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Empowering Student's Learning Involvement Through STEM Approach in Citizenship Education Learning in the New Normal Era

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Abstract.
This study identified the empowerment of student's learning involvement through STEM approach in learning Citizenship Education during the New Normal era at Universitas Pendidikan Indonesia and STKIP Pasundan, Cimahi. This study used quantitative and qualitative research procedures which undertook three steps: 1) preparing the use of the STEM approach in citizenship education learning; 2) implementing the STEM approach in citizenship education learning; and 3) reflecting the implementation of the STEM approach. The results showed that students had an awareness to learn, experience, and directly experience themselves. Learning was carried out concretely as well as by developing cooperative attitudes in students. In addition, 30% of the empowerment of students' learning involvement in visual activities was conducted in the form of reading, viewing images, observing experiments, and demonstrations, while 50% of oral activities (i.e., expressing opinions, connecting an event, asking questions, and giving suggestions), and 20% of writing activities (i.e., writing reports, making outlines or summaries, and doing tests). This article concludes that student learning involvement through a stem approach in civic education learning is in an effort to produce quality cognitive, psychomotor, and affective human resources. The STEM approach used in civic education learning can ultimately increase the activeness and attitude of student involvement.

Keywords: empowering student's, learning involvement, STEM approach, in citizenship education learning, new normal era

1. INTRODUCTION

Changes in situation and conditions along with the Covid 19 pandemic have driven changes in human life. To contain the initial spread of the virus, many countries chose to close schools [1]. Covid-19 pandemic has revealed many weaknesses in the system of life so far [2]. Related to this, education cannot be separated from changes in terms of learning and learning. It was said that security in response to Covid 19 pandemic had cause various psychological effects such as anxiety, stress, fear, frustration, and boredom for students [3]. In addition, Covid 19 pandemic affected services in education [4]. On the other side, many are switching from physical teaching to distance teaching [5]. In a learning situation during the Covid 19 Pandemic, teachers and students will develop important digital competencies [6]. Therefore, innovation is needed in accordance with new normal period.

The existence of learning and learning situations during new normal, has an impact on various learning innovative ideas in students. Various models, strategies, learning techniques are carried out to balance the learning atmosphere; one of them is the use of the STEM approach in Civic Education learning. STEM is an approach that integrates science, technology, engineering, and mathematics in learning. the use of STEM in learning has provided information in terms of achievement and persistence among students [7]. Developing STEM in learning is a portal for educational resources to help teachers [8]. A study has proven that the use of STEM has shown a lot of increased effectiveness in student learning, as well as civic awareness [9]. STEM is commonly used in school settings to help students to strengthen their learning [10]. The use of STEM in Civic Education learning during new normal is appropriate because it supports the achievement of the 21st century skills, namely collaboration, communication, creative-innovative, and critical. A study emphasized that STEM supports students increase their level of participation [11]. Students are highly involved in STEM activities and have implications for the learning experience. Thus, the use of STEM in Civic Education learning is the right choice [12].

The use of STEM in Citizenship Education learning during new normal is the answer to concerns about the use of various technological products in learning. The use of technology as a tool to improve thinking has significant implications [13]. In a learning, technology is an environment for students. The environment consists of three components, one of which is a computerized system for students [14]. STEM in learning can support knowledge discovery, organization, and integration of students [15]. In this matter, a study emphasizes the willingness of educators to embrace innovation and

produce quality learning [16]. One of the 21st century skills can be realized through a content-based and project-based approach [17]. Therefore, with the use of STEM in Civic Education learning, it is expected to be able to encourage students to be able to reason, analyze, and solve problems, because the 21st century skills have modified teaching styles in learning [18].

In Indonesia, Citizenship Education is one of the compulsory subjects in higher education. In practice, Citizenship Education has a vision in realizing good citizens. In Citizenship Education, citizenship competencies that are useful in the life of the nation and state is developed [19]. The purpose of Citizenship Education is to prepare citizens to think critically and act democratically. It is stated that Citizenship Education is a way to foster citizens [15]. Besides, there is an effort towards the independence of the Nation [20]. In this era, students are required to have hard and soft skills [21]. Therefore, because Citizenship Education is a learning that teaches democratic values, morals, norms, the use of STEM is one of the efforts to encourage students to form good citizens' characters and be aware of their rights and obligations. As a study says that Citizenship Education is a way to develop citizens [22]. Civic education displays an active subfield of comparative education hard skills but also soft skills in civics education is something that must be achieved by students and in the process the use of the STEM approach is an alternative [23].

Based on the background that has been described, the researcher views that the identification of strengthening student learning involvement through the STEM approach in the learning of citizenship education in the New Normal era is very important to implement. STEM offers important lessons for policy makers and practitioners involved in new school models [24]. It is said that integrative learning with technology helps students build their meta-representational competencies [25]. Therefore, the researchers took this theme to combine the encounter between the new normal era and the STEM Approach. The research question that we used was "how is the empowerment of students' learning involvement through STEM approach in Civic Education learning during new normal?". The practical benefit of this research was that it could serve as a basis for further researchers who had the same discussion, theoretically contribute ideas in terms of the STEM approach, especially in the subject of Citizenship Education learning in Indonesia.

This research focuses on the theme being studied, namely contributing to students becoming problem solvers, inventors, innovators, logical thinkers, technology literate so that they are able to connect the values of citizenship in the STEM Approach. The novelty of this research is to provide an overview of the application of STEM in

Civics education learning in universities so that students can define problems, plan and conduct investigations and analyze and interpret data logically and mathematically.

2. RESEARCH METHOD

The method used in this study was a combination of qualitative and quantitative, hereinafter referred to as mixed methods. The use of this method was based on an opinion of mixed research is research that combines qualitative and quantitative research [26]. Mixed method is a combination of qualitative and quantitative concept to obtain reliable results [27]. It is also known as a method that set knowledge about systematic and logical steps of data retrieval [28]. This study involved students who took Citizenship Education course in 2022, classified as class A1, A2, A3, A4 and A5 at Universitas Pendidikan Indonesia, and class PK 19, PK 20, PK 21 at STKIP Pasundan, Cimahi. Careful planning leads to a brief investigation of the research [29]. The data were collected through interviews, observations and scales, while the data were validated using triangulation. Regarding the application of STEM in civic education that the researchers did in the Citizenship Education course at Universitas Pendidikan Indonesia and STKIP Pasundan, they are:

1. Analyze Basic Competencies on material that can be taught using the STEM approach.
2. Identify topics that contain STEM content
3. Formulate indicators of competency achievement.
4. Conduct STEM material analysis
5. Description of STEM content can be seen in table 1.

Table 1: Description of STEM content in the citizenship education course at Universitas Pendidikan Indonesia and STKIP Pasundan.

No	STEM Payload	Payload Description
1	Science	Namely facts, data, and processes about science contained in the basic competencies of the material to be studied
2	Technology	That is the technology used or developed
3	Engineering	Namely engineering activities such as what products are designed, tools and materials, testing and evaluation
4	Mathematic	Namely mathematical activities carried out in the form of counting, locating, measuring, designing, playing and explaining

The sample in this study were students who took the Citizenship Education course in 2022, classified as class A1, A2, A3, A4 and A5 at Universitas Pendidikan Indonesia, and class PK 19, PK 20, PK 21 at STKIP Pasundan, Cimahi. The data analysis used is of

qualitative and quantitative, namely in the early stages of this research method using qualitative methods and the next stage using quantitative methods. The emphasis of the method is more on the first method, namely the qualitative method and is further complemented by the quantitative method. Mixing the data of the two methods is connecting between the results of the first study and the next stage.

The procedure for this research is to begin with the implementation of research at the qualitative level, namely: 1) knowing how to apply STEM to the Citizenship Education course at the Indonesian Education University, and STKIP Pasundan, Cimahi, 2) Conducting a theoretical study regarding STEM and Citizenship Education. 3) formulation of hypotheses 4) application of STEM on Citizenship Education course at Universitas Pendidikan Indonesia, and STKIP Pasundan in sample class for students taking Citizenship Education course in 2022, classified as class A1, A2, A3, A4 and A5 at Universitas Pendidikan Indonesia, and class PK 19, PK 20, PK 21 at STKIP Pasundan, Cimahi. 4) qualitative and quantitative data collection 5) qualitative and quantitative data analysis to answer the problem formulation and test the hypotheses that have been formulated

3. RESULT AND DISCUSSION

This study found that there was an empowerment of learning involvement in the Citizenship Education course at Universitas Pendidikan Indonesia and STKIP Pasundan, Cimahi. In this case, learning outcomes shape the practice of information literacy in higher education [30]. Several components that appear to increase in the use of STEM can be seen in Table 1.

Table 2: Components of increasing the use of STEM.

No	Ways of empowerment
1	Awareness to learn
2	Experience and directly experience it yourself
3	Learning is implemented concretely,
4	Developing cooperative attitude in students

Based on previous table, detailed actions are required to perform learning outcome [31]. When Citizenship Education learning activities are empowered, learning outcomes can be harmonized with theory. A study has also confirmed that the development of a pedagogical model based on citizenship theory is an attempt to document student learning related to its construction [32]. When using the STEM approach successfully, learning that is in accordance with the demands of the 21st century can be carried out. On

the other hand, didactic, web-based, and experiential learning need to be developed in the setting of education quality policy [33]. In a complex learning system, the use of learning evaluation can help to focus on improving quality [34]. A study explained that the conception of the technology professional development process is to develop the 21st century pedagogical knowledge [35]. Of the contextual, design-based, and methodological, educational context is the one that provides the most variability in student learning outcomes [36, 37]. Therefore, when there is an increasing component in the use of STEM in Citizenship Education learning, then there is already a learning that involves students directly to interact, investigate, and solve a problem.

In using stem approach in citizenship education course at Universitas Pendidikan Indonesia and STKIP Pasundan, there are factors that influence learning improvement, namely motivation, attitudes, interests, study habits and self-concept. Empowering students' learning involvement through STEM approach in Citizenship Education learning underlines that students have strengthening engagement in learning. A study implied that professional development presents many challenges in structuring the 21st century environment [38]. In addition, there was a strengthening of learning involvement using STEM approach in Citizenship Education course at Universitas Pendidikan Indonesia and STKIP Pasundan.

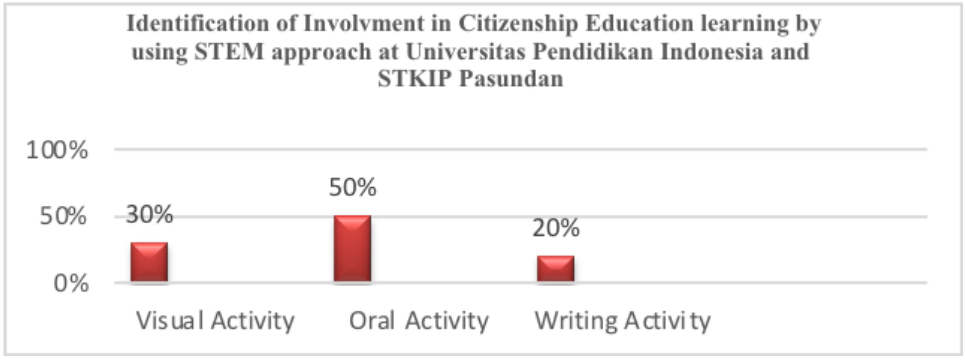

Figure 1: Identification of Involvement in Citizenship Education learning by using STEM approach at Universitas Pendidikan Indonesia and STKIP Pasundan.

Several studies had investigated the relationship between academic achievement strategies and testing related to learning outcomes [39], while involvement can increase students' enthusiasm [40]. Based on previous figure, students' learning involvement can be manifested as visual activities (30%), in the form of reading, viewing pictures, observing experiments, demonstrations, 50% of oral activities such as stating opinion, connecting an incident and asking questions and giving suggestions, and 20% of writing activities such as writing reports, making outlines or summaries, and doing tests. On the other hand, emotional involvement in students is a significant factor in enriching student

learning outcomes [41]. In learning Citizenship Education using STEM approach, there are several interesting learning engagements that do not only achieve learning success, but also reflect the hard and smart work of students. Learning outcome is oriented to the fundamental differences between didactics [42]. Various aspects of learning and practice serve a well-functioning introduction to the general education function [43]. There are four approaches in increasing positive student learning outcomes, namely financial accountability, regulation, professional accountability, and participatory accountability [44].

There is an increase in learning involvement using STEM approach that can lead students to be able to have the ability to carry out their daily activities more meaningfully, because formal learning is aligned with the knowledge process, and it can also affect learning outcomes [45]. By using STEM approach, students have the opportunity to follow the lesson plan within a certain time limit. However, a study noted that different types of learning activities attract different antecedents in learning outcomes [46]. In learning reflection, the empowerment of students' learning involvement was 30% of visual activities in the form of reading, viewing pictures, observing experiments, demonstrations – indicating that students have a disciplined attitude manifested in using study time well. On the other hand, differences in learning outcomes indicate a strong influence of the educational environment [47], as evidenced by a study which proven outdoor-learning to stimulate students' knowledge [48]. In oral activities such as expressing opinions, relating an incident, asking questions and giving suggestions can stimulate students to prioritize learning [49]. In writing activities such as writing reports, making outlines or summaries, and doing tests, are such a set of effective way in learning [50]. Similarly, understanding between pedagogy, curriculum, assignments, grades, providing active mastery experiences, and peer feedback to achieve student transformation are other effective ways [40]. STEM learning constructs mean different things to people [51]. Finally, STEM approach involves students totally in exploring the substance of the meaning of the course.

4. CONCLUSION

The application of STEM approach in both universities had met the indicators in learning engagement, such as starting with students having the awareness to learn, experience and experience for themselves, learning is carried out concretely, developing cooperative attitudes in students. Besides, in implementing STEM activities, students had been able to develop several engagements, namely 30% of visual activities in the form of

reading, viewing pictures, observing experiments, demonstrations, 50% of oral activities such as expressing opinions, connecting an incident and asking questions and giving suggestions, and 20% of writing activities such as writing reports, making an outline or summary, and doing the test. STEM approach has provided an overview to empower students' learning involvement during new normal period. Finally, STEM approach in Citizenship Education learning can increase the activeness and attitude of students' involvement.

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References

[1] Hoffman KS, Barragan Torres M, Wotipka CM. "Cross-national variation in school reopening measures during the covid-19 pandemic.," AERA Open. vol. 7, no. 1, p. 2021. https://doi.org/10.1177/23328584211010180.

[2] Madhok A. Globalization, de-globalization, and re-globalization: some historical context and the impact of the covid pandemic. Bus Res Q. 2021;24(3):199–203.

[3] Williams ML, Morse BL, DeGraffenried W, McAuliffe DL. Addressing stress in high school students during the covid-19 pandemic. NASN Sch Nurse. 2021 Jul;36(4):226–32.

[4] Sullivan E, Brey L, Soleimanpour S. School-based health center operations during the covid-19 pandemic: a preliminary study. Health Promot Pract. 2021 Sep;22(5):616–21.

[5] Tremmel P, Myers R, Brunow DA, Hott BL. Educating students with disabilities during the covid-19 pandemic: lessons learned from commerce independent school district. Rural Spec Educ Q. 2020;39(4):201–10.

[6] Shamir-Inbal T, Blau I. Facilitating emergency remote K-12 teaching in computing-enhanced virtual learning environments during covid-19 Pandemic - blessing or curse? J Educ Comput Res. 2021;59(7):1243–71.

[7] Collins KH. Confronting color-blind STEM talent development: toward a contextual model for black student STEM identity. J Adv Academics. 2018;29(2):143–68.

[8] Kim C, Yuan J, Kim D, Doshi P, Thai CN, Hill RB, et al. Studying the usability of an intervention to promote teachers' use of robotics in STEM education. J Educ Comput

Res. 2017;56(8):1179–212.

[9] Daniel KL, Mishra C. Student outcomes from participating in an international STEM service-learning course. SAGE Open. 2017;7(1):2158244017697155.

[10] Plasman JS, Gottfried MA. Applied STEM coursework, high school dropout rates, and students with learning disabilities. Educ Policy. 2016;32(5):664–96.

[11] Stoeger H, Greindl T, Kuhlmann J, Balestrini DP. The learning and educational capital of male and female students in STEM magnet schools and in extracurricular STEM programs: a study in high-achiever-track secondary schools in Germany. J Educ Gift. 2017;40(4):394–416.

[12] Collins MA, Totino J, Hartry A, Romero VF, Pedroso R, Nava R. Service-learning as a lever to support STEM engagement for underrepresented youth. J Experiential Educ. 2019;43(1):55–70.

[13] Lajoie S, Poitras E. Crossing disciplinary boundaries to improve technology-rich learning environments. Teach Coll Rec. 2017;119(3):1–30.

[14] Berglas-Shapiro T, Eylon BS, Scherz Z. A technology-enhanced intervention for self-regulated learning in science. Teach Coll Rec. 2017;119(13):1–26.

[15] Wang Q, Peng Y, Wang H. A curation activity-based self-regulated learning promotion approach as scaffolding to improving learners' performance in STEM courses. J Educ Comput Res. 2021;60(4):843–76.

[16] Puslednik L, Brennan PC. An Australian-based authentic science research programme transforms the 21st century learning of rural high school students. Aust J Educ. 2020;64(2):98–112.

[17] Donovan L, Green TD, Mason C. Examining the 21st century classroom: developing an innovation configuration map. J Educ Comput Res. 2014;50(2):161–78.

[18] Calamlam JM. The development of 21st-century e-learning module assessment tool. J Educ Technol Syst. 2020;49(3):289–309.

[19] Hidayah Y, Sapriy C. Darmawan, E. Malihah, and E. Karliani, "Promoting civic intelligence in applied science to promote interaction between science: an overview in the perspective of citizenship education.,". Universal Journal of Educational Research. 2020;8(8):3782–91.

[20] Trihastuti M. "Model konseptual civic enterpreneurship melalui koperasi mahasiswa dalam membina kemandirian ekonomi di era digital," (2021).

[21] DEWI DA. "Pengembangan model pembelajaran project citizen berbasis digital untuk peningkatan civic literacy siswa SMP era kewarganegaraan digital," (2021).

[22] Yuen TW. Civic education stuck in a quagmire: A critical review of civic education in Hong Kong? Citizenship, Social and Economics Education. 2016;15(2):69–82.

[23] Hahn CL. Comparative civic education: an introduction. Res Comp Int Educ. 2015;10(1):3–6.

[24] Young VM, House A, Sherer D, Singleton C, Wang H, Klopfenstein K. Scaling up STEM academies statewide: implementation, network supports, and early outcomes. Teach Coll Rec. 2016;118(13):1–26.

[25] Tseng TH, Tai Y, Tsai SP, Ting YL. Students' self-authoring mobile app for integrative learning of STEM. Int J Electr Eng Educ. 2018;:0020720918800438.

[26] Creswell JW. Research design: pendekatan metode kualitatif, kuantitatif dan campuran. Edisi Keempat (Cetakan Kesatu). Yogyakarta: Pustaka Pelajar; 2016.

[27] Sugiyono, Metode penelitian kuantitatif, kualitatif, dan R&D. Alfabeta, Bandung, 2011.

[28] Bahtiar W. Metodologi penelitian dakwah. Jakarta: Logos; 2001.

[29] Yu H, Abdullah A, Saat RM. Overcoming time and ethical constraints in the qualitative data collection process: A case of information literacy research. J Librarian Inform Sci. 2014;46(3):243–57.

[30] Hicks A, Lloyd A. Reaching into the basket of doom: learning outcomes, discourse and information literacy. J Librarian Inform Sci. 2022;55(2):282–98.

[31] Wajid HA, Chattha HT, Khawaja BA, Al Ahmadi S. An automated continuous quality improvement framework for failing student outcomes based on mathematics weaknesses. Int J Electr Eng Educ. 2020;60(3):273–88.

[32] Landon AC, Tarrant MA, Rubin DL, Stoner L. Beyond 'just do it': fostering higher-order learning outcomes in short-term study abroad. AERA Open. 2017;3(1):1–7.

[33] Bowe SN, Laury AM, Kepchar JJ, Lospinoso J. Programmatic assessment of a comprehensive quality improvement curriculum in an otolaryngology residency. Otolaryngol Head Neck Surg. 2016 Nov;155(5):729–32.

[34] Woodland RH. Evaluating PK–12 professional learning communities: an improvement science perspective. Am J Eval. 2016;37(4):505–21.

[35] Koh JH, Chai CS, Lim WY. Teacher professional development for TPACK-21CL: effects on teacher ict integration and student outcomes. J Educ Comput Res. 2016;55(2):172–96.

[36] Bredow CA, Roehling PV, Knorp AJ, Sweet AM. To flip or not to flip? a meta-analysis of the efficacy of flipped learning in higher education. Rev Educ Res. 2021;91(6):878–918.

[37] Pawlowsky S, Ryan TG. The 21st-century school library: perpetual change or evolution? Int J Educ Reform. 2016;25(1):38–55.

[38] Robberts AS, Van Ryneveld L. Design principles for introducing 21st century skills by means of game-based learning. Ind High Educ. 2022;36(6):824–34.

[39] Rodriguez F, Kataoka S, Janet Rivas M, Kadandale P, Nili A, Warschauer M. Do spacing and self-testing predict learning outcomes? Active Learn High Educ. 2018;22(1):77–91.

[40] Gedeon SA, Valliere D. Closing the loop: measuring entrepreneurial self-efficacy to assess student learning outcomes. Entrepreneurship Education and Pedagogy. 2018;1(4):272–303.

[41] Nkhoma M, Sriratanaviriyakul N, Le Quang H. Using case method to enrich students' learning outcomes. Active Learn High Educ. 2017;18(1):37–50.

[42] Elde Mølstad C, Karseth B. National curricula in Norway and Finland: the role of learning outcomes. Eur Educ Res J. 2016;15(3):329–44.

[43] Pfund RA, Norcross JC, Hailstorks R, Stamm KE, Christidis P. Introduction to psychology. Teach Psychol. 2018;45(3):213–9.

[44] Komba AA. Educational accountability relationships and students' learning outcomes in Tanzania's public schools. SAGE Open. 2017;7(3):2158244017725795.

[45] Kushwaha P, Rao MK. Integrating the linkages between learning systems and knowledge process: an exploration of learning outcomes. Bus Perspect Res. 2016;5(1):11–23.

[46] Kyndt E, Gijbels D, Grosemans I, Donche V. Teachers' everyday professional development: mapping informal learning activities, antecedents, and learning outcomes. Rev Educ Res. 2016;86(4):1111–50.

[47] Ding H, Chen A. Instructional and learning outcomes in China and the USA as policy implications. Eur Phys Educ Rev. 2017;25(1):21–34.

[48] Mayer B, Blume A, Black C, Stevens S. Improving student learning outcomes through community-based research: the poverty workshop. Teach Sociol. 2018;47(2):135–47.

[49] Chow JC. Collaboration to support language and learning outcomes for students with disabilities. Interv Sch Clin. 2022;58(3):143–5.

[50] Van der Kleij FM, Feskens RC, Eggen TJ. Effects of feedback in a computer-based learning environment on students' learning outcomes: a meta-analysis. Rev Educ Res. 2015;85(4):475–511.

[51] Lombardi D, Shipley TF, Bailey JM, et al. The curious construct of active learning. Psychol Sci Public Interest. 2021;22(1):8–43.