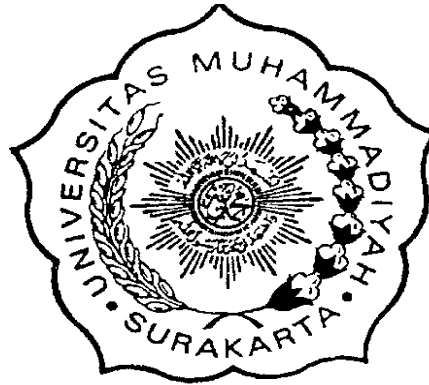


**MATHEMATICS LEARNING MANAGEMENT IN INTEGRATING 21<sup>st</sup>  
CENTURY SKILLS**



**Disusun sebagai salah satu syarat menyelesaikan  
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## MATHEMATICS LEARNING MANAGEMENT IN INTEGRATING 21<sup>st</sup> CENTURY SKILLS

### Abstrak

Penelitian ini dilakukan dengan tujuan untuk mendeskripsikan perencanaan, pelaksanaan dan penilaian pembelajaran matematika dalam mengintegrasikan kecakapan abad 21 di SMA ABBS Surakarta, metode penelitian ini adalah kualitatif dengan sumber data wakil kepala sekolah bagian kurikulum, guru matematika dan 3 siswa dari program kelas ICT dan teknik pengumpulan data dengan observasi, wawancara dan dokumentasi. Teknik analisa data dengan analisis model interaktif Miles dan Huberman yang meliputi reduksi data, penyajian data dan penarikan kesimpulan. Hasil penelitian ini diantaranya 1) perencanaan pembelajaran matematika dengan membuat perangkat pembelajaran yang meliputi silabus, KKM, RPP diawal tahun pelajaran dengan mengacu kurikulum 2013, 2) pelaksanaan pembelajaran matematika berpedoman RPP yang sudah disusun dengan integrasi kecakapan abad 21 dan dalam proses pembelajaran matematika dengan dua bahasa yaitu bahasa Inggris dan bahasa Indonesia, 3) penilaian pembelajaran matematika dilakukan dengan tes pilihan ganda, quizizz, kahoot untuk penilaian harian, tetapi untuk penilaian tengah semester dan penilaian akhir semester dengan portal Al Abidin Surakarta.

**Kata kunci:** kecakapan abad 21, manajemen pembelajaran, matematika, penilaian

### Abstract

This study was conducted with the aim of describing the planning, implementation and assessment of mathematics learning in integrating 21st century skills at SMA ABBS Surakarta, this research method is qualitative with data sources from the principal, the vice principal of the curriculum section and mathematics teachers for the ICT class program and collection techniques, data by observation, interviews and documentation. The data analysis technique uses Miles and Huberman's interactive model analysis which includes data reduction, data presentation and conclusion drawing. The results of this study include 1) planning learning mathematics by making learning tools that include syllabus, KKM, RPP at the beginning of the school year by referring to the 2013 curriculum. 2) the implementation of mathematics learning based on lesson plans that have been prepared with the integration of 21st century skills and in the mathematics learning process in two languages, namely English and Indonesian, 3) the assessment of mathematics learning is carried out with multiple choice tests, quizzz, kahoot for daily assessments, but for mid-semester assessment and end-semester assessment with the Al Abidin Surakarta portal.

**Keywords:** 21st century skills, learning management, mathematics, assessment.

## 1. PENDAHULUAN

Learning management is a way to manage teaching and learning activities in the classroom, how a teacher makes teaching plans, carries out teaching and learning activities in the classroom and assesses student learning outcomes, whether students have mastered the competencies and understand the material that has been given with the standard value above or equal to the KKM, namely Minimum completeness criteria. KKM for each subject can be different for the education unit. The KKM for mathematics in schools that the researcher observed is 75, where a student is said to have completed learning one Basic Competence if the cognitive value or knowledge is above or equal to 75. Mathematics is a subject that must be studied by students at all levels of education. Because mathematics is so important in life, the mathematics learning process must be managed properly and pleasantly as the 2013 Curriculum demands (Mus & Basri, 2017). In the context of the 2013 curriculum, it has accommodated 21st century skills, both in terms of content standards, process standards, and assessment standards (Redhana, 2019). The US-based Partnership for 21st Century Skills (P21), identified the competencies needed in the 21st century, namely "The 4Cs" - communication, collaboration, critical thinking, and creativity. (Zubaidah, 2016). The 21st century skills are termed the 4Cs (Communication, Collaboration, Critical Thinking and Problem Solving, and Creativity and Innovation). To realize 21st century learning, schools as educational institutions provide opportunities for students to realize 21st century skills with various activities in learning. In addition, teachers must also develop competence and professionalism in order to have the ability to manage learning well (Kadri et al., 2021).

The success of a teacher in managing learning is strongly influenced by several factors including the teacher's ability to plan teaching and learning activities, prepare learning tools using strategies, techniques and media in the learning process, the ability to communicate with students, mastery of the material being taught and plan daily assessments to find out to what extent children understand the concepts that have been given. As the results of research conducted by Onur and Kozikoglu that the ability of teachers to master 21st century skills is very important in guiding students in the teaching and learning process (Onur & Kozikoglu, 2020)

In the process of learning Mathematics, teachers must understand the characteristics of students so that in using strategies or media that are used or planned according to student needs and make mathematics lessons fun (Masfuah et al., 2021). But most students consider Mathematics to be a difficult subject and not easy to learn, because mathematics is abstract, full of symbols and formulas that must be learned, between one formula and another are interrelated so that it takes perseverance, critical thinking and collaboration with friends to discuss ways. math problem solving. Expectations of students in learning mathematics, the teacher

explains as much as possible so that students easily understand it or it can be said that learning is teacher-centered. This situation is not in accordance with 21st century learning where students must think critically, creatively, collaboratively in solving mathematical problems in everyday life and communicatively in conveying brilliant ideas and ideas in the learning process.

Management of mathematics learning through the stages of learning planning, implementation of learning and assessment of learning. Mathematics learning planning is contained in the lesson plans prepared by the teacher as a reference for the teaching and learning process in the classroom so that learning is effective and in accordance with the targets in the curriculum. This is in accordance with research conducted by Herviani and Budiastuti (2018), which states that to achieve the success of a learning process it is necessary to have a careful learning plan from a teacher in preparing a Learning Implementation Plan (RPP) for effective learning (Herviani & Budiastuti, 2018 ). But sometimes there are obstacles in planning learning because of heterogeneous student abilities, especially in planning learning methods to suit the characteristics of students and planning knowledge or cognitive assessments in the hope that students get scores above the KKM. These factors cause teachers to plan the implementation of learning not in accordance with the reality in the classroom, so it can be said that RPP is only limited to the needs of teacher administration. The implementation of the 2013 curriculum brings consequences for teachers to be better in carrying out learning activities.

In this study, there are similarities with previous research related to learning management and learning management which includes planning, implementation and learning assessment. The implementation of mathematics learning in the classroom requires the teacher's ability to use mathematical learning models and methods to explore the ability of students to be communicative, creative, think critically and be able to collaborate 4C in solving Higher Order of Thinking Skill (HOTS) questions. As in the revised 2013 curriculum, there is a scientific approach and 21st century skills content which is usually abbreviated as 4C. The preparation of RPP is based on the 2013 revised 2017 curriculum by integrating 21st century skills. This study aims to describe: 1) mathematics learning planning in integrating 21st Century Skills at SMA ABBS Surakarta, 2) implementation of mathematics learning in integrating 21st Century skills at SMA ABBS Surakarta, and 3) assessment of mathematics learning in integrating 21st Century skills at SMA ABBS Surakarta.

## **2. METODE**

This research includes qualitative research because this research is to describe and analyze natural phenomena, events, social activities (Sutama, 2019). This study uses a case study design because it explores the integration of 21st century skills in

mathematics learning in the ICT class program at SMA ABBS Surakarta. The research was conducted at SMA ABBS Surakarta from July 2022 to October 2022.

Data collection techniques using observation, interviews, and documentation. Sources of data are the Principal, the vice principal of the curriculum section and mathematics teachers for the ICT class program. The validity of the data used in this study is source triangulation and technique triangulation. The data analysis techniques uses Miles and Huberman's interactive model analysis. Miles and Huberman state that the interactive model analysis consists of three components, namely data reduction, data presentation and conclusion drawing (Sutama, 2019).

### **3. HASIL DAN PEMBAHASAN**

Learning is a teaching and learning activity that is carried out programmatically to achieve educational goals, namely educating the nation's life, making the young generation of noble character, character and capable in facing the era of globalization, so that learning requires a curriculum that is in accordance with the development of science and technology. Education curriculum as a guideline for the implementation of the learning process must be adapted to the development of technology and information. In accordance with the Law of the Republic of Indonesia No. 20 of 2003 concerning the National Education System Article 1 paragraph 19 states that the curriculum is a set of plans and arrangements regarding the objectives, content, additional lessons and methods used as guidelines for the implementation of learning activities to achieve certain educational goals (Hamzah, et al, 2018). The curriculum used at SMA ABBS Surakarta is the 2013 Revised 2017 edition, so it has not used the Merdeka Curriculum. In the 2013 curriculum for high school there are groups of compulsory subjects and specialization subjects. Specialization subjects for high school are academic specialties according to the choices and interests of students. In SMA ABBS Surakarta in the ICT class Program, all students from class X to class XII only have specialization in Mathematics and Science or called MIPA. The teacher's role is very important in integrating 21st century skills in the mathematics learning process as the results of research conducted by Siti Zubaidah (2016) that the teacher's role in implementing 21st century learning is very important in realizing a better future for children (Zubaidah, 2016). The integration of 21st century skills at SMA ABBS Surakarta is described as follows,

#### **1) Characteristics of mathematics learning planning in integrating 21st century skills**

Teachers as professional educators with the main task of educating, guiding, training, assessing and evaluating students in primary and secondary education. The presence of teachers in the classroom is very influential on the learning process, so that the competence of teachers in planning learning must be good. Based on the results of interviews with the vice principal of the



curriculum section, the curriculum used at SMA ABBS Surakarta is a combination curriculum between the 2013 revised 2017 edition curriculum and the school's ICT curriculum and adopts some subjects from Cambridge. But for mathematics lessons, the 2013 revised 2017 edition of the curriculum is used, so there is compulsory mathematics and specialization in mathematics for the Mathematics and Natural Sciences program. At SMA ABBS Surakarta the specialization program is only Mathematics and Natural Sciences in class X, class XI and class XII on the grounds that it is adjusted to the competence of the teacher, the teacher at ABBS Surakarta High School even though he teaches mathematics, he must also be able to deliver mathematics lessons in English, so that the teacher's ability in both material and lesson content and communication in English must be good. The program being studied is the ICT class program, because apart from the ICT class program at SMA ABBS Surakarta, there are Cambridge programs and Thafidz programs. At the beginning of every year, the teachers who teach at SMA ABBS Surakarta, a workshop is held on learning administration which includes the syllabus, Analysis of Core Competencies and Basic Competencies, Learning Implementation Plans, Minimum Completeness Criteria. In addition to the beginning of the year, School MGMP activities are held every 4th Saturday with a group of Subject Teachers. Each teacher makes and composes learning tools starting from the Syllabus, Core Competency Analysis, Basic Competencies, Minimum Completeness Criteria and Learning Implementation Plans. The minimum completeness criteria as a guideline in the assessment with the KKM for mathematics subjects is 75. The preparation of the RPP refers to the circular letter of the Minister of Education and Culture Nadiem Makarim that the preparation of the RPP is only 1 sheet with the contents of Learning Objectives, Learning Activities and Assessments. Based on the documentation data at SMA ABBS Surakarta for the preparation of the RPP in accordance with the circular letter of the Minister of Education and Culture, there are learning objectives, learning steps, assessment of learning outcomes and added media/tools, materials and learning resources. In the core activities in the Learning Implementation Plan there are critical thinking, Collaboration, Communication and Creativity which are the 4Cs of 21st century skills. Then in the media in the Learning Implementation Plan it is planned to have geogebra and quizizz applications on limit material in infinity of algebraic functions and trigonometric functions and there is kahoot on the limits of trigonometric functions.

Geogebra application is a mathematics learning software designed to combine geometry, algebra and calculus in one interface. Geogebra is a freely available open source, software program created by Markus Hohenwarter in

2001 (Hohenwarter et al., 2009). The existence of geogebra is very helpful for teachers and students in learning mathematics, especially those related to geometry, limits at infinity of algebraic functions and trigonometric functions or linear programming, namely shading the solution area for a system of linear inequalities of two variables, because anyone can check the truth of the image or graph that we have created. in solving problems with geogebra. Next, the quizizz application is used as an interactive quiz for competency assessments that have been delivered by the teacher in the hope that students understand the material that has been given well. Furthermore, in addition to quizizz, it is planned with the kahoot application. Kahoot is an educative online game to foster student learning motivation because the game has challenges (challenges), fantasy (delusion) and curiosity (curiosity) and promotes speed in thinking or making decisions (Irwan et al., 2019). In the assessment of mathematics learning outcomes in lesson plans, two assessments are planned, namely knowledge assessment and skills assessment. For knowledge assessment in the form of multiple choice written test and written description, oral test or question and answer to discussion, and skills assessment in the form of performance assessment, project assessment, product assessment and portfolio assessment.

## 2) Characteristics of implementing mathematics learning in integrating 21st century skills

The implementation of learning is the implementation of the Learning Implementation Plan or RPP that has been made by the teacher. The implementation of mathematics learning includes preliminary activities, core activities and closing activities. Preliminary activities are activities to direct learning and motivate students to learn. Things that need to be done in the introduction include (1) Orientation, meaning to focus students' attention on the material to be studied, for example by showing animations or video shows about natural phenomena and the teacher also conveying the learning objectives to be achieved, (2) Apperception, meaning provide initial perceptions to students about the material to be studied, (3) Motivation, motivate students about the benefits of studying this material, (4) Providing references, teachers need to provide references in the form of teaching and learning mechanisms, tasks to be carried out and assessments to be carried out (Sani Abdullah, 2015). Core Learning Activities are activities to achieve Core competencies and Basic Competencies. This activity uses learning models and strategies that are adapted to the characteristics of the subject matter and student characteristics. Closing activities need to be carried out to provide reinforcement to students about the subject matter and follow up in the form of assignments and informing the subject matter for the next meeting.

The implementation of mathematics learning at SMA ABBS Surakarta is adjusted to the Learning Implementation Plan that has been made previously by the mathematics teacher. In accordance with the results of the documentation in the form of a mathematics lesson plan document with learning steps, (1) preliminary activities, the teacher greets students by greeting and asking whether there are students in the class whether there are zero or not due to what reason, the teacher reviews the material that has been prepared. previously studied and ask questions to remember and relate the material that has been delivered, convey motivation about what is obtained by studying mathematical material, then explain the things to be learned, competencies to be achieved and learning methods to be used (2) core learning activities Mathematics integrates 21st century skills known as the 4Cs, namely communication, collaboration, critical thinking, and creativity. The following is the integration of 21st century skills in the implementation of mathematics learning at SMA ABBS Surakarta in the ICT class program, 1) Communication is a person's skill in conveying information both written and oral. Mathematical communication skills are the ability to explain and present solutions to everyday problems related to mathematics in the form of representations such as graphs, tables or diagrams. In the current era of digitalization, the process of seeking knowledge or solutions to a mathematical problem is not only based on one source from the teacher, but students can search for applications on Google about solutions to math story problems and communicate with other students. Mathematical problems related to the limit at infinity in the learning process, one of which is: Chemical compounds undergo continuous decay. The number of decays of the compound

expressed in function  $f(x) = \frac{15 \sin^2(\frac{1}{x})}{\frac{1}{x} \tan(\frac{3}{x})}$ , with x time the chemical compound

decays. If  $f(x)$  expressed in grams, determine the amount of decay of the compound. Here students are required to have mathematical communication skills to solve these math problems. 2) Collaboration, integration of collaboration in mathematics learning after the COVID-19 pandemic, teachers at SMA ABBS Surakarta, teachers provide student worksheets (LKS) containing controlled/group exercises, and independent exercises. Controlled/group exercises with the aim of the teacher facilitating and guiding students to solve the HOTS math calculations by completing the answers that have not been filled in and done by students together or discussing at school. Independent exercises with the aim of teachers facilitating and guiding students to solve HOTS math calculations by completing answers that have not been filled in and done by students independently at school. Sari's research results show that problem solving-based worksheets have a big effect on improving

students' critical thinking skills (Sari, 2018). 3) Critical thinking skills or critical thinking skills are a person's skills in dealing with, solving problems and making decisions rationally. Critical thinking skills must be possessed by everyone because this relates to the information obtained is true or not, facts or opinions, hoaxes or not. Critical thinking skills can be integrated in learning mathematics by getting students to practice HOTS questions. In critical thinking skills, SMA ABBS Surakarta High School teachers provide opportunities for students in class to identify as many things as possible that have not been understood from factual questions to hypothetical questions, about limit material in infinity algebraic functions and trigonometric functions, for example in the problem of calculating limit values. the following trigonometric functions: Calculate the value of  $\lim_{x \rightarrow \frac{\pi}{4}} \frac{\cos 2x}{\sin x - \cos x}$  , from these

questions students must think critically by remembering the double angle formula, namely  $\cos 2x$ , then factoring the double angle with reference to  $a^2 - b^2$  , if there are the same factors, both the numerator and denominator can be crossed out, so that the limit value can be substituted, but also must understand the sine and cosine values of special angles in trigonometry material. This is in line with the suggestion in research conducted by Saraswati and Agustika (2020) that teachers are expected to familiarize students with working on HOTS-oriented math problems in a sequence from understanding the questions, planning solutions, calculating carefully and rechecking the results of the completion to practice critical thinking skills (Saraswati & Agustika, 2020). 4) Creativity, creativity is the ability of teachers to come up with new and interesting ideas, ideas and actions. In general, creativity is defined as a thought process that produces new and meaningful products. In mathematics, this product can be in the form of student ideas or opinions, proposed problems, and solutions to new problems (Schoevers et al., 2022). In learning mathematics at SMA ABBS Surakarta in the ICT class program, the teacher uses geogebra (Fitriasari, 2017). Geogebra is very attractive to students of the ICT class program, because they are students who study technology and information in the learning process in the classroom. In general, geogebra software has the ability to handle number, vector and point variables, find derivatives and integral functions (Nurzannah et al., 2021). It can be said that geogebra software is very supportive and helps students in learning abstract mathematics. Furthermore, the last step in the implementation of learning is closing, in this closing section, the teacher concludes the formulas that have been studied and suggests studying the next material and gives encouragement not to give up easily to learn mathematics.

### 3) Characteristics of mathematics learning assessment in integrating 21st century skills

Assessment is the process of concluding and interpreting facts and making professional basic judgments to make decisions based on a collection of information (Sani Abdullah, 2015). In Permendikbudristek No. 21 of 2022, it is stated that assessment is the process of collecting and processing information to determine the learning needs and developmental achievements or learning outcomes of students. The assessment carried out by the teacher in the classroom related to teaching and learning activities is a process to collect facts or student learning documents to make improvements to the learning program. Assessment is used by teachers to create or improve lesson plans. In general, the assessment is carried out to monitor learning progress and learning outcomes, determine the level of mastery, establish improvement programs tailored to the level of mastery of competence (Syaifuddin, 2020). The assessment method carried out at SMA ABBS Surakarta refers to the Minister of Education and Culture Regulation No. 23 of 2016 that the assessment of student learning outcomes in primary and secondary education includes aspects, (1) attitudes, (2) knowledge and (3) skills.

The assessment conducted at SMA ABBS Surakarta emphasizes authentic assessments that are genuine, real or valid. Authentic assessment is an assessment carried out comprehensively to assess starting from the input (input), process and output (output) of learning. The following describes the characteristics of the assessment carried out at SMA ABBS Surakarta, (1) Assessment of the attitude or affective domain. The term attitude in English is called attitude. Attitude is a way of reacting to a stimulus (Suharyat, 2009). So measuring the affective domain is not as easy as assessing the knowledge or cognitive domain, because children's attitudes and behavior are always changing (Saidah, 2018). Attitude assessment is an activity carried out by educators to obtain descriptive information about student behavior. Assessment of attitude aspects includes spiritual and social aspects. For mathematics learning, the assessment of the attitude aspect used is the social aspect with a description of the competence to appreciate and practice honest, disciplined, polite, caring, responsible, responsive and pro-active behavior (Attachment of Permendikbud No 21 of 2016). According to observations at SMA ABBS Surakarta, the teacher conducts an attitude assessment using observations and journals. Observations were made by the teacher during class teaching activities to find out students' attitudes towards mathematics lessons, honest or not, disciplined or not in collecting assignments or entering class, especially in the first hour or hours after rest, responding or not when asked questions and being responsible for completing assignments. In addition to

observations, teachers have special notes or journals about student learning progress related to 21st century skills. But based on interviews with mathematics teachers that attitude or affective assessment includes observations, journals of student notes during math lessons, self-assessment for each student and assessment between students, where one student with another student assesses each other's attitudes that are carried out daily during school, especially when learning mathematics.

(2) Knowledge Competency Assessment or cognitive aspect is an activity carried out to measure the mastery of knowledge by students, as the opinion of Nurul Waizah and Herwani in their research that the assessment of knowledge competence is an assessment carried out by teachers to measure the level of achievement or mastery of students in the knowledge aspect. Knowledge assessment is carried out by educators, education units and the government. One of the teacher's tasks is to assess the learning process. Based on the observations of researchers at SMA ABBS Surakarta, the assessment made by teachers in the mathematics learning process is (1) with quizziz, as research conducted by Sugian Noor (2020) that the use of quizziz is very good in the learning assessment process. Likewise research conducted by Rukiye Degirmenci (2021) that Quizizz is effective and plays an important role in learning and the perspective of teachers and students on Quizizz is positive. Quizizz is a web tool for creating interactive quiz games that can be used to assess learning in the classroom, such as formative assessment. Quizizz is very easy to use, has up to 4-5 answer choices including the correct answer (Noor, 2020). When the quiz is ready, we can distribute the 6-digit code to students. With Quizizz students will be enthusiastic and think critically because they only have a short time to work, and students will be more communicative after working out of curiosity with the wrong answers.

(2) Group discussion, so students can share knowledge or collaborate in solving math problems.

(3) the written test is in the form of multiple choice questions, but in the process the solution is included, so that the teacher can assess the extent to which students understand the material that has been given.

(4) With Kahoot, Kahoot is one of the fun interactive games because once answering the wrong position will shifted, so it is very good for reasoning and understanding concepts that affect learning outcomes, as research conducted by Irwan, Zaky Farid and Atri Walidi (2019) concluded that kahoot is an alternative interactive learning media and has been proven to significantly improve student learning outcomes (Irwan et al. al., 2019). Kahoot is used to assess the speed and activity of students in answering questions, with this kahoot students have digital communication skills.

3) Skills Competency Assessment, skills assessment is an assessment carried out to measure students' abilities in achieving core competency skills and to determine students' abilities in applying their

knowledge in completing tasks and activities (Sarkadi, 2019). Skills assessment for the mathematics learning process at SMA ABBS Surakarta includes portfolio assessment, project assessment, performance assessment, and project assessment.

#### 4. PENUTUP

In this study, it was concluded that 1) mathematics learning planning was carried out at the beginning of the academic year by compiling Syllabus, KKM, RPP which contained 21st century skills, 2) the implementation of mathematics learning referred to the lesson plans that had been made by subject teachers which included preliminary activities, core activities and closing, so that the RPP made is only 1 sheet but the content of the material that is located in the attachments is in English because SMA ABBS Surakarta applies two languages, namely English and Indonesian in the learning process in the classroom, so in this case the findings that researchers get are the learning process mathematics using English. 3) Assessment of mathematics learning to assess students from a cognitive perspective, especially for daily tests using multiple-choice tests but the working process must exist and may not ask each other, for assignments and discussions with student worksheets, Quizizz and Kahoot. The findings that researchers get if students or students are not honest in the test, the value obtained must be zero.

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