhatsApp class (20 students). The researcher uses the Facebook and WhatsApp in the learning process. The result is shown in Table 2.

|                      | Facebook | WhatsApp |
|----------------------|----------|----------|
| Technique:           |          |          |
| easy to operate      | 1 3 9 6 1 3 8 8 |
| Easy to access       | 2 2 10 6 2 3 9 6 |
| Inexpensive          | 2 3 8 7 2 2 9 7 |
| get used to          | 1 2 10 7 1 2 9 8 |
| non-memory consuming | 3 4 8 5 6 5 5 4 |
| non-time consuming   | 7 6 5 2 6 6 5 3 |
| non-eyestrain        | 8 6 4 2 7 6 4 3 |

| Instructional:       |          |          |
| easy access in searching material | 3 4 8 5 2 5 7 5 |
| material is shareable | 2 2 9 7 2 4 8 6 |
| facilitator’s availability | 3 4 9 4 3 4 8 5 |
| learning anytime and anywhere | 1 2 10 7 2 3 9 6 |
| providing fun learning | 2 2 9 7 1 2 10 7 |

Based on Table 2, the number of students who stated the practicality of using Facebook in the learning process is: very less 15%, less = 17%, good = 41%, and very good = 27%. While the number of students who stated the practicality level of use of WhatsApp in the learning process is: very less 15%, less = 19%, good = 38%, and very good = 28%. These results indicate that in general the use of Facebook and Whatshap in the learning process can be declared practical (Facebook = 68% and WhatsApp = 66% practicality in both good and excellent category). Technical obstacles in the use of Facebook in the learning process is little and can be overcome. Those obstacles are time-consuming (65%) and eyestrain (70%). While on the use of WhatsApp, there are technical constraints also occur due to consuming memory (55%), time-consuming (60%), and eyestrain (65%).

3.3. **Learning design effectiveness**

The explanations of each of these elements are [17] : 1) analyzing, the process of learning something to identify elements or relationships between elements; 2) Evaluating, the process of critically reviewing and responding to materials, procedures, or ideas, and assessing them against other objectives, standards, or criteria; 3) applying, the process of using ideas, processes, or skills in a new situation; 4) Generating ideas, a process of expressing thoughts that express originality, speculation,
imaginations, a personal perspective, flexibility in thinking, discovery or creativity; 5) expressing ideas, the process of presenting initial and logical ideas while using appropriate language for the audience. The rating category uses the rubric as follows: very good if it meets all indicators, good if it meets only 4 indicators, less if it meets only 3 indicators, is very less if it meets less than 3 indicators. Data were obtained from observation of student activity in the group for the Facebook class (20 students) and WhatsApp class (20 students) by 2 observers. The results obtained are shown in Table 3.

Table 3. Student’s Critical Thinking Skills

|            | Facebook | WhatsApp |
|------------|----------|----------|
| Analyzing  | 2 7 30 1 | 3 6 28 3 |
| Evaluating | 2 6 29 3 | 2 5 31 2 |
| Applying   | 3 5 31 1 | 5 8 25 2 |
| Generating ideas | 5 5 28 2 | 6 7 27 0 |
| Expressing ideas | 6 7 27 0 | 6 8 25 1 |

Based on Table 3, the use of Facebook in the learning process produces critical thinking skills of students as follows: very less 9%, less = 15%, good = 72.5%, and very good = 3.5%. While the use of WhatsApp in the learning process produces critical thinking skills of students as follows: very less 11%, less = 17%, good = 68%, and very good = 4%. These results show that in general, the use of Facebook and WhatsApp in the learning process can effectively train critical thinking skills (Facebook = 76% and WhatsApp = 70% in both good and excellent category). Effectiveness is also reviewed from how students respond to learning (looking for a deeper explanation, finding information from multiple sources, sharing experiences, expressing ideas, new experiences of social media in learning). The results obtained are shown in Table 4.

Table 4. Student’s Response to Learning Process

|                                | Facebook | WhatsApp |
|--------------------------------|----------|----------|
| Looking for a deeper explanation of the physical phenomena | 0 3 11 6 | 0 2 10 8 |
| Seeking information from various sources | 0 2 12 6 | 0 1 13 6 |
| Sharing experiences about physical phenomena in everyday life | 0 1 10 9 | 0 0 13 7 |
| Expressing an easy-to-understand idea | 0 2 9 9 | 0 3 11 7 |
| New experiences of social media in learning | 0 3 11 6 | 0 2 12 8 |

Based on Table 4, the number of students responding to Facebook usage in learning process is: very less 0%, less = 11%, good = 53%, and very good = 36%. While the number of students who respond to the use of WhatsApp in the learning process is: very less 0%, less = 9%, good = 59%, and very good = 36%. The results show that in general, the use of Facebook and WhatsApp in the learning process get a positive response from students (Facebook = 89% and WhatsApp = 91% of students respond which is in good and excellent category).
4. Discussion
Validation results indicate that both instructional and technical aspects are 44% in the good category and 56% in the excellent category. It shows that conceptually, the use of Facebook and WhatsApp in the learning process is stated valid which means that the developed learning design can be applied in the learning process in the classroom. Learning scenarios, learning materials, instructional media, and learning environments can be applied well because the features make it possible to do so. That is why we can choose mobile learning based on this innovative technology [23]. Technically, it is also compatible with the previous research such as low cost, simple, high accessibility, and efficient [24]. The results showed that in general the use of Facebook and WhatsApp in the learning process can be stated practical (Facebook = 68% and WhatsApp = 66% practicality in both good and excellent categories). Technical obstacles in the use of Facebook in the learning process are considered little and can be overcome (those are time-consuming (65%) and tiring (70%)). While on the use of WhatsApp, technical constraints also occur due to memory consuming (55%), time-consuming (60%), and eyestrain (65%). Obstacles experienced are overcome by limiting the duration of the learning process per session for only 100 minutes. Learning using Facebook and WhatsApp overcomes the availability of facilitators and learning can be done anytime and anywhere such as the results of previous research [25].

This research examines the effectiveness of using Facebook and WhatsApp in terms of its success in training critical thinking skills with the following elements: analyzing, evaluating, applying, generating ideas, and expressing ideas. Assessment of each element using indicators: clarity, accuracy, relevance, depth, and logic. The results showed that in general, the use of Facebook and WhatsApp in the learning process effectively trained critical thinking skills (Facebook = 76% and WhatsApp = 70% in both good and excellent categories). Effectiveness is also reviewed from how students respond to learning (looking for a deeper explanation, finding information from multiple sources, sharing experiences, expressing ideas, new experiences of social media in learning). The results showed that in general, the use of Facebook and WhatsApp in the learning process get positive responses from students (Facebook = 89% and WhatsApp = 91% of students respond in good and excellent categories).

5. Conclusions
The use of Facebook and WhatsApp in the process of physics learning to train students' critical thinking skills conceptually can be declared worthy of being applied in the classroom. Technical obstacles arise due to the use of Facebook and WhatsApp i.e. time consuming and eyestrain. Besides, the use of WhatsApp also takes a huge memory of the smartphone. The constraint is overcome by limiting the duration of learning time to just 100 minutes. The use of Facebook and WhatsApp is effective because it trains students' critical thinking skills through the elements of analyzing, evaluating, applying, generating ideas, and expressing ideas, with which the categories are measured by clarity, accuracy, relevance, depth, and logic indicators. Moreover, it also gets a positive response from students. Learning by using Facebook and WhatsApp can be used to train students' critical thinking skills.

References
[1] Yavuz F 2016 Do Smartphones Spur or Deter Learning: WhatsApp Case Study Int J Edu Sci 15 (3) pp 408—15
[2] Lenhart A, Madden M, Macgill A, Smith A. Teens and social media York Press
[3] Calvo R, Arbiol A, & Iglesias A 2014 Are all chats suitable for learning purposes? A study of the required characteristics Procedia Computer Science 27 pp 251—60
[4] Feynman R. 2010 Basic Physics, The Feynman Lectures on Physics 1 (02)
[5] Willingham D T 2007 *Critical Thinking Why Is It So Hard to Teach?* American Federation of Teachers

[6] Bouhnik D & Deshen M 2014 *WhatsApp goes to school: Mobile instant messaging between teachers and students* Journal of Information Technology Education: Research Vol 13 pp 217—31

[7] Bere A 2012 *A comparative study of student experiences of ubiquitous learning via mobile devices and learner management systems at a South African university*. Proceedings of the 14th Annual Conference on World Wide Web Applications; Durban

[8] Facebook 2011 *Facebook press room: Statistics* Retrieved from http://www.facebook.com/press/info.php?statistics

[9] Fewkes A M & McCabe M 2012 *Facebook: Learning Tool or Distraction?* Journal of Digital Learning in Teacher Education Vol 28 No 3 pp 92—8

[10] Bowers & Campbell J 2008 *Cyber "pokes": Motivational antidote for developmental college readers* Journal of College Reading and Learning 39 (1) pp 74—87

[11] Church K & de Oliveira R 2013 *What's up with WhatsApp? Comparing mobile instant messaging behaviors with traditional SMS* Proceedings of the 15th International Conference on Human-computer Interaction with Mobile Devices and Services pp 352—61

[12] Bere A 2013 *Using mobile instant messaging to leverage learner participation and transform pedagogy at a South African University of Technology* British Journal of Educational Technology Vol 44 No 4 pp 544—61

[13] Chipunza P R C 2013 *Using mobile devices to leverage student access to collaboratively generated resources: A case of WhatsApp instant messaging at a South African University International Conference on Advanced Information and Communication Technology for Education (ICAICTE 2013)*

[14] Plana M G C, Escofet M I G, Figueras I T, Gimeno A, Appel C, & Hopkins J 2013 *Improving learners’ reading skills through instant short messages: A sample study using WhatsApp* 4th World-CALL Conference, Glasgow, 10-13 July 2013

[15] Rozakis L 1998 *81 Fresh & Fun Critical-Thinking Activities* Scholastic Teaching Resources

[16] Paul R & Elder L 2006 *The Miniature Guide to Critical Thinking Concepts and Tools* Foundation for Critical Thinking

[17] Valentino & Catherine 2000 *Developing Science Skills* Houghton Mifflin Company

[18] Pence H E 2007 *Preparing for the real Web generation* Journal of Educational Technology Systems Vol 35 No 3 pp 347—56

[19] Sayan H 2016 *Affecting Higher Students learning Activity by Using WhatsApp* European Journal of Research and Reflection in Educational Sciences Vol 4 No 3 Progressive Academic Publishing UK p 88-93

[20] Dick W, Carey L, & Carey J 2009 *The Systematic Design of Instruction* (7th ed) Boston MA: Pearson A&B

[21] Fraenkel J R & Wallen N E 2003 *How To Design And Evaluate Research in Education* (Fifth Edition) McGraw-Hill Higher Education: New York

[22] Chan L 2005 *WebCT revolutionized e-learning* UBC Reports 51(7)

[23] Amry A B 2014 *The Impact of WhatsApp Mobile Social Learning on The Achievement and Attitudes of Female Students Compared With Face to Face Learning in The Classroom* European Scientific Journal 10 (22) pp 116—36
[24] Gon S & Raweka A 2017 Effectivity of E-Learning through Whatsapp as a Teaching-Learning Tool MVP Journal of Medical Sciences 4 (1) pp 40–6

[25] Bansal T, Joshi D 2014 A study of students’ experiences of mobile learning Global Journal of Human-Social Science 14 (4)