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ORIGINAL RESEARCH

FACEBOOK® GROUP USAGE TO SUPPORT FLIPPED-CLASSROOM LEARNING ON OCULAR TRAUMA

Muhamad Reza Utama[1]*, Deny Yuliawan[2], Yoyo Suhoyo[3], Widyandana[3]
[1]Medical Education Unit, Faculty of Medicine, Universitas Muhammadiyah Surabaya, Surabaya - INDONESIA
[2]Master in Medical and Health Professions Education, Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, Yogyakarta – INDONESIA
[3]Department of Medical Education and Bioethics, Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, Yogyakarta – INDONESIA

ABSTRACT

Background: Facebook has been acknowledged as an alternative media in supporting traditional learning activities. However, its potential in enhancing students' cognitive engagement on flipped-classroom' activities is still not much known. This study aims to measure undergraduate medical students' cognitive engagement changes after joining an ocular trauma flipped-classroom' Facebook group.

Methods: This pre-experimental study was involving 45 third-year undergraduate medical students of Muhammadiyah Surabaya' University who were joining the ocular trauma flipped-classroom' Facebook group. Three cognitive engagement variables were measured before students were joining the group and after the flipped-classroom' face to face session ended. Finally, metrics data of the group members' activities, which had been collected using Facebook Insight, used to shown changes between the active and passive user.

Results: All users' (n = 45) cognitive engagement were rising significantly after join the Facebook group (motivation, p = 0,000; self-directed learning readiness, p = 0,000; knowledge towards ocular trauma topic, p = 0,000). Increase in average active user knowledge was 11.09 points higher than passive users. Self-efficacy aspect of the students' learning motivation and self-management aspects of the students' self-directed learning readiness were the most increased sub-components.

Conclusion: Facebook group has the potential to improve students' cognitive engagement on ocular trauma' flipped classroom.

Keywords: Facebook, social media, undergraduate medical students, flipped-classroom, self-regulated learning.

PRACTICE POINTS

- *Facebook* group can enhance students' cognitive engagement towards flipped-classroom method.
- User friendly features and familiar interfaces can help both teacher and students to interact appropriately across intergenerational ages.
- Simple and free microanalytic data analyser feature in *Facebook* group, known as *Insight*, can help teacher/ facilitator to observe/ monitor group activity.

*corresponding author, contact: mrezautama.md@gmail.com

Utama, Yuliawan, Suhoyo, Widyandana. JPKI, 2020; 9(1): 32—43

JPKI

INTRODUCTION

The involvement of students (students' engagement) is considered an important marker that is optimal for measuring the success of academic activities. This involvement refers to the level of involvement of students in various scientific activities in the academic process.[13] However, the amount of information needed for medical practice has grown exponentially. The ability for one doctor to remain fully following all the body of knowledge comprehensively has long been exceeded by the presence of technology. Doctors and other health professionals, especially students, are bearing a very heavy burden on consuming and managing the amount of information available to them, meanwhile, they are also expected to be able to maintain memory related to medical knowledge that continues to grow. Those challenges would become more difficult to be handled if there is no support for cognitive enhancement. A new model of learning is needed for health professionals in this transformative era especially for a newly established faculty.

In the context of ophthalmology education for medical students, a more active and efficient learning process is needed. The limitations of the duration of the study, the quality of expert facilitation on the learning process, and the involvement of students in the topic are issues that need to be addressed.1 In respond to those challenges, a study from Tang et al.[2] had proven that the flipped-classroom approach can be a better choice compared to traditional lecture classes in teaching oculi trauma modules. Flipped-classroom has increased student motivation, increased performance in final examinations, and can help improve critical thinking skills, clinical reasoning, and clinical communication.[2] In the same context, the study of Lin et al.[3] found that the flipped-classroom approach has provided opportunities for students to obtain basic level cognitive abilities before face-to-face classes were held, so that valuable time in the classroom could be used for the development of higher cognitive abilities such as; apply, analyze, evaluate, and create. This transition not only provides more freedom and flexibility for independent learning, but also greatly enhances teamwork skills, material retention, and, most importantly, stimulates student interest in the content and learning process.[3]

While some studies show that flipped-classroom offers many positive results, several studies have also proved the limitations of flipped-classroom. Challenges present can include; low self-learning readiness of some students, failure of some students to schedule their study time, and to adequately study outside classroom learning content.[4]

Facebook in the medical education context has been recognized can be used to build and maintain meaningful interactions with other people, so that the possibility of an agentive, behavioral, cognitive and emotional engagement can be fulfilled.[5,6] Facebook has been proven to be a solution to increase engagement with class-based teaching practices. Viewed from the aspect of behavior (behavioral), affective (emotional), and cognitive, student engagement with the learning process can be optimized through the features possessed by Facebook usage in the setting of higher education.[5,7] Facebook has become the top choice for educators who are interested in using social networking sites in learning activities, especially in the medical education context, because of its potentials to improve information dissemination and learning collaboration through its feature and social learning format.[8,9] The continuously improved and legally protected user privacy policies have been considered as a benefit for this free-access digital learning environment.[8,10–12] Integrating Facebook as a learning media to enhance cognitive engagement - such as motivation to learn and achievement of learning objectives - through an independent learning process in various domains of science still needs to be studied.[5–7]

Challenges are still existing in flipped-classroom implementation. One of the issues is students' cognitive engagement to this method. On the other side, Facebook, as a learning resources, has proven capable to support students' engagement to traditional methods. However, its potentials in enhancing students' cognitive engagement to flipped-classroom method still need further studies. Thus, this study aimed to measure changes in the level of study motivation, self-directed learning readiness, and knowledge gain as variables of cognitive engagement of undergraduate medical students after joining a closed Facebook group which moderated to support

Utama, Yuliawan, Suhoyo, Widyandana. JPKI, 2020; 9(1): 32—43

JPKI

ocular trauma' flipped-classroom. User activity will be observed to see changes between active and passive user in the three variables of cognitive engagement. In this study, several hypotheses are needed to be proven, including; (1) significant increase in students' knowledge about ocular trauma emergencies, (2) significant increase in students' motivation to study, (3) significant increase in students' self-directed learning readiness, and (4) significant increase in all those students' cognitive engagement' variables is achieved after joining a closed Facebook group which moderated to support ocular trauma' flipped-classroom. Thus, it is hoped that this study can answer questions related to Facebook's usability in enhancing cognitive engagement on undergraduate medical students and questions related to its potentials in supporting flipped-classroom method.

METHODS

The pre-experimental study applied single group pretest-posttest design and analyzed further based on users' activities metrics which collected through the Facebook's feature called 'Insight'. Informed consent was obtained from all subjects, the participation of students in this study is carried out voluntarily after students receive an explanation of the purpose and process of the research. The ethical feasibility of the research from this study was approved by the medical and health research ethics committee of FKKMK UGM with registration number KE / FK / 0303 / EC / 2019.

The inclusions criteria of this study are; officially registered as a third-year medical student at Muhammadiyah Surabaya University, active students (never took any academic leaves), having an experience in using social media, having internet access, and having individual handheld/ devices to access Facebook. The exclusion criteria of this study are; transferred student, student who did not following pretest and posttest, student who did not joining the ocular trauma' Facebook group, and student who unwilling to participate in the research.

Fifty third-year medical students (N), all (100%) agreed to be the subjects of the study. Of the 50 people who agreed to be the subject of research, 1

person was a transfer student. However, to fulfill the ethical aspects of educational research, these students are still included in the Facebook group and a series of flipped-classroom activities in this study. The transferred-student's data, both from the activities in the Facebook group recorded through metrics and the results of knowledge, motivation, and self-readiness test results were excluded from data analysis processes. Thus, it was found that 49 students (98%) who met the inclusion criteria were willing to become participants in the study.

Of the 49 people who were willing to become study participants, one participant joined the group after the flipped-classroom face-to-face session was held and left the group 1 day before the study was completed. In addition, 3 participants have never joined the Facebook group even though invitations and appeals to join have been submitted. In the end, out of 49 prospective participants, 4 were declared withdrawn by the research and were considered not willing to participate in the study. Thus, the number of participants (n) who were recorded as participating fully in this research are 45 students (90%). The number of participants (n = 45) fulfilled the minimum number (44 people) of participants needed by this study.

A set of information related to ocular trauma topics that had been designed following the principles of Zimmerman's self-regulated learning were delivered before, during, and after the flipped-classroom's face-to-face session by the researcher through a closed Facebook group. Of 7 days duration, the content of information provided during the forethought phase (3 days before the implementation of face-to-face session) consisted of expected learning outcomes, user instructions and ethical guidelines, various types of infographics, videos, and video lecture recordings that were equivalent to the level of knowledge domain C1 -C2 from revised Bloom's taxonomy. During the performance phase, namely during the flipped-classroom face-to-face phase, the results from the pretest were announced through the group. Quotations of motivational sentences, posttest results, and videos containing recommended learning techniques and strategies are given through the Facebook group to guide the self-reflection phase

Utama, Yuliawan, Suhoyo, Widyandana. JPKI, 2020; 9(1): 32—43

JPKI

(3 days after the implementation of the face-to-face session).

The flipped-classroom face-to-face session was conducted to adapt the face-to-face format carried out in a study by Lin et al.[3] In that study, a face-to-face session was given to optimizing higher order level capabilities of the cognitive domain according to revised Bloom's taxonomy. In the face-to-face session, the initial knowledge that was previously obtained by students was elaborated into more complex knowledge through a form of cased-based discussion by small groups to facilitate the learning of ocular trauma and glaucoma for medical students. In this study, a face-to-face session was held for 150 minutes involving the first author as a moderator in collaboration with an eye specialist as an expert resource person. All 45 participants divided into 6 small groups. Each small group led a short problem-solving session and presenting their answer towards ocular trauma case-based scenario, meanwhile other group were responding by giving questions and feedbacks. After each small group presentation, the expert was giving feedbacks and clarifications.

In this study, all students' cognitive engagement variables were measured 3 days before and 3 days after students attended a flipped-classroom face-to-face session. After that, metrics data of the group members' activities during seven days of the study period which had been collected using Facebook's 'Insight', a built-in feature of social learning mode in the Facebook group, were used to categorize all research participants into active/moderate/passive user. All statistics data in this study had been analyzed using SPSS version 23 and Microsoft Excel 2016 edition.

The motivation was measured using the Motivated Strategies for Learning Questionnaire (MSLQ) questionnaire developed by the National Center for Research to Improve Posts Teaching and Learning,

University of Michigan and has been validated by previous research in the context of computer-based learning (CBL) methods for Indonesian' undergraduate medical students.[15] In this study only intrinsic goal orientation, task value, and self-efficacy for learning and performance were used. The total items used were 18 items consisting of 4 items to measure the intrinsic goal orientation, 6 items to measure task values and 8 items to measure self-efficacy for learning and performance. The results of the construct validity test on the student learning motivation questionnaire, as many as 18 items, showed that all the correlation items were meaningful. The results of reliability testing on the learning motivation questionnaire showed a high-reliability coefficient, which was 0.96.[15] A total of 36 validated items in the Indonesian version will be used to describe the 3 dimensions of SDLR, namely; self-management (13 items), desire to learn (10 items), and self-control (13 items). For the SDLRS questionnaire, reliability testing with Cronbach's alpha shows good reliability, which is equal to 0.90.[16]

RESULTS AND DISCUSSIONS

Participants characteristics

Student characteristics are seen through indicators of; current age, age of participant when beginning to use social media, amount of social media that had been frequently used as learning resources, gender, origin of high school (public/private), experience in using social media as formal learning platform, educational period of participant beginning to use social media as learning platform, frequency of social media usage during class-based activities in Muhammadiyah Surabaya Faculty of Medicine, and type of social media frequently used to support learning activities in Muhammadiyah Surabaya Faculty of Medicine. The characteristics of participants can be seen in the following table and pictures.

Utama, Yuliawan, Suhoyo, Widyandana. JPKI, 2020; 9(1): 32–43

JPKI

Table 1. Characteristics of participants

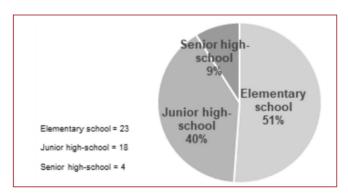| Characteristics of participants (n:45)		Median (Min-Max)
Current age		21 (19-23) y.o
Age of participant when beginning to use social media		12 (10-15) y.o
Amount of social media that had been frequently used as learning resources		3 (1-9) type(s)
		n (%)
Gender	Male	19 (42,2%)
	Female	26 (57,8%)
Origin of high school (public / private)	Public	32 (71,1%)
	Private	13 (28,9%)

Elementary school = 23
Junior high-school = 18
Senior high-school = 4

Figure 1. Characteristics by educational period of participant beginning to use Social Media as a learning platform

Not using at all = 1
< 30 minutes a day = 10
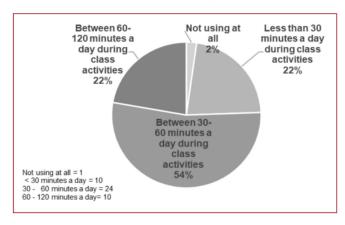30 - 60 minutes a day = 24
60 - 120 minutes a day= 10

Figure 2. Characteristics by frequency of Social Media' daily usage during class-based activities in Muhammadiyah Surabaya' Faculty of Medicine

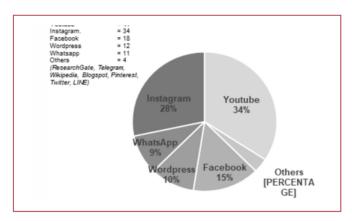Utama, Yuliawan, Suhoyo, Widyandana. JPKI, 2020; 9(1): 32—43

JPKI

Figure 3. Characteristics of Participants by Type of Social Media Independently Used to Support Learning Activities in Muhammadiyah Surabaya Faculty of Medicine.

Changes in the level of knowledge, study motivation, and self-directed learning readiness of student before and after joining the Facebook group

Each dependent variable of this study, which includes; the level of knowledge, study motivation, and self-directed learning readiness scale from all students belonging to the *Facebook* group (n: 45) had increased. Thus, the first to the third hypothesis in this study is accepted. The average increase between the situation before and after joining the *Facebook* group of the three variables can be seen through the following Table 2.

Table 2. Changes in level of knowledge, study motivation and self-directed learning

	Pretest Mean (±SD)	CI 95%	Posttest Mean (±SD)	CI 95%
Knowledge gain	36,7 (±10,7)	33,5-40,0	64,7 (±10,8)	61,5-68,0
Study motivation	84,5 (±10,7)	81,3-87,7	96,0 (±11,4)	92,6-99,5
Self-directed learning readiness	136,4 (±11,2)	133,0-139,8	141,6 (±12,0)	138,0-145,1

The level of knowledge of students before and after joining the Facebook group and the difference between the two is known to have normal data distribution. The paired T-test was conducted to see the significance of changes in the level of student knowledge between before and after joining the Facebook group. From the results of these tests, the average level of knowledge of students before joining at 36.7 (± 10.7) points was increased significantly (p = 0,000) with a difference of 28.0 (± 20.8) points to 64.7 (± 10.8) points after joining the Facebook group. Difference between pretest-posttest learning motivation and independent learning readiness has abnormal data distribution. Therefore, to test the significance of changes in learning motivation and readiness for independent learning between before and after joining the Facebook group, the rank-signed Wilcoxon test was used. From the results of these tests, it was found that student learning motivation increased significantly (p = 0,000) seen from the median value of pretest 84 (61,0-109,0) which changed to 97,0 (74,0-118,0) at posttest. The readiness of students' independent learning also experienced a significant increase (p = 0,000) seen from the median value of pretest 135.0 (111,0-164,0) which changed to 140,0 (112-140,0) at posttest. These results indicate that the fourth research hypothesis is accepted.

Utama, Yuliawan, Suhoyo, Widyandana. JPKI, 2020; 9(1): 32–43

JPKI

The results of observation of group use activities using the Facebook Insight

Through the 'Insight' feature, researchers as group administrators are possible to observe the activity of group members in the format of post units and units of learning. Behavioral student engagement such as; access frequencies and features that are most often used while joining groups can be recorded through this feature. Observation metrics from *Facebook's Insight* show that; the only *Facebook* group feature that has been used by students during the study is "Likes", there is no comment activity or use of other features recorded during the study, and most students see content through the newsfeed.

The activity of users is categorized based on the top and bottom percentiles of the total activities carried out while joining the group. Indicators of these activities include; the number of posts viewed (in total and per type of information, such as information in the form of text, infographics, learning strategy videos, pretest-posttest results, and lecture videos), number of units accessed, and number of reactions given. The number of active users was 24.4% (n: 11) of the total member population, while passive users were 48.9% (n: 22) of the total population of members. Both active users, as well as passive users, mostly accessing infographic content followed by learning strategy videos, and least accessing narrative text content. The following table (Table 3) is the results of a descriptive cross-analysis of knowledge gain, motivation, and self-directed readiness only for active and passive users of the *Facebook* group.

Table 3. Increased components of knowledge, learning motivation, and self-directed learning readiness of active and passive *Facebook* group users

Cognitive engagement variables			Mean score		
			Active user (n:11)	Passive user (n:22)	All [incl. moderate] user (n:45)
Knowledge gai**n**		Pre	32,99	39,67	36,69
		Post	67,73	62,51	64,72
		Difference	34,74	22,84	19,07
Study motivation	*Intrinsic goal orientation*	Pre	12,28	15,22	19.07
		Post	13,50	17,26	21.00
		Difference	1,22	2,04	1.93
	Task value	Pre	17,50	23,52	28.84
		Post	20,56	26,85	32.80
		Difference	3,06	3,33	3.96
	Self-efficacy for learning & performance	Pre	23,94	29,70	36.58
		Post	26,78	33,85	41.73
		Difference	2,83	4,15	5.16
Self-directed learning readiness	Self-management	Pre	46,27	46,73	46.76
		Post	50,64	48,95	49.40
		Difference	4,36	2,23	2.64
	Desire for learning	Pre	39,55	39,09	39.24
		Post	40,64	39,77	40.07
		Difference	1,09	0,68	0.82
	Self-control	Pre	50,82	50,09	50.40
		Post	52,45	52,68	52.36
		Difference	1,64	2,59	1.96

Utama, Yuliawan, Suhoyo, Widyandana. JPKI, 2020; 9(1): 32—43

JPKI

Based on Table 3, it can be seen that the increase in average active user knowledge is 11.09 points higher than passive users. The component of self-efficacy on learning motivation and self-management on self-directed learning readiness are the most increasing in both variables of cognitive engagement when compared with other components. Thus, it can be said that even though there was an increased in curiosity or interest in the topics or material learned in the flipped-classroom, students' assessment of their ability or competence to succeed was the most increasing component after joining the Facebook group. In addition, the student's assessment of self-management ability has become the most increasing component of self-directed learning readiness. However, it should be noted that in this study, the self-control component was the most increasing component among other passive users' self-directed learning readiness indicators and all components of passive users' intrinsic motivation indicators were increased higher if compared to the active users.

Increased student knowledge

Current empirical evidence shows that the flipped-classroom approach to health professional education all results in a statistically significant increase in student performance compared to traditional teaching methods. In research related to the effectiveness of flipped-classroom, studies with pretest-posttest design, practice/simulation, and objective assessment of a learning process can increase the acquisition of knowledge of students. In addition, the flipped-classroom will be more effective when instructors use quizzes at the beginning of each face-to-face session in class.[17] Pickering and Bickerdike found that Facebook can play an important role in supporting students in preparing for exams.[18]

In line with the findings of previous empirical studies, similar things were also found in this study. The level of student knowledge gained increased significantly (p = 0,000) after joining a Facebook group with a higher increase in average active users of 11, 09 points compared to passive users. The gap between the results of quantitative studies and observational studies has revealed the possibility that the results of increased knowledge are more due to face-to-face

sessions. The results of qualitative interviews can explain various reasons why this can occur.

Increased student learning motivation

During the implementation of learning tasks, self-efficacy along with other personal and situational factors has influenced cognitive involvement, including; motivation for learning, emotional response, and task selection.19,20 Situational factors, in this case during the face-to-face session, have been described by students as active, collaborative and motivating situations. Although the factors that represent personal attributes such as; habit of access time, intention to use, and prior experience identified as inhibiting usage behavior, individual trust factors such as; expectations for performance and expectations for ease of use can offset these challenges.

The motivation of student learning gained significantly (p = 0,000) after joining the Facebook group with the highest increase in self-efficacy, both for active users and passive users. Even though there is an increase in curiosity or interest in the material learned in flipped-classroom, students' assessment of their ability or competence to succeed is the aspect that is most felt to increase after joining the Facebook group. Thus, we argue that the results of learning motivation that increase significantly are the result of utilizing an online set of information that is designed to complement each other with face-to-face sessions by students as a unified flipped-classroom learning method.

Some interesting phenomenon had occurred in this study is that all the components of the learning motivation of passive users increase higher when compared to the active users' motivation. Related to this, it is well known that motivation can influence an increase in knowledge. This can be explained by a concept known as generative processing. Generative processing is a cognitive process that aims to understand the core material in more depth (mainly consisting of the process of organizing and integrating). The process is created by the motivation of students to understand material and can be supported by instructional methods that can promote the involvement of students in the material they want

Utama, Yuliawan, Suhoyo, Widyandana. JPKI, 2020; 9(1): 32–43

JPKI

to learn.[21] Although the increase in knowledge gain of the passive user is lower than that of active users, the unique findings prove that, with increasing learning motivation of users, especially passive users, after joining the Facebook group, generative processing of students can contribute to the improvement of knowledge.

Increased self-directed learning readiness

Although the popularity of the role of technology for education is increasingly widespread, there are several potential problems related to technology-based learning environments. Many students, for example, find it difficult to be independently finishing or complete tasks without external support.[22-24] A particular concern is that students often lack self-regulation skills, for example, to control behavior, emotions, and thoughts. When students cannot regulate themselves in a technology-based environment, the possible consequences include; anxiety, frustration, and even failure.[25,26] Therefore, lecturers and instructional design developers need to develop to develop learning techniques that can support self-regulated learning (SRL) when students work in a technology-based environment.

Self-regulation of students, especially for cognitive and metacognitive controls, is very important. Cognitive control refers to how students regulate the use of cognitive strategies to achieve learning goals; Metacognitive control refers to how students monitor and modify their cognitive strategies to make adaptive changes when they learn.[27] Therefore, apps/ media that act as scaffoldings need to be given to improve the cognitive and metacognitive control of students in a digital learning environment. Scaffoldings can generally be divided into hard scaffolds and soft scaffolds. Hard scaffolding, also known as fixed scaffolds, is a static guide and cannot be adapted to all individual learning needs of students. The hard scaffolding for the development of self-regulation can be useful if the individual needs of each student are carefully considered. As a result, students need to build commitment to the regulations that exist in themselves to obtain meaningful learning experiences. Empirical evidence has found that hard scaffolding can be provided to help students monitor their understanding and guide their learning activities, however, the mechanism of students adopting hard scaffolding into the development of their self-regulation is still not known.[26]

Soft scaffolding, also known as adaptive scaffolds, is spontaneous and can appear at any time so that it can be used to diagnose a problem when a problem is occurring. Student and lecturer interactions can form soft scaffolds, which can complement the shortcomings of hard scaffolding. It cannot be denied, learning is a social process where significance can be negotiated, learning objectives are born from social processes, and success is indicated in context. Social constructivism experts argue that the internal cognition of students can be born as a result of instructional agents who are instructional driven to interact with information-rich environments.[26,28,29]

Observation studies using insight group metrics have shown that the most accessed content is supporting information content before the forethought phase. All content before that face-to-face session is presented in the form of infographics. The result of descriptive quantitative study shown that self-management ability has become the most increasing component of students' learning readiness after joining the Facebook group. Authors argue that the increasing of self-management may be the result of hard scaffold exposure to students which were provided through Facebook groups. Meanwhile, the effect of soft scaffold function in the online environment cannot be reported in this study because of the lack of two-way activities that have been recorded in the group learning environment. This may be a result of the user's self-control, especially in passive users, which is found to be increased in this study. Further confirmation by users through in-depth interviews can confirm these results.

CONCLUSION

All student cognitive engagement variables (n = 45) after joining the Facebook group increased significantly compared to the initial conditions before joining the group (motivation, p = 0,000; independent learning readiness, p = 0,000; increased knowledge, p = 0,000). From these

Utama, Yuliawan, Suhoyo, Widyandana. JPKI, 2020; 9(1): 32—43

JPKI

results, we can conclude that the Facebook Group has potentials to improve students' cognitive engagements on ocular trauma flipped-classroom. On the other side, Facebook Insight shows that; the only Facebook group feature that has been used by students during the study is "Likes / Likes", there is no comment activity or use of other features recorded during the study, and most students see content through the newsfeed. All findings from the observational phase show passive and minimal usage activities from group members. Thus, there is a gap between user behavior and the results of quantitative studies. Therefore, subsequent qualitative studies are needed to confirm and look for explanations as to why the gap in behavioral engagement with cognitive engagement can occur and what affective (emotional) engagement factors might influence it.

RECOMMENDATION

We learned that the Facebook group can be a low-cost learning media alternative that manageable to be operated and moderated by a small team of teachers. The user-friendly interface, either desktop or mobile version, and features of Facebook itself could be an advantage. Simple micro analytics features such as "Insight" can be used to monitor activities. We also acknowledge that there are some limitations to this study. The learning environment in a study program that is a relatively new established and private university environment is contextual limitations of this study. Thus, the use of mixed-method design, especially using at least one in-depth qualitative method, for the next study will further strengthen the potential for research replication, as well as advanced developmental study in other educational institutions. Another limitation is the use of social media, especially Facebook, itself as a medium for supporting learning information. With the existence of legal regulations and ethics that protect the privacy of users of social media, the observational method to obtain empirical evidence still needs to pay attention to and protect sensitive aspects of

the privacy of the respondents. A third-party observational metrics application usage must be considered carefully. Researchers suggest using built-in features as its usage already protected by law and user regulation.

The researcher also recommends replication of research using similar social media for other medical subjects or its use as a companion to other learning methods, including for workplace-based education, to test contextual specificity. Also, a comparative study between the use of Facebook groups and other social media or the learning management system (LMS) using an experimental design needs to be done to explore the effectiveness and impact of each media tested. With notes, the factors that can influence the result must be controlled as optimum as possible. In other words, further exploration with qualitative methodology before further experimental study is needed.

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COMPETING INTERESTS

Authors declare that there is no competing or possible conflict of interest regarding the article.

AUTHORS' CONTRIBUTIONS

MRU - main researcher, contributing as the manuscript writer, instructional designer, Facebook group administrator, and main data analyst; DY – contributing as fellow data analyst; YS – contributing as fellow instructional designer, and fellow data analyst; WD – contributing as the manuscript writer, fellow instructional designer, and fellow data analyst.

Utama, Yuliawan, Suhoyo, Widyandana. JPKI, 2020; 9(1): 32–43

JPKI

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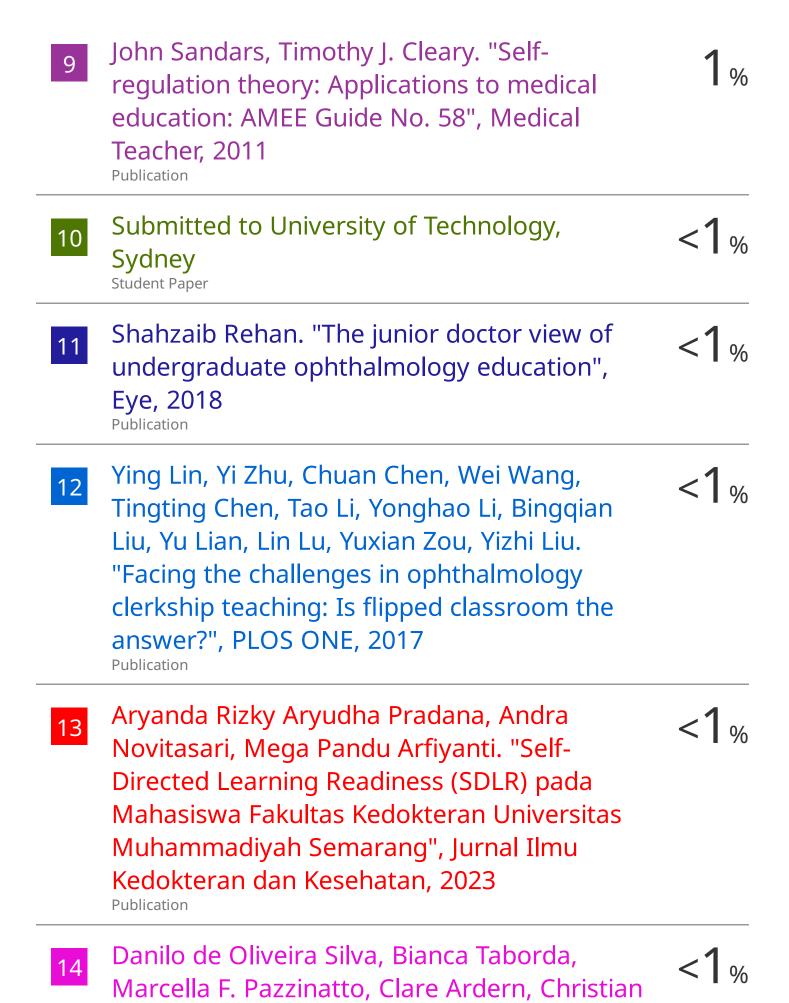| 1	Fabrizio Zeri, Frank Eperjesi, Craig Woods, Stefan Bandlitz et al. "Evidence-based teaching in contact lenses education: Teaching and learning strategies", Contact Lens and Anterior Eye, 2023 Publication	1%
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