Towards Successful Implementation of a Virtual Classroom for Vocational Higher Education in Indonesia

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Abstract. The virtual classroom continues to grow, but it is becoming more and more the norm, and it is fundamentally different from the vocational students at the Indonesian university. With the promised benefits of the virtual classroom, many challenges and difficulties come in the implementation. Although there are already successful design principles for virtual classrooms that support organizations in overcoming the challenges, the approach to implementing the design principles of virtual classroom at the vocational higher education in Indonesia is still lacking. In this study, we aim to answer the research gap and used the design sciences research by interviewing the lecturers to design the solutions. The proposed design approaches were implemented in a course and evaluated with students from two different groups. Overall, the evaluation of the proposed approaches shows1 significant results as an indicator of the benefits of the implementation of a virtual classroom for vocational students in Indonesia.

Keywords: Online Learning, Design Challenges, Design Principles, Vocational Education, Indonesian Higher Education.

1 Introduction

A virtual classroom is a technological approach mainly used in the educational world. Chen and Liu [1] define the virtual classroom as "synchronous learning model in ICT based", while Clark and Mayer [2] include the virtual classroom as part of e-learning to illustrate what is meant by virtual classroom. In this study, we define the virtual classroom as learning with the use of various digital media (e-learning) that support digital presence and real-time interaction between students and instructors. Some advantages of a virtual classroom are presented [3], among others are to improve the interaction between teachers and students, to enable immediate and fast reactions to students and to give students the feeling of being connected with the instructors [3].

The integration of technology into classrooms is important in preparing instructors and students for the 21st century and push the implementation of the virtual classroom can support teaching and learning in the digital age. In the context of a virtual learning

environment, which focuses on real-time interaction between instructors and their students, the use of virtual classroom must be supported by the readiness of stakeholder, user capabilities and access on technology to implement the virtual classroom. Therefore, evaluating the implementation of the virtual classroom is an essential factor for the sustainability of the virtual classroom.

Although the virtual classroom has many advantages for the world of education, there are various obstacles to its implementation. These challenges include for students: Lack of skills and bad experiences with digital tools. For instructors: Lack of technological and didactic skills and the intention to allow more face-to-face meetings and for fear of change [4]. General strategies have been developed to overcome obstacles to the implementation of virtual classrooms by establishing online community learning or the use of wiki systems [5]. However, barriers tend to evolve over time and context. For example, specific barriers for educational institutions in Indonesia require more attention to the availability of software and hardware [6], barriers related to Indonesian regulations for virtual classrooms with a maximum share of 50% of online classrooms [7] or culture-specific barriers based on the cultural dimension of the Hofstede [8], e.g. unequal power distances and lower values for individualism, which can hinder the establishment of a virtual classroom for individual trainers.

Reports on higher education in Indonesia show that there are 80.6% of a total of 3276 public and private campuses offering vocational education programs [9]. Several studies have tried to implement virtual classroom to support teaching and learning activities in vocational higher education institute in Indonesia [10, 11]. Although some studies show the positive impact of implementing a virtual classroom, the lack of a general approach that can be used by vocational higher education as a guide for the integration of a virtual classroom in Indonesia remains an obstacle for various vocational institutions in Indonesia. Some of the ideas used to support the implementation of virtual calssroom are the use of Moodle and Edmodo software in the teaching and learning process integrated into a blended learning environment. To our knowledge, however, there is no research discussing how to implement virtual classroom for vocational students in Indonesia. Using Google Scholar as a search engine using the search keywords "Virtual Classroom" AND "vocational" AND "Indonesia" queries in English (results in 342 sources) and Indonesian translation of keywords (21 sources) from the search results does not yet offer any form of the proposed design approaches within the context of the vocational higher education in Indonesia. Therefore, we want to fill the gap by proposing design approaches on how the implementation of virtual classroom will be carried out in this context. To answer the research gap, in this study, we used the Design Science Research (DSR) [12], starting with an initial first problem, such as lack of the applicable concept to implement virtual classroom in Indonesian higher education. Then we used [13] as basic principles in the preparation of proposed design approaches, which we discussed with university lectures from three different higher educational institutes. We then applied the proposed approaches in a lecture module of the vocational school and evaluated the results with 100 students. The proposed approaches show the potential both for new students as well as the students that other

vocational higher educational institutions in Indonesia can use the approaches as guidelines for the implementation of the virtual classroom that comply with the regulation for the institutions of higher education in Indonesia.

In this work, first, we present literature and information related to our study and the explanation of principles for successful implementation of virtual classrooms [13]. Then, we give a short description of the steps that we have taken in the Methods section. Next, the results of the research including the proposed implementation design and the evaluation of the proposed design. Finally, we provide information about the limitations of the study, conclusions and future steps that can be taken with the results of our research.

2 Theoretical foundation

2.1 Overview Learning Theory

In the development of learning theory, the learning process has undergone a paradigm shift in the learning approach, from pedagogy to andragogy and now heutagogy [14]. Heutagogy learning emphasizes that students learn independently (self-determined learning), in this case, the student can determine what they want to learn, manage teaching material in a format beloved by students, a wide variety of digitally learning resources, and the use of educational social platforms such as Edmodo, Youtube, and Whatsapp [15]. To support these developments, educational institutions need to provide a learning environment that can make it easier for students to develop their own knowledge anytime and anywhere. In other words, learning technology should be an integral part of the current learning model [16].

2.2 Design Principles of Successful Virtual Classroom

A virtual classroom is an online class that enables students to communicate, present lessons, interaction with teaching materials, and works in groups [17]. The virtual classroom is not a novelty, the discussion about e-learning at the end of 1990 became the gateway to the integration of digital materials into the educational world. The web-based learning management system at the university level was used at the beginning of 2000 as a tool to promote learning [18]. As time goes by, advances in technology and infrastructure become more sophisticated to support real-time digital interaction between students and instructors. A holistic approach of educational institutions using digital learning materials is proposed to support as many learning activities as possible [19]. One of the main challenges in online learning is interactivity in the virtual classroom [20]. Referring to the research conducted by [13], the seven basic principles for a successful interactive virtual classroom can be seen in Figure 1.

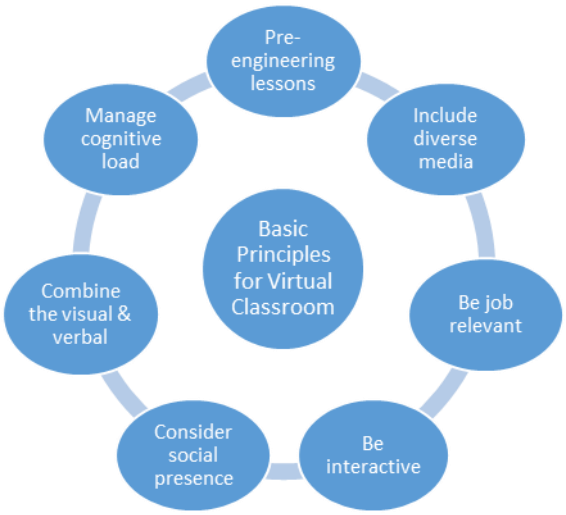

Fig. 1. Seven basic principles for successful virtual classroom based on [13].

Based on Figure 1, to be able to effectively implement virtual classroom, it is essential to pay attention to the seven basic principles of successful virtual classroom including: 1) Pre-engineering lessons: advance planning and preparation of all the major elements of the event; 2) Include diverse media: diverse delivery media complement one another; 3) Be job relevant: good virtual events are explicitly relevant job; 4) Be interactive: learning is interactive; 5) Consider social presence: social presence promotes learning; 6) Combine the visual and verbal: appropriate visual and verbal modalities; 7) Manage cognitive load: cognitive load must be managed in all instructor-led events. The advantage of design principles of a virtual classroom by [13] is the ability of the design principles to adapt into different context and cultures [21-23] which is relevant with multicultural characteristic of Indonesian society. Furthermore, the design approaches [13] focuses more on the technique of developing a learning environment. We, therefore, used these principles [13] as a basis for our research.

3 Method

In this study, we applied design science research (DSR) process [12] aiming to tackle the initial research problem and evaluate the proposed solution close to the object of the study and their environment. Lack of available design approach to implementing virtual classroom for a vocational university in Indonesia is the initial research problem that guiding our research study in the next step of the DSR. For a phase of a solved definition, in this study, we used qualitative research on the phase of design solution by using an interview with university lectures from three different universities in Indonesia who had 10 to 16 years of teaching experiences, and it was not involved in the writing of this paper. The interview was conducted both in form face-to-face meeting as well

as an online interview. Each result of the interview is recorded and documented in written format. We had adapted the design principles [13] for the virtual classroom, combined with the interview and the study literature, a set of design approaches for the implementation of the virtual classrooms for vocational students and presented in the results section. The proposed design approaches were then implemented and tested for a one-course semester of selected study module of the vocational program at one of a private university in Indonesia. The course modules consist of two different groups of students. The first group consists of students of the 5th semester and the second group for the first semester students. Two different groups are selected to show a general effect of the proposed approach for vocational students. At the end of the semester, the student was asked questions about the implemented design approaches in the form of blended learning. We used Likert scale (1: very poor - 5: very good) online questionnaire consisted of 9 questions required by the institution where the solution approaches were implemented (see Table 1) to meet our study purpose. The proposed approaches, as well as the result of the evaluation, are presented in the following section.

Table 1. Items Question (Adapted from [24]).

No	Questions
1	Availability of teaching content (material, discussion, assignments, etc.)
2	Use of tools (Edmodo, Kahoot, etc.)
3	Compatibility with the teaching and learning process
4	Support for increasing learning motivation
5	Support for improving learning methods
6	Support for improving learning outcomes
7	Supporting facilities (guidelines, instructors, etc.)
8	Overall evaluation

4 Result and Discussion

In this section, we present two main findings of the study. The first results are related to the proposed design approach and the second results is the evaluation of the proposed approaches.

4.1 Proposed Approaches

Our study proposed seven design approaches for a vocational private university in Indonesia to implement a virtual classroom. The seven approaches can be seen in Figure 2.

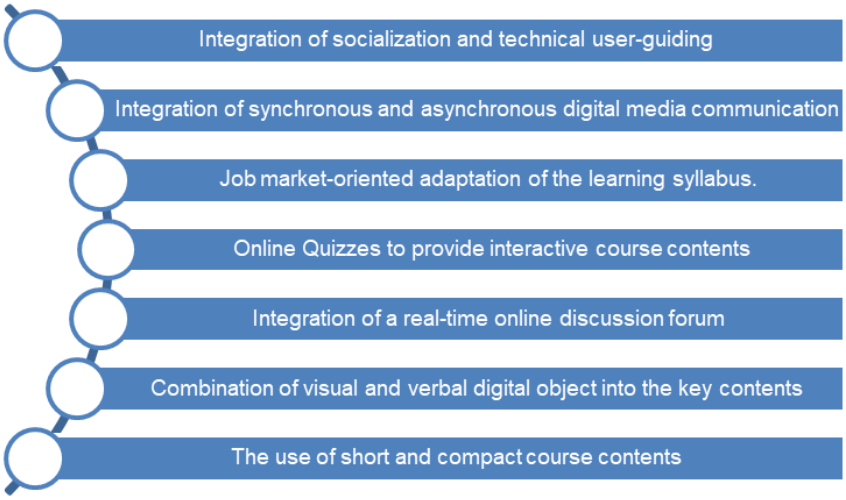

Fig. 2. Proposed design virtual classroom.

More details are explained as follows:
Integration of socialization and technical user-guiding features for new users. The first design approach is based on principles of pre-engineering lessons that focus on the planning and preparation of the virtual class both by providing digital and printed guideline book for the students about how to use the virtual class. The printed book was made to give information of module handbook and the printed book, as well as the digital version were socialized among the students at the first course meeting. The guideline book included information about the method in the blended learning, explanation about the course contents and how to use the required tools and procedures of the courses. The importance of the virtual class is also stated in the interview for instance: "...a virtual class is still a new thing for the students; therefore, it is important to socialize the guideline how to use the virtual classroom...".

Integration of synchronous and asynchronous digital media communication. The use of different media is the second principle of a successful virtual class. We elaborated the second principle and focused on the integration of several digital media as well as the use of open source tools that can utilize synchronous and asynchronous virtual learning activities. For this second approach, we used different digital learning media, including digital slide presentations, video tutorials uploaded to the YouTube platform and other open source platforms to store the digital learning content. In addition, social media such as Facebook group and WhatsApp group were used to support synchronous communication. The importance of the multichannel media to support learning activities for a virtual class is also mentioned in the interview: "...there is a need for media that can support synchronous and asynchronous learning activities...".

Job market-oriented adaptation of the learning syllabus. The third approach to implement virtual classroom is by adapting the course syllabus based on the need of the

current job market. Identifying relevant contents based on the analysis of the job market collected from industry and available job vacancy that listed in any online job portal. The solution approach focus on relevancy between the activities in the virtual classroom with the targeted competencies for students. We customized the course syllabus also by adding more detail information to the learning plan that includes design activities and teaching content, design content of course descriptions, a design of task content, draft discussion forum, a design of quiz content, design of learning videos and design of blended learning activities. Based on the interview, some notable comments related to the proposed design solution are "...We need to have a detailed blended learning plan..." other interviewee stated that "...The activities that are taught must be relevant and clear..." and "...The design of blended learning activities must be explicit...".

Online Quizzes to provide interactive course contents. This fourth solution relies on the "Be interactive" principle, which explains the importance of interaction between teacher and student and between students in a virtual class. Based on the results of interviews with the teaching team to increase the interactive activities, we conducted an online quiz with Kahoot's game-based learning tools in one session (See Figure 3). The proposed solution is also supported on the basis of an interview that there are no online quiz questions yet for the learning content.

Fig. 3. The use of Kahoot platform to provide an interactive quiz.

Integration of a real-time online discussion forum. This fifth approach embodies the principle of taking social presence into account and the approaches are also still related to the second proposed design approach. The fifth approach aims to integrate social activities into virtual class-based learning activities. Based on the results of interviews, social media-based tools are needed to increase social activities in learning. The tools used are Edmodo LMS and WhatsApp applications. Edmodo LMS is used to create discussion forums related to learning materials and related tasks that are assigned online. In addition to social activities, the WhatsApp group is also used to facilitate social activities in the teaching and learning process.

Combination of visual and verbal digital object into the key contents. The sixth solution follows the principle of the importance of combining visual and verbal techniques in the teaching content used. Based on the results of interviews to improve the effectiveness of the students' competence performance, the learning content is not only created in the form of texts but also made interesting by adding pictures, graphics and videos. The proposed approach supports the result from an interview "...Activities and digital content must be made more interesting in relation to topics considered important...".

The use of short and compact course contents. For the last proposed solution, the principle of controlled cognitive stress is applied. The principle describes the importance of cognitive load control for all learning activities. Based on the results of the interviews, the summarized learning content, which highlights the main points of the learning materials supported by the instructor's narrative, accessible anytime and anywhere, is important for students to facilitate discussion and repetition of self-learning. The proposed solution is also related to the proposed second approaches related to the selection of the online repository. Based on the interview, some notable comments related to the proposed design solution are "...the choice of content depends on whether the subject is interesting / not..." and "...must pay attention to the level of difficulty of the material to be taught.....".

Next, we present the assessment result of the implemented proposed approach.

4.2 Analysis of Evaluation

Evaluation of the results is done by involving 100 students (32 for the first group, 68 for the second group, 60% male students, 40% female students, age 18-19th: 32 respondents, age 20-21 years: 68 respondents) who are registered as active students in the virtual classroom that has been created. The evaluation method used a survey method with a questionnaire tool, containing 8 items of questions that represent the student's perceptions of the results of the design of the virtual classroom that have been made. A summary of the results of student evaluations is shown in Table 2.

Table 2. Relative numerical distribution of all variables.

Score	All			Old Students			New Students		
	Y	R	Rk	Y	R	Rk	Y	R	Rk
Teaching content	3,86	77,20	8	3,94	78,82	5	3,69	73,75	7
Tools	4,22	84,44	2	4,25	85,00	1	4,19	83,75	2
Compatibility in learning	4,23	84,60	1	4,22	84,41	2	4,25	85,00	1
Learning motivation	4,00	80,00	4	3,96	79,12	4	4,09	81,88	3
Learning method	3,97	79,40	5	3,96	79,12	4	4,00	80,00	4
Learning outcome	3,93	78,60	6	3,91	78,24	6	3,97	79,38	5

Score	All			Old Students			New Students		
	Y	R	Rk	Y	R	Rk	Y	R	Rk
Supporting system	4,14	82,80	3	4,12	82,35	3	4,19	83,75	2
Overall evaluation	3,90	78,00	7	3,91	78,24	6	3,88	77,50	6

Y: Mean, R: Relative Weight; Rk: Rank

Table 2 shows that compatibility in learning and tools are the two highest score for student perceptions, while teaching content is in the lowest score from the result of student assessment of the design of the virtual classroom. On the one hand, for the old student tools availability of the proposed design approaches is evaluated at the top, on the other hand, for the new student shows the compatibility in learning is in the first place and as an indication of how helpful the student experiences on technology for the implementation of the proposed approaches for virtual classrooms. Overall, the findings of the evaluation indicate that the overall assessment of students in the design of virtual classroom shows positive results. This can be seen from the average range of all variables between 3, 86 (77, 2%) and 4.23 (84, 60) with all mean score above 3, 41 (68, 2%). Thus, it can be said that the design of the virtual classroom can be well received by the student in order to support the effectiveness of blended learning activities.

5 Discussion

Interestingly considering to the results of this study compared to previous studies, some points of discussion appear. The first is related to the barriers that exist in Indonesia, previous studies mentioned about the barrier related to the implementation associated with infrastructure, the availability of supporting software and hardware [4, 6]. We also found this out through the results of the interviews, so that there are suggestions for the use of open platforms, open source software, and social media. Second, the use of social media as a learning medium is also consistent with research on the role of social media in supporting the teaching, learning, and knowledge transfer process [25, 26]. The popularity of WhatsApp in Indonesia [27] as the way of group communication can be used to enhance real-time feedback that can be seen to all students.

Next, we also utilized the well-known platform for learning such as Edmodo, Kahoot, and the use of YouTube to 24 hours online available video tutorial to provide individual learning as part of the solution. Interestingly, lack of infrastructure [6] to access the video platform was not mentioned in the interview. Instead, the interviewee recommended such video open platform to enhance virtual learning. Fourth, the use multiple media channels resulting on the overall score; however, the results of the interview show that there is still a need for guidance on how to integrate the implementation and use of these different tools, and also support prior research on the obstacles related to skills in the use of tools [6]. Therefore, it is still necessary to provide information on guidelines in a face-to-face format at the first session of a course. Finally, the use of design principles [13] are also supported as a general approach that is in line with the needs of the instructors as the result of the interview, moreover the proposed

approaches also providing an overall accepted score for the implementation for vocational students.

6 Outlook and Future Work

Based on the literature review, current research in the field of online learning is leading to increasing the effectiveness of a virtual classroom. The main key to create an effective learning in the virtual classroom is to develop teaching and learning design. Therefore, this research tries to develop a proposed design for the implementation of a virtual classroom, especially for a vocational university in Indonesia. The development process is focused on the interaction between students and instructors in an online learning environment.

From the theoretical perspective, the result of this study provides an insight into the needs of different approaches to how a virtual classroom can be integrated into vocational education modules in Indonesia. Moreover, the study also shows the successful implementation of the basic principle of designing a virtual classroom. While in practice, the results of this study can be utilized by higher education institutions to design and improve existing online learning services.

The results of this research have shown that the virtual classroom can support online learning at the higher education sector, especially for a vocational university in Indonesia. In addition, this study also shows that student can interact with instructors as a real. That is, the focus of a virtual classroom is not only on the use of the technology but also on the virtual learning environment. Therefore, the result of this study can be used as a starting point for further research.

In our future work, we are going to analyze the factors that influence the success of a virtual learning environment. The results also can provide us with basic approaches to support us analyzing the impact of using virtual classroom both on improving student and instructor performance. Finally, we will incorporate the proposed design to institutional curricula for various higher vocational study programs or subjects.

References

1. Chen, R. C., Liu, S. C.: Applying concept mapping on the influent learning in virtual classroom. In: International Conference on Hybrid Intelligent System, IEEE Computer Society Press, (2009).
2. Clark, R. C., Mayer, R. E.: E-Learning and the science of instruction: proven guidelines for consumers and designers of multimedia learning. 3rd Edition, Pfeiffer/John Wiley & Sons, San Francisco, (2011).
3. Wang, A. Y., Newlin, M. H.: Online lectures: Benefits for the virtual classroom. The Journal, 29(1), 17-18, (2001).
4. Barajas, M., Owen, M.: Implementing virtual learning environments: Looking for holistic approach. Educational Technology & Society, 3(3), 39-53, (2000).
5. Palloff, R. M., Pratt, K.: Building online learning communities: Effective strategies for the virtual classroom. John Wiley & Sons, (2007).

6. Hendrastomo, G.: Dilema dan Tantangan Pembelajaran e-Learning. Majalah Ilmiah Pembelajaran, 4(1), 32-35, (2008).
7. Ristek Dikti Website: http://kelembagaan.ristekdikti.go.id/wp-content/uploads/2016/11/permen24tahun2012.pdf, last accessed 2019/01/08.
8. Hofstede Website: https://www.hofstede-insights.com/country-comparison/indonesia/, last accessed 2019/01/08.
9. Kopertis Website: Indonesian government institution for private higher education, http://kopertis3.or.id /v5/wp-content/uploads/Buku-Statistik-Pendidikan-Tinggi-2017.pdf, last accessed 2019/01/08.
10. Ambarita, A.: Implementasi sistem e-learning menggunakan software moodle pada politeknik sains dan teknologi wiratama maluku utara. IJIS-Indonesian Journal on Information System, 1(2) (2017).
11. Silanegara, I.: Penerapan konsep reengineering untuk mengidentifikasi kebutuhan teknologi informasi (studi kasus: progam studi teknik energi di politeknik negeri). Jurnal Poli-Teknologi, 9(3) (2013).
12. Hevner, A. R.: A three cycle view of design science research. Scandinavian journal of information systems, 19(2), 4, (2007).
13. Clark. R. C., Kwinn. A.: The new virtual classroom: Evidence-based guidelines for synchronous e-Learning. Pfeiffer/John Wiley & Sons, San Fransisco, (2007).
14. Acedo, C., Hughes C.: Principles for learning and competences in the 21th-century Curriculum. Prospects, 44(4), 503-525 (2014).
15. Blaschke, L. M.: Heutagogy and lifelong learning: A review of heutagogical practice and self-determined learning. The International Review of Research in Open and Distance Learning, 13(1), 56-71, (2012).
16. Dabbagh, N., Benson, A. D., Denham, A., Joseph, R., Al-Freih, M., Zgheib, G., & Guo, Z.: Learning Technologies and Globalization: Pedagogical Frameworks and Applications. Springer. (2015).
17. Thinyane. H., Mufeti. K.: Google docs and skype for a low bandwidth virtual classroom for developing countries. International Information Management Corporation, (2010).
18. Rios, A. P., Callaghan, V., Gardner, M., Alhaddad, M. J.: The interreality portal: A mixed reality co creative intelligent learning environment. In: International Conference on Intelligent Environments, IEEE Computer Society Press, (2012).
19. Z., Jiang., X., Guo.: A miniature e-learning portal of full teaching and learning capacity. IEEE Computer Society Press, (2012).
20. Repman, J., Zinskie, C., Carlson, R.: Effective use of CMC tools in interactive online learning. Computers in the Schools, 22(1/2), 57-69, (2005).
21. Keramidas, C. G., Ludlow, B. L., Collins, B. C., Baird, C. M.: Saving your sanity when teaching in an online environment: Lessons learned. Rural Special Education Quarterly, 26(1), 28-39, (2007).
22. Valaitis, R., Akhtar-Danesh, N., Eva, K., Levinson, A., Wainman, B.: Pragmatists, positive communicators, and shy enthusiasts: three viewpoints on web conferencing in health sciences education. Journal of Medical Internet Research, 9(5), (2007).
23. Wickens, C. D., Hollands, J. G., Banbury, S., Parasuraman, R.: Engineering psychology & human performance. Psychology Press, (2015).
24. Aditya, B. R., Permadi, A. :Implementation of utaut model to understand the use of virtual classroom principle in higher education. In Journal of Physics: Conference Series (Vol. 978, No. 1, p. 012006). IOP Publishing. (2018, March).
25. Pirkkalainen, H., Pawlowski, J. : Global social knowledge management: from barriers to the selection of social tools. Electronic Journal of Knowledge Management, 11(1), (2013).

26. Baird, D. E., Fisher, M.: Neomillennial user experience design strategies: Utilizing social networking media to support “always on” learning styles. Journal of educational technology systems, 34(1), 5-32, (2005).
27. Kurniasih, N., Riyadhsyah, T.: Virtual Ethnography Study of Inter-lecturer Communication in National Young Lecturers Forum WhatsApp Group. In Proceedings of the 8th International Conference of Asian Association of Indigenous and Cultural Psychology, (2018).