KnE Social Sciences
ICITEP
International Conference on Innovation and Teacher Professionalism
Volume 2023

Research Article

# Technology-based Learning and 21st-Century Skills for Primary School Students

**Oktaviani Adhi Suciptaningsih[1], Titik Haryati[2], Ilham Mulya Putra Pradana[1]**

[1]Sekolah Pascasarjana, Universitas Negeri Malang, Indonesia
[2]Pascasarjana, Universitas PGRI Semarang, Indonesia

**Abstract.**
The 21st-century skills must be presented in the learning process in the digital era for all students, including elementary school students. Various kinds of 21st-century learning content must be integrated into the learning process in the classroom according to the material contained in the independent curriculum. This study aims to analyze technology-based learning and 21st-century skills in elementary school students. Observations of the learning process were carried out on 41 students at SD N 1 Jarum and 143 students at SD IT Persada Bayat within 2 semesters. Students were interviewed in groups and some of them were interviewed individually to get some more specific information. Document analysis was carried out to see various supporting information that can complement the data. The results showed that technology-based learning and 21st-century skills in elementary school students can be applied using critical thinking, problem solving, communication, and collaboration. Various activities can be carried out to support the achievement of this model, including individual activities, small group activities, large groups, in the classroom, outside the classroom, idea-based, product-based, and digital-based activities. This model will be effective if all activities are carried out in a synergistic pattern.

**Keywords:** learning technology, 21$^{st}$-century skills, students, primary school

Corresponding Author: Oktaviani Adhi Suciptaningsih; email: oktaviani.suciptaningsih.pasca@um.ac.id

**Published** 5 June 2023

Publishing services provided by Knowledge E



Selection and Peer-review under the responsibility of the ICITEP Conference Committee.



## 1. INTRODUCTION

The quality of education in Indonesia is still far from perfect, this can be seen from the 2021 World Population Review ranking which places Indonesia in 54th place out of 78 countries included in the world education ranking [1]. The results of the Program for International Student Assessment (PISA) also show that 70% of students aged 15 years are below the minimum competence in understanding simple reading or applying basic mathematical concepts. This PISA score has not experienced a significant increase in the last ten to fifteen years. The study shows that there are large disparities between regions and between socio-economic groups in terms of the quality of learning. This is exacerbated by the COVID-19 pandemic. Therefore, the Government of Indonesia is currently working on improving the quality of education by issuing a policy of implementing the Merdeka Curriculum. The Merdeka Curriculum is a breakthrough that helps

teachers and principals change the learning process to be far more relevant, immersive, and enjoyable. The Merdeka Curriculum has been implemented in 34 provinces and 509 districts/cities in Indonesia. Schools that implement the Merdeka Curriculum are called Sekolah Penggerak. In 2022 there are 14,237 schools enrolled in the Sekolah Penggerak which are divided into several levels of education, namely 3,645 PAUD levels, 6,039 primary schools, 2,972 junior high schools, 1,322 senior high schools, and 259 special schools.

One of the implementations of the Merdeka Curriculum is carried out with the Merdeka Teaching Platform, which is a technology platform specifically provided for teachers so they can improve themselves to become a driving force in a series of processes both teaching, working, and learning [2]. The Merdeka Mengajar platform can be used through an application on an Android device or through a website page so that teaching and learning activities can be carried out easily. The role of science and technology is very important in the implementation of the Merdeka Curriculum and the Freedom to Teach Platform. The Indonesian government stated that the Merdeka Curriculum and the Merdeka Teaching Platform were at the same time a solution to realizing learning in the 21st century.

21st-century learning is an implication of the development of society in the era of globalization [3]. 21st-century learning is a transitional learning in which the developed curriculum guides schools to change the learning approach from teacher-centered to student-centered. In learning the teacher focuses on transferring knowledge from teacher to student, students receive information passively, learning and assessment are separate things, emphasis on knowledge outside the context of its application, the role of the teacher as a provider of information and assessor and only focus on one area of scientific discipline [4 ][5][6]. Whereas in student-centered learning knowledge is built by the students themselves, students are actively involved in learning, learning and assessment are closely related, the learning culture is cooperative, collaborative, and mutually supportive, and the emphasis is on mastering and using the knowledge that reflects new and old issues as well as solving real-life context problems, the teacher's role as a driver and provider of learning facilities, teachers and students evaluate learning together and approaches to integration between scientific disciplines [7][8][9][10]. Student-centered learning is by future demands where students must have the ability to think and learn.

In 21st-century learning, students are not only equipped with 3R skills, namely Read, Write Arithmetic, but also must be equipped with 4C skills, namely Critical Thinking, Communication, Collaboration, and Creativity [11]. Critical Thinking is the ability to think,

rationally, and systematically about what to do and involves reflective and independent thinking. Students who have critical thinking skills can do the following: 1) understand logical relationships between ideas, 2) identify, build and evaluate arguments, 3) detect inconsistencies and common errors in reasoning, 4) solve problems systematically, 5) identify the relevance and importance of ideas, and 6) bring up an understanding of beliefs and values in a person. By thinking critically students know how to use the information they have obtained to solve problems, find relevant sources of information, and decide on the best solution [12].

Communication is defined as the ability of students to convey their ideas and thoughts quickly, clearly, and effectively. This skill consists of several sub-skills, such as language skills that are right on target, the ability to understand context, and the ability to read listeners (audience) to ensure the message is conveyed either orally, in writing, symbols, graphics, pictures, or numbers. Communication is important in human civilization [13].

Collaboration is a process in which students at various levels of ability (performance) work together, synergize with each other, adapt to various roles and responsibilities, and respect differences toward a common goal. In collaboration, there will be mutual filling in of deficiencies with the strengths of others so that the problems encountered can be solved properly in an atmosphere of togetherness [14].

Creativity is the ability of students to create new ideas or ideas that are different from those that existed before. Creativity is the ability to develop (create) new ideas and ways that are different from before. Meanwhile, creativity is a person's ability to create new things, whether in the form of ideas or concrete works. Creativity or creativity can have a positive impact on everyone and the community. Creativity and innovation are often equated by most people. However, creative and innovative are different. Innovation is manifested in innovation which is a new idea or idea that is obtained through gradual development and is embodied in an idea or work. Creative thinking skills are innate. However, this skill can also be trained by providing challenges in the form of problems that require finding new solutions, either in the form of ideas or in the form of work in solving these problems [15].

4C skills can be trained in a variety of learning. Critical thinking can be trained with problem-based learning models, project-based learning, cooperative group investigation, inquiry learning, and case studies. Communication can be trained with the discussion learning model. Collaboration can be trained with cooperative learning models. Creativity can be trained with problem-based learning, project-based learning, cooperative group investigation, and inquiry learning models.

This article will in-depth analyze technology-based learning and 21st-century skills for students at SD N 1 Jarum and SD IT Persada Bayat who are members of the Batch 1 Sekolah Penggerak in Klaten Regency and are implementing the Merdeka Curriculum from 2021.

## 2. METHOD

This study uses the case study method, which in-depth analyzes cases of technology-based learning and 21st-century skills in students of SDN 1 Jarum and SD IT Persada Bayat who are members of the Sekolah Penggerak in Klaten Regency and implement the Merdeka Curriculum from 2021. The research subjects consisted of students grade 1 SDN 1 Jarum a total of 21 students and grade 4 SD N 1 Jarum a total of 20 students, grade 1 students of SD IT Persada Bayat a total of 74 students, grade 4 students of SD IT Persada Bayat a total of 69 people, teachers of grades 1 and 4 SD N 1 Jarum and teachers of grades 1 and 4 SD IT Persada Bayat. The informants consisted of teachers for grades 2, 3, 5, 6 SD N 1 Jarum and teachers for grades 2, 3, 5, 6 SD IT Persada Bayat, Principal of SD N 1 Jarum, Principal of SD IT Persada Bayat, Supervisor of SD N 1 Jarum and Supervisor of SD IT Persada Bayat. Data collection was carried out by observing student teachers' learning for 1 semester, interviewing research subjects and informants through in-depth interviews and focus group discussions as well as conducting a study of learning materials and learning outcomes documents in grades 1 and 4 at the two primary schools. The data validity technique uses the triangulation technique, while the data analysis technique uses the Stake technique which consists of (1) collecting categories, the researcher looks for a collection of data examples and hopes to find meaning relevant to the issues that will arise; (2) direct interpretation, the case study researcher looks at one example and draws meaning from it without looking for many examples. It is a process of pulling data apart and putting it back together to make it more meaningful; (3) the researcher forms a pattern and looks for equivalence between two or more categories. This equivalence can be implemented through a table showing the relationship between the two categories; (4) in the end, the researcher develops naturalistic generalizations through data analysis, these generalizations are drawn through people who can learn from a case, either their case or applying it to a population of cases.

## 3. RESULTS AND DISCUSSION

The 21st-century learning contained in the Merdeka Curriculum implemented by the Sekolah Penggerak at the primary school level is carried out using problem-based learning, project-based learning, cooperative learning, and discussion models. The problem-based learning model is a learning method that is triggered by problems, which encourages students to learn and work cooperatively in groups to find solutions, think critically and analytically, and be able to determine and use appropriate learning resources [16]. The project-based learning model is a learning model that uses projects/activities as media. Students carry out exploration, assessment, interpretation, synthesis, and information to produce various forms of learning outcomes [17]. The cooperative learning model is a learning model by giving assignments to students who are smarter in a small group whose results will be presented to other groups in the class [18]. The discussion learning model is a learning model in which teachers and students exchange opinions to exchange ideas to find solutions to problems, and answer the truth about a problem [19]. The four learning models can stimulate 4C skills in students, namely skills for critical thinking, communication, collaboration, and creativity. The following is the syntax for each of these learning models:

TABLE 1: Learning Model Syntax.

| Syntax of Problem Based Learning Learning Model | Project-Based Learning Syntax Learning Model |
|---|---|
| Student Orientation Organizing students to learn Guiding individual as well as group investigations Develop and present results Analyze and evaluate the problem-solving process | Planning an investigation process according to the driving question. Searching for the theoretical background of the driving question. Presenting that theoretical background to the class and discussing the issue. Deciding the study group the way of collecting data and data analysis. Evaluating data, concluding, presenting the project in class preferred, and discussion. |
| Cooperative Learning Syntax Learning Model | Discussion Learning Model Syntax |
| Present goals and set Present information Organize students into learning teams Assist teamwork and study Test on the materials Provide recognition | Set goals and set settings Direct the discussion Group discussion End the discussion Doing short questions and answers about the discussion process |

### 3.1. Technology-Based Learning and 21st-Century Skills at SD N 1 Jarum

SDN 1 Jarum is one of the public primary schools in Bayat District, Klaten Regency. This primary school implements the 2013 Curriculum for students in grades 2, 3, 5,

and 6, while students in grades 1 and 4 implement the Merdeka Curriculum. Learning in grades 1 and 4 is based on technology and 21st-century skills. Technology-based learning is a learning process that uses various technologies as learning media to strengthen students' learning experiences [20]. It places more emphasis on higher quality instruction and provides access to more challenging content for students, feedback through formative assessments, opportunities to learn anywhere and anytime as well as individual instruction to ensure all students maximize all their potential to be useful in life later. Technology-based learning includes many different aspects, tools, and applications to support and empower teachers and students in hybrid learning, content, and digital resources. In addition, technology-based learning can be used as a professional learning media for teachers and provide personalized learning experiences for students. In technology-based learning, the teacher's role as the sole authority of knowledge turns into a facilitator for students to interact with various learning resources. This is an attempt to change the learning paradigm from teacher-centered to student-centered because students are directly and actively involved. Technology-based learning is carried out by utilizing the internet, using videos, using LCDs, and using Chromebooks as learning resources. The following is an example of the use of each of these media in learning in grades 1 and grade 4.

The internet in learning provides many benefits for both teachers and students, including the internet provides opportunities to increase the creativity of teachers and students, making it easier for teachers and students to find references, making it easier for students to understand learning material, reducing boredom in learning, provides useful inspiration, makes it easier to completing assignments, facilitating communication between teachers and students and online education tools. Learning using the internet in grades 1 and 4 of SD N 1 Jarum is carried out in the form of online learning using zoom or meet. The use of zoom and meet helps to learn in the era of the covid pandemic which limits student activities at school. Teachers and students can still interact directly using laptops or cell phones that have zoom or get installed. Teachers can provide material and students can ask if there is a material that is not clear. Apart from zoom and meet, teachers and students in grades 1 and grade 4 also use Google Classroom as a virtual class. Based on the results of observations, it was shown that there was an increase in learning activities (reading, viewing pictures, asking questions, giving feedback, writing stories) by 60% in grade 1 students and 70% in grade 4 students by utilizing the internet as a learning medium. The use of the internet as a learning medium conditions students to learn independently. Through independent study, students become doers, as well as

thinkers [21]. The role of the internet in learning is very important because the internet is the main source of data and knowledge.

The use of video in learning for grade 1 and grade 4 students of SD N 1 Jarum is carried out by the teacher by utilizing YouTube videos. The teacher selects and sorts which YouTube videos are appropriate to the material, student characteristics, and available time allocation. Teachers in grade 1 are still limited to using videos on YouTube, while teachers in grade 4 have started making their learning videos. Learning videos are learning media that combine audio and visuals to convey a learning topic [22]. This media is a learning medium that is quite effective in conveying messages and helping students understand. The learning videos contain learning materials that contain concepts, principles, procedures, and theories of the application of knowledge. For example, when the grade 1 teacher gives the Count Numbers material, the teacher uses the Count Numbers video in which there are animated images of whole numbers in the form of fruit that can move and sound. In this case, students are expected to be able to demonstrate an understanding of whole numbers up to 100 by writing, reading, determining place value, and comparing and ordering numbers. Based on the results of the document study, it was found that students' understanding of whole numbers increased by 80% compared to when the teacher did not use video media. Based on the results of interviews with students, they stated that they preferred to learn by watching videos because the pictures could move and sound, so students were more motivated to work on the questions given by the teacher. While the example of using video in grade 4 in learning large count numbers, the teacher makes a learning video for large count numbers, in which there is a concept, of how to read whole numbers up to billions using animated images of the population in a country. Based on the results of the document study, it was found that student's understanding of large whole numbers increased by 85%. Video is a medium for teachers to make it easier to provide material and media for students to make it easier to understand the material.

The use of LCD in learning in grades 1 and 4 at SD N 1 Jarum is used to display material that is packaged into PowerPoint and uses the Canva application. Based on the results of interviews with grade 1 teachers and grade 4 teachers, it was found that the use of LCDs in learning has many benefits, including 1) learning is more effective and efficient because the time used for teaching is not wasted just writing on the blackboard and making notes. In addition to the visual quality, it is more comfortable with material that is visible compared to writing on a blackboard; 2) environmentally friendly, because LCDs only use electricity, rather than using a whiteboard with a marker or writing on a blackboard with chalk which results in environmental pollution which can have an

impact on health; 3) accustom students to technology literacy, indirectly the use of LCD can educate students to further express their creative ideas in the use of technology, which can be useful for their development.

Utilization of the internet, video, and LCD in learning is used in conjunction with the use of problem-based learning and project-based learning models. An example of using the problem-based learning model in grade 1 students in “Body Parts” material. Students are divided into several groups and then students are asked to listen and watch a learning video about the “Parts of the Body”. Furthermore, students are given the assignment to observe a picture that contains parts of the human body arranged randomly in the form of a puzzle. Students are asked to discuss assembling the puzzle to form a complete human puzzle. Students are asked to present their results in front of the class. Based on the results of observations, showed that students studied actively in their groups, they looked enthusiastic about discussing solving puzzles of body parts by giving input to their friends, and they were interested in trying to place puzzle pictures, even though they made mistakes several times and tried to think critically about where each part was located. the puzzles. Until finally they managed to complete each section and present the results in front of the class. In this case, the use of the problem-based learning model can stimulate 21st-century abilities in grade 1 students. By assembling a puzzle of body parts students can develop critical thinking skills on how to solve problems in the form of pictures of body parts arranged randomly. Students receive information about body parts from the learning videos studied before then try to recall the shape of each part of the body and find each piece of the picture of the body part and try to arrange them to form a picture of the whole human body part. Communication skills are developed through the process of group discussion and presentation of results in front of the class. Students learn how to communicate the puzzles that have been assembled and explain the functions of each of these body parts. Collaboration skills are developed in group discussion activities, namely how they work together to solve problems by compiling puzzles and mentioning the function of each part of the body. Creativity skills are developed when compiling puzzles which require students to think creatively about how to arrange random puzzles and be creative in composing sentences that will be delivered during presentations in front of the class. Grade 1 students have the characteristics of happy playing, happy to move, happy in groups, and happy to do something directly. Based on this, the application of the problem-based learning model is very suitable for learning in elementary students to build students’ critical thinking, communication, collaboration, and creativity from an early age.

An example of the application of learning using the project-based learning model in grade 4 on material “Changes in Substance Forms”. Students are asked to make a project example of changes in the state of matter. This project aims to utilize the basic concept of changing the state of matter to deal with the challenges faced in everyday life. At the beginning of the lesson, the teacher gives material to students about watching YouTube videos. Then the teacher makes sure students understand the goals and criteria of the given project. The teacher conveys the options for any transformation project in each group. The teacher informs the assessment rubric. In making the project students are asked to utilize the items around them. Students are asked to make a journal in the form of notes. Students are asked to bring tools and materials from home then make a project in class and present the results in front of the class. The project-based learning model has characteristics in which the teacher becomes a facilitator. The role of the facilitator is to provide problems in the form of case studies which will later be resolved for students in the form of projects. Based on the results of the document study, shows that the results of student projects regarding examples of changes in the state of matter are very creative and interesting even by using simple objects around them. The project of changing the form of matter can develop students’ thinking skills which enable them to have creativity, be skilled and encourage to work together and be skilled in communicating.

## 3.2. Technology-Based Learning and 21st-Century Skills at SD IT Persada Bayat

SD IT Persada Bayat is a private primary school in the Banyuripan Village, Bayat District, Klaten Regency. Like SD N 1 Jarum, this primary school is also part of the Batch 1 Sekolah Penggerak. Technology-based learning and 21st-century skills at SD IT Persada Bayat is carried out using this primary school to implement the 2013 Curriculum for students in grades 2, 3, 5, and 6. while in grades 1 and 4 students implement the Merdeka Curriculum and use the Integrated Islamic School Network Curriculum. Technology-based learning in grades 1 and 4 is carried out using the internet, video, LCD, and Chromebooks.

The use of the internet as a learning resource in grades 1 and 4 of SD IT Persada Bayat is carried out in the form of online learning through meet, zoom, and google classroom. Teachers in grades 1 and 4 of SD IT Persada Bayat use the internet to access various up-to-date information that can be used to develop materials. The internet is very helpful for teachers in developing materials because teachers must deliver various materials using

the Merdeka Curriculum as well as the Integrated Islamic School Network Curriculum. Based on the results of the document study, showed an increase in the student learning activity by 85% in grade 1 students and 90% in grade 4 students.

The use of video in learning for grade 1 and grade 4 students is carried out by the teacher by downloading various YouTube video shows and then editing in several parts according to the material, the learning objectives in the Merdeka Curriculum, and the Integrated Islamic School Network Curriculum are then used as learning media in class. With the video used, learning becomes more effective and efficient, because it is easier and faster for students to understand the material than students studying textbooks. After all, the teacher tries to make it look more attractive. Based on document studies and observations, showed an increase in students' understanding of 70% in grade 1 students and 80% in grade 4 students when using video as a learning medium.

The utilization of LCD in learning is used to display interactive PPT. This is very helpful for teachers in conveying material to students easily so that the knowledge transfer process can run better. In addition, it also helps teachers in class management, because the number of students in grades 1 and 4 is quite a lot, on average 30 students in each class. Based on the results of interviews with students, it was stated that learning using interactive PPT media made students focus on the material explained by the teacher and could be involved in two-way learning which ultimately provided an interesting and meaningful learning experience.

Apart from using the internet, video, and LCD as learning resources and media, teachers, and students in grades 1 and 4 of SD IT Persada Bayat also use Chromebooks. Chromebook is a laptop that uses Google's Chrome OS operating system. This laptop operating system was designed by Google to make it easy to use, operate quickly, have layers of security systems, and can be used by many users with different accounts (shareable) [23]. The use of Chromebooks helps teachers in the teaching and learning process. Because Chromebooks have several advantages including having built-in virus protection so that when browsing online and offline it will be virus free wherever it is used. With over eight hours of battery life, teachers can focus on getting things done. Teachers can carry out various jobs online using the Google Chrome browser. Many web-based applications can be run offline. Teachers can store large amounts of data because almost all applications and data are in the cloud. Various Chromebook applications can be obtained through the Google Play Store or Google Web App Store, making it easier for teachers to use them. Five functions are obtained from Chromebooks that can run various software. First, there is Google Workspace for Education which includes Google Docs, Google Sheets, Google Slides, and Google Drive tools. The second

function is software for creating learning content such as Magisto video editor and soundtrack for education. Chromebooks can also operate tinkercad software, which is a free to pay tool for students to create and design applications in three dimensions: science, technology, engineering, art, and mathematics. The fourth function that can be obtained from Chromebooks is that teachers can run the equation software, which is an extension for students to prepare functions into documents for further mathematics learning. The fifth function is that Chromebooks can run seesaw software. The toolkit is for teachers to create activities to share with students, which capture teachers' work in a portfolio that parents can also view.

21st century-based learning in grades 1 and 4 at SD IT Persada Bayat uses problem-based learning, project-based learning, cooperative learning, and discussion learning models. An example of learning using the project-based learning model for grade 1 students is that students are asked to make a project of interviewing parents about daytime activities according to the rules at home. This activity begins with the teacher asking students about the activities students do at home during the day. Students mention the various activities they do at home during the day but many of them are not by the rules that have been agreed upon at home. Finally, the teacher and students agreed on what project they should work on, namely making a project of interviewing parents about daytime activities according to the rules at home. For the duration of the work, the teacher discussed with the students, until they found an agreement on the duration of the work for one week. After one week, teachers and students reflect together. Some students said that according to their parents the activities carried out during the day according to the rules at home were midday prayers according to the time, lunch between 12.00 and 13.00, afternoon naps at 13.00 to 14.30 and some answered that it was time to help their parents. The teacher makes sure the students understand the purpose of doing the project by asking students why each house has different rules. Several students ventured to express their opinions, that is, every house has different situations and conditions, so it has different rules. From these answers, the teacher concluded that his students had understood the various activities carried out during the day at home in different contexts. The teacher involves students in each stage of the project-based learning so that the learning is student-centered and departs from a problem background to work on real projects or activities which will make students experience various contextual obstacles, so they must carry out investigations and problem-solving to achieve attitude, knowledge and competency competence. Skills. The purpose of implementing project-based learning is to improve students' ability to solve project-based problems, acquire new knowledge and skills

in learning, make students more active in solving complex project problems with real product results, develop and improve students' skills in managing materials or tools to complete assignments, and enhance student collaboration. Project-based learning has characteristics that distinguish it from other models, these characteristics are 1) centrality, namely that this model is the center of learning activities; 2) driving questions, namely focusing on questions or problems that lead students to be able to find solutions with appropriate scientific concepts/principles; 3) constructive investigation, namely with this model students can build knowledge by carrying out investigations independently where the teacher is the facilitator; 4) autonomy, namely demanding student-centered with students as problem-solving of the problems discussed; 5) realism, namely that the activities carried out by students focus on work that is similar to the actual situation. These activities integrate authentic tasks and produce professional attitudes [24].

An example of the application of cooperative learning to grade 4 students on "Plants the Source of Life on Earth". Cooperative learning is a learning model by giving assignments to students who are smarter in a small group whose results will be presented to other groups in the class. At the beginning of the lesson, the teacher conveys the goals and motivates students, then presents information about the material to be studied at the meeting. The teacher divides students into small groups and asks students to discuss to determine the leader of the group. The teacher asks students to discuss examples of plants that are around the student's environment which are a source of life. The teacher guides the work and study groups in discussions in each group that has been divided. Each group was asked to appoint a student as their representative to present their results. Teachers and students jointly evaluate the results and conclude together. At the end of the session, the teacher gave awards to the most active group and could present the results of the discussion well. The basic elements of cooperative learning are 1) togetherness; 2) responsibility; 3) having a common goal; 4) equal distribution of duties and responsibilities; 5) joint success; 6) having the same opportunity to be appointed as a leader; 7) individually responsible for material handled in groups [25].

## 4. CONCLUSION

Technology-based learning at SD N 1 Jarum and SD IT Persada Bayat is carried out by utilizing the internet, using YouTube videos, using LCDs, and using Chromebooks. The 21st-century-based learning in both elementary schools is carried out using problem-based learning, project-based learning, cooperative learning, and discussion models.

Technology-based learning and 21st-century skills can change learning from teacher-centered to student-centered and stimulate students' critical thinking skills, communication skills, and collaboration skills and increase student creativity in various stages of learning in the various models used.

## References

[1] worldpopulationreview.com.

[2] http://kurikulum.kemdikbud.go.id/

[3] Kabanda MN. "Globalization and curriculum in the 21$^{st}$ Century: A. Case for Flexible and Dynamic Curriculum". Asian J Interdisciplinary Res. 2021;4(3):18-29. doi: https://doi.org/10.34256/ajir2132.

[4] Emaliana I. "Teacher-centered or student-centered learning approach to promote learning?". Jurnal Sosial Humaniora. 2017;10(2):59-70. doi: http://dx.doi.org/10.12962/j24433527.v10i2.2161.

[5] Lak M, Soleimani H, Parvaneh F. "The effect of teacher-centeredness method vs. learner-centeredness method on reading comprehension among Iranian EFL learners." J Adv Engl Lang Teach. 2017;5(1):1-10.

[6] Nurjannah I, Husniyah F, Harjanto T. "Teacher-centered learning and student-centered learning approaches in nursing school: Which one is better?" Belitung Nursing J. 2017;3(2):65-72. doi: https://doi.org/10.33546/bnj.59.

[7] Keller LS. "Teachers' roles and identities in student-centered classrooms". Int J STEM Educ. 2018;5(34):1-20. doi: 10.1186/s40594-018-0131-6.

[8] Xhomara N. "The effect of student-centered teaching and problem based learning on academic achievement in science." J Turk Sci Educ. 2020;17(2):180-199. doi: 10.36681/tused.2020.20.

[9] Boyaci Z, Sahin S, Hasirci HME, Kilic A. "Student-centered education scale: A validity and reliability study". Eur J Educ Res. 2017;6(1):93-103. 10.12973/EU-jer.6.1.93.

[10] Rini WA. " Pembelajaran dengan Pendekatan Student Centered Learning (SCL) pada Sekolah Minggu". Jurnal Shanan. 2019;3(1):85-96. doi: https://doi.org/10.33541/shanan.v3i1.1575 .

[11] Satriani FB, Sutiyarti U, Wahyuningsih R. "Analisis Metode Pembelajaran 4C dalam Pembelajaran Daring Bahasa Jepang Kelas X Bahasa SMAN 1 Batu". Jurnal Pendidikan Bahasa Jepang. 2022;8(1):45-56. doi: https://doi.org/10.23887/jpbj.v8i1.

[12] Changwong K, Sukkamart A, Sisan B. ”Critical thinking skill development: Analysis of a new learning management model for Thai High Schools”. J Int Studies. 2018;11(2):37-48. doi: 10.14254/2071- 8330.

[13] Erdogan V. ”Integrating 4C skills of 21st Century into 4 Language Skills in EFL Classes.” Int J Educ Res. 2019;7(11):113-124.

[14] Yu TX, Mohammad WMRW. ”Integration of 21st Century Learning Skills (4C Elements) in interventions to improve english writing skill among 3K class students”. Int J Contemporary Educ. 2019;2(2):100-121. doi: doi.org/10.11114/ijce.v2i24498.oi.org.

[15] Nawawi M, Laili M, Christanti A. ”Analysis of Students’4C Skills Based on the Pedagogy Multiliteracies Model”. Jurnal Scientia. 2022;10(2):233-241. doi: doi.org/10.35337/scientia.

[16] Uliyandari M, Candrawati E, Herawati AA, Latipah N. ”Problem-based learning to improve concept understanding and critical thinking ability of science education undergraduate students”. IJORER: Int J Recent Educ Res. 2021;2(1):65-72. doi: doi.org/10.46245/ijorer.v2i1.56.

[17] Guo P, Saab N, Post LS, Admiraal W. ”A review of project-based learning in higher education: Student outcomes and measures.” Int J Educ Res. 2020;102:1-13. doi: doi.org/10.1016/j.ijer.2020.101586.

[18] Silalahi TF, Hutauruk AF. ” The application of cooperative learning model during online learning in the pandemic period”. Budapest Int Res Critics Institute-BIRCI J. 2020;3(3):1683- 1691. doi: doi.org/10.33258/birciv3i3.1100.

[19] Williams G, Clement J. ”Identifying multiple levels of discussion-based teaching strategies for constructing scientific models.” Int J Sci Educ. 2015;37(1):82-107. doi: doi.org/10.1080/09500693.2014.966257.

[20] Selwyn N, Eynon R, Potter J. ”A decade of learning media and technology: Looking back and looking forward”. Learning, Media and Technology. 42(2):127-129. doi: doi.org/10.1080/17439884.2017.1324483.

[21] Meier D. The accelerated learning hand book. Bandung: Kaifa; 2002.

[22] Lange C, Costley J. ”Improving online video lectures: Learning challenges created by media”. Int J Educ High Educ. 2020;17(16):1-18. doi: doi.org/10.1186/s41239-020-00190-6.

[23] Alfageh D, Alkarzon A. ”Elementary teacher perceptions about chromebook technology use in the classroom”. Int J Arts Human Soc Sci Stud. 2020;5(6):9-17.

[24] Markula A, Aksela M. ”The key characteristics of project-based learning: How teachers implement project in K-12 science education”. Disciplinary and Interdisciplinary

Science Education Research. 2022;4(2):1-17. doi: doi.org/10.1186/s43031-021-00042-x,

[25] Watson SB. ”The essential elements of cooperative learning”. Am Biol Teach. 1992;54(2):84-86. doi. doi.org/10.2307/4449413