

## STUDENT WORKSHEET DESIGN ANALYSIS BASED ON ADAPTIVE INTELLIGENCE WITH AN APPROACH OF ASSESSMENT AS LEARNING

Rukli<sup>1\*</sup>, Muh Nur Iqramsyar<sup>2</sup>

<sup>1\*,2</sup>Universitas Muhammadiyah Makassar, Makassar, Indonesia

\*Corresponding author. Jl. Sultan Alauddin No.259, 90221, Makassar, Indonesia

E-mail: [rukli@unismuh.ac.id](mailto:rukli@unismuh.ac.id) <sup>1\*)</sup>  
[muh.iqramsyar@gmail.com](mailto:muh.iqramsyar@gmail.com) <sup>2)</sup>

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### Abstract

Creativity is part of the demands of learning mathematics, but the existing worksheets teachers make do not support the development of student's creative abilities. This study aims to design worksheets according to student intelligence with an assessment approach as learning. This study uses an exploratory, descriptive, evaluative approach to study, analyze, and evaluate teacher-made worksheets with an assessment approach as a learning approach to obtain work processes and components of student worksheet design based on adaptive intelligence. The research subjects were elementary school students and teachers. There were nine students and three teachers involved in this study. Subjects were divided into three groups. Each group has three students and one teacher to conduct a dialogue with assessment as a learning approach. The instrument uses an observation sheet and a fill-in sheet. Data analysis used a constructive descriptive approach. The results of the study show the following. The nine multiple intelligences are linguistic, spatial, and logical. The core consists of two parts, namely blocks and cubes. Adaptive worksheets focus on how to work according to students' creativity. Exercise is part of the learning process; the material is not separate. Worksheet design is more of an adaptive worksheet creation process. The teacher designs adaptive worksheets by paying attention to the core subject matter and the dominance of multiple intelligences.

**Keywords:** Assessment as learning; dominant multiple intelligence; student worksheet design analysis.

### Abstrak

Kreativitas merupakan bagian dari tuntutan pembelajaran matematika tetapi LKS yang ada yang dibuat oleh guru tidak mendukung pengembangan kemampuan kreatif siswa. Penelitian ini bertujuan untuk merancang LKS sesuai kecerdasan siswa dengan pendekatan penilaian sebagai pembelajaran. Penelitian ini menggunakan pendekatan eksploratif, deskriptif, evaluatif untuk mengkaji, menganalisis, dan mengevaluasi LKS buatan guru dengan pendekatan asesmen sebagai pendekatan pembelajaran untuk memperoleh proses kerja dan komponen desain LKS berbasis kecerdasan adaptif. Subjek penelitian adalah siswa dan guru sekolah dasar. Ada sembilan siswa dan tiga guru yang terlibat dalam penelitian ini. Subjek dibagi menjadi tiga kelompok. Setiap kelompok terdiri dari tiga siswa dan satu guru untuk melakukan dialog dengan penilaian sebagai pendekatan pembelajaran. Instrumen menggunakan lembar observasi dan lembar isian. Analisis data menggunakan pendekatan deskriptif konstruktif. Hasil penelitian menunjukkan sebagai berikut. Sembilan kecerdasan majemuk menjadi linguistik, spasial, dan logika. Isi inti terdiri dari dua bagian yaitu balok dan kubus. LKS adaptif menitikberatkan pada cara mengerjakan sesuai kreativitas siswa. Latihan merupakan bagian dari proses pembelajaran materi tidak terpisah. Desain lembar kerja lebih ke proses pembuatan lembar kerja adaptif. Guru merancang LKS adaptif dengan memperhatikan materi inti mata pelajaran dan dominasi kecerdasan ganda.

**Kata kunci:** Analisis desain lembar kerja siswa; kecerdasan ganda yang dominan; penilaian sebagai pembelajaran



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## INTRODUCTION

The Inpres Elementary School Barombong III, Tamalate District, Makassar City, shows that teachers have used the Student Activity Sheet (SAS) for several years according to the Rev. K13 curriculum. However, teachers experience limitations in optimizing students' abilities with different types of intelligence. Students are directed according to the SAS work process, so student activity is limited. Students are confused and do not understand and forget the subject matter a few days before, so the teacher has to repeat it.

Furthermore, the teacher applies SAS in the classroom, referring to cognitive mastery without paying attention to Multiple Intelligences (MI). It becomes an obstacle for teachers to access the intelligence of students further. As a result, less optimal learners receive intelligence information at the end of each task.

Furthermore, the principal wants students to be involved in the assessment process in class. Teachers provide access to students to be actively involved but adaptive in the learning process at school. In addition, the school principal requires MI information for each student to make other decisions and report the results to the student's parents or the district education office. Every student has more than just intelligence. This intelligence is specific for each student, but some are more dominant in some students or classes (González-Treviño et al., 2020, Al-Qatawneh et al., 2021). Although there is research that intelligence tests are no longer needed in diagnosing certain learning difficulties (Wibowo et al., 2020). But other studies show that intelligence tests need to be developed with artificial intelligence to meet future needs (Li et

al., 2018) and there is an undeniable connection that intelligence tests are closely related to learning achievement (Karwowski et al., 2021).

There are nine MIs that students can have: linguistic, logical-mathematical, spatial, kinesthetic, physical, musical, interpersonal, intrapersonal, naturalist, and moral-spiritual intelligence (Chatib, 2017; Lunenburg & Lunenburg, 2014; Yavich & Rotnitsky, 2020). The application of MI as a strategy for developing innovative and relatively new learning in the world of education (Azid et al., 2019; Ghaznavi et al., 2021). MI-based SW is in line with the objectives of the 2013 curriculum prototype and independent curriculum, where the measurement of attitudes, skills and knowledge cannot be separated. This is progress in designing MI-based SW according to the era of the industrial revolution 4.0. (IR). IR directs future learning behavior patterns where creativity and innovation are the main requirements to withstand competition.

Furthermore, the principal wants students to be involved in the assessment process in the classroom. The teacher gives access to students to be actively engaged but adaptive in the learning process in the school. In addition, the principal requires MI information for each student to make other decisions and report the results to the parents of students or the district education office. Every student has more than intelligence. This intelligence is specific for each student, but some are more dominant in some students or classes (González-Treviño et al., 2020, Al-Qatawneh et al., 2021). Although there are studies that intelligence tests are no longer needed in diagnosing specific learning difficulties (Wibowo et al., 2020).

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There is nine MI that students can own: linguistic intelligence, logical-mathematical, spatial, kinesthetic, physical, musical, interpersonal, intrapersonal, naturalist, and moral-spiritual (Chatib, 2017; Lunenburg & Lunenburg, 2014; Yavich & Rotnitsky, 2020). Application of MI as a strategy to develop innovative and relatively new learning in the world of education (Azid et al., 2019; Ghaznavi et al., 2021). MI-based SAS is in line with the objectives of the 2013 curriculum prototype curriculum and independent, where the measurement of attitudes, skills, and knowledge is inseparable.

Likewise, the use of MI-based worksheets can significantly affect students' cognitive, affective, and psychomotor competencies (Rezki et al., 2015). It is following the principles of 1) students are told to lead students to find out, 2) learning that applies the principle that anyone is a teacher, anyone is a student, and anywhere is a class, and 3) there is recognition of individual differences and the cultural background of students (Permendikbud No. 65. 2013). When viewed from these three points, the teacher interacts with students to pay attention to the MI of each student according to Assessment as Learning (AaL). AaL is an assessment approach involving students to identify, design, and make assessments (Lee et al., 2019). AaL benefits teachers and students in the process and learning outcomes according to their potential (Lam, 2018). AaL allows students to freely choose according to the MI they like and their potential so that students are more active and creative.

The research results related to worksheets do not involve students from the beginning of their manufacture. For example, the study

only uses google forms (Iqbal et al., 2018), digital eco learning (Sumarmi et al., 2021), education for environmentally sustainable development to enhance scientific literacy (Ekantini & Wilujeng, 2018), based on higher order thinking skill (Sutama et al., 2021). So, if students are more towards the object than the subject of learning, it can hinder students' creativity. Indeed, creativity is part of the demands of the industrial revolution 4.0, so as the queen of science, learning mathematics must foster creativity. However, the SAS made by teachers, as in previous studies, has not supported the development of student's creative abilities. For this reason, this study aims to design SAS starting from the beginning with the AaL approach according to students' emotional intelligence.

## **METHOD**

The research method uses an explorative, descriptive, evaluative approach to examine, analyze, and evaluate teacher-made math worksheets with the AaL approach. The AaL approach regarding MI obtains an adaptive intelligence-based SAS design.

The research subjects were students of class V and teachers of grades IV-VI. There were nine students and three teachers involved in the study. Then, The research subjects were divided into three groups: three students and one teacher. Each group has 15 minutes to discuss and conclude the group's results. Notes on group results become research data to be the next source of information. Besides that, limited observation and interview data with guidelines set for groups and individuals are also a source of data. The object of this research is the building of cubes and blocks. The

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building of cubes and blocks is put together by paying attention to the core content of the two cubes and blocks.

The flow of discussion with the AaL approach is that students and teachers discuss in the form of taking and giving about the needs related to core content and MI. The teacher opens a discussion about the parts of the old SAS that the teacher has used. The old SAS was dissected and analyzed for deficiencies and obstacles in terms of substantive and implementation in the classroom. Matters related to the old SAS became a source of Analysis of the needs of students and teachers while still paying attention to the interests of the principal and parents of students.

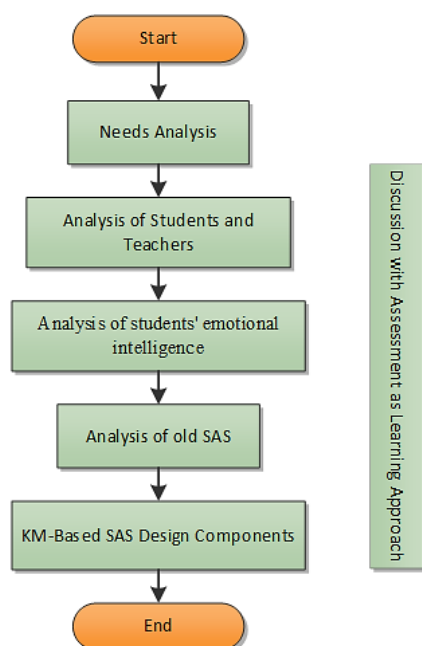


Figure 1. Research stages

Figure 1 describes the stages of the research. The details of the stages are as follows. (1) Analyze the needs of students, teachers, and school principals related to SAS. The data is in the form of constraints and desires of the user, especially the principal, requiring a more creative classroom learning situation. (2) Student and teacher

analysis is a continuation of needs analysis. Students and teachers discuss with the AaL approach needs and want. (3) Analysis of the emotional intelligence of each more dominant student. The dominant intelligence becomes three as the core to further develop in the new SAS. (4) The material, time, learning, and evaluation components of the old SAS were dialogued with the AaL approach. (5) The results of several previous stages are discussed in groups and between groups to produce new SAS design components.

The results of these conclusions become a source of data in the design. Students and teachers engage in open dialogue with the AaL approach. SAS is in demand and is expected to be related to MI. Each student presents the reasons and approvals set while the teacher and other students comment on the reasons and approvals. It was done before and during the design of the MI-based SAS. After recording the new strengths and weaknesses, the discussion will continue regarding SAS opportunities and challenges. Each group has 15 minutes to discuss and conclude the group's results. The results were discussed between groups using the AaL approach. Documentation notes of group results become research data for designing MI-based SAS in the adaptive learning process.

The study used observation sheets and filling sheets. The instrument was validated qualitatively by employing experts. Observation sheet to observe the behaviour of students and teachers and their interactions during dialogue with the AaL approach. Filling sheet to record the advantages and disadvantages of the old SAS and absorb the needs and desires of students and teachers for the new MI-based SAS.

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The spreadsheet does not use a standardized format for the order of the dialogue themes. The filling sheet gives flexibility to each group member so that a two-way and even multi-way take and dialogue between participants follow AaL. The analysis technique uses a constructive descriptive approach in depth from data and facts from structural interviews, observation sheets and filling sheets.

## RESULT AND DISCUSSION

The initial stage before the design was to observe and deepen the SAS made by the teacher regarding student activity and MI, including the material. The results of observations and discussions between students and teachers show that students tend to be less active. Then, activities include the MI component related to pictures or visuals, drawing, and colouring, using language well to convey information, reading and writing, speaking, active body movements, and learning sports, like cooperation and like math lessons involving numbers and challenges to solve a problem. Problems related to learning and everyday problems. Likewise, the format or components in the SAS made by the teacher in the classroom are in the form of multiple choice questions, entries, and essays from the material studied separately from learning activities. Thus, the SAS made by the teacher has similarities with the lesson plan.

As the results of observations of student and teacher discussions, students tend to be active with activities related to reading stories, writing essays or opinions, drawing and colouring an object, learning outside the classroom, such as in the park, and learning about plants and animals. These lessons are related to calculations and are like a

challenge to solve a problem. The teacher and student want SAS to be effective and efficient. It means SAS have specific thematic learning (core content), making it easier for students to understand the material being taught. These results are shown in Figure 2.

- Soal kurang dipahami karena penjelasan kurang jelas
- Isian
- pilihan ganda
- Uraian.
- lebih mudah pilihan ganda
  - kendala
    - \* Isian: penjelasan guru kurang jelas
    - \* Uraian: penjelasan guru kurang jelas
- Tematik lebih mudah
  - Siswa lebih suka menggambar dan menulis
  - Siswa lebih mudah memahami LKPD dalam bentuk gambar dan tulisan

Figure 2. AaL approach discussion

The results of the teacher's discussion with students obtained data on student worksheets used in learning, which are only in the form of multiple choice questions, entries, and essays from the material that has been studied. The questions that are done are also monotonous, so students tend to get bored. The design stage was carried out based on the initial discussion results. Then, the design activity begins with an introduction from the head of the research team about the aspects of the study: preparation of the SAS device format, media design, teaching material design, and MI-based SAS design. The activity has two stages, namely, a description of the activities of each group and the presentation of the results of each group's activities. The results of the three groups were discussed in more detail to get an MI-based SAS design following the optimal MI results from students.

Group 1 discussion with AaL approach with a severe but relaxed atmosphere. Group I was led by a

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teacher with three students. The atmosphere of dialogue between participants provides opportunities for all participants to ask and answer related to each part of the design. The needs of students and teachers are discussed with the AaL approach concerning MI-based SAS design. The atmosphere of the dialogue is shown in Figure 3.



Figure 3. The teacher notes the discussion



Figure 4. The teacher demonstrates building space

Group 2 has an engaging discussion in Figure 4. The teacher gives examples of space objects to invite students to have honest conversations. Students ask and answer questions from students and teachers. Serious but relaxed students follow the dialogue with the AaL approach. At the end of the discussion, the teacher and students conclude the MI of each student. There are various MI for each student, but in general, there are four

main things: linguistic, spatial, logical, mathematical, logical, and kinesthetic.

Group 3 conducted the discussion naturally in Figure 5. The teacher opened the meeting slowly, with a simple sound and display style. The teacher asks several questions related to space material by once reinforcing flat shapes. Building space has an essential requirement to get up flat. At first, students were confused by the teacher's questions, but the discussion became active with focused questions. Students began to be interested and directed to the material of the building space. Students start to ask and answer space material. Constraints and students' preferences for the material are presented so that at the end of the dialogue. The teacher writes the results of the discussion with the help of students. Five main things concern MI students: logical-mathematical, spatial, kinesthetic, physical, musical, and interpersonal.



Figure 5. The teacher records the results of the discussion

The results of group 1 activities have been documented in Figure 6. SAS that students are interested in is interesting material such as pictures and transparent colours. There are three forms of questions, namely multiple-choice, description or filling, or others. Media is made more transparent and easier to use by students and teachers. SAS consists of shorter and clearer

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questions in the form of stories. Questions can be in the form of multiple choices, descriptions, or entries. Students prefer to count and estimate. SAS is easy to apply, namely practical and non-theoretical. Students prefer that the worksheets are accompanied by logical and spatial concrete objects, although they still pay attention to linguistics.

- Bentuk Soal
- Pilihan ganda : lebih jelas pilihan jawaban.
  - Uraian : lebih cepat memahami gambar-gambar disertai uraian.
  - Isian : lebih mudah memahami jika disertai dengan gambar
- Penggunaan media lebih jelas dan mudah dipahami
- LKPD yang baik
- Soal lebih pendek dan jelas
  - Soal berbasis cerita
  - Pilihan ganda, uraian, dan isian.
  - lebih senang membaca dan menulis
  - lebih suka kegiatan praktek
  - lebih senang di sertai benda konkrit.

Figure 6. Results of group discussion 1

- Bahan ajar yang baik
- Media konkrit
  - Gambar yang jelas dan menarik
  - Tulisan yang baik dan jelas
- Materi Ajar
- Lebih singkat
  - Tidak terlalu panjang
  - Terkesan menarik karena disertai dengan gambar
- Kendala
- Materi terlalu panjang.
  - Hanya didominasi oleh bacaan.
- Rancangan Asesmen / penilaian
- Pilihan ganda, uraian, dan isian (pengetahuan).
  - Penilaian meliputi aspek (kognitif, afektif, & psikomotorik)
  - di dalam penilaian ada petunjuk pengerjaan.
  - Kegiatan keterampilan
    - \* lebih senang berkelompok
    - \* lebih mudah atau lebih ringan untuk diselesaikan.

Figure 7. Results of Group Discussion 2

The results of group 2 activities have been documented in Figure 7. Several points are needed in making SAS: suitable teaching materials with

concrete media criteria, precise and exciting pictures, and sound and clear writing. SAS has simple but solid material that is not convoluted and is accompanied by photos.

The problem with SAS is that the material is too long, such as guidebook material, mainly in text form, and there are very few pictures. Furthermore, SAS has multiple choice assessments, short descriptions and entries but is denser in sentences, including options for multiple choice and clear scoring tables for description assessments, so other assessment variations are needed, such as scales or questionnaires.

Assessment includes cognitive, affective, and psychomotor aspects where instructions for work accompany each evaluation. In skilled activities, students prefer to discuss, and SAS is easier to implement. While concrete objects are used to assist in understanding space so that it is easier and faster to solve spatially.

- ① \* LKPD lama (rancangan)
- LKPD tergolong susah
  - LKPD isian, pilihan ganda, esay
  - Identitas tidak ada.
  - Tujuan pembelajaran ada.
  - Alat dan bahan kurang dalam penggunaan.
  - Petunjuknya jelas dalam penggunaan dan disertai dengan soal
  - Pilihan ganda mudah.
  - Ada praktek dan proyek
  - soalnya banyak.
- \* Media
- pernah menggunakan media pembelajaran.
  - Guru membuat media.
- \* Materi Ajar
- Siswa paham penjelasan guru
  - Materi susah.
  - Menggunakan LKPD saat pembelajaran dalam penjelasan materi
- ②
- Sultan lebih suka olahraga
  - Ayah suka membaca, menghitung, dan menggambar
  - Anna suka membaca, menulis, suka olahraga.
  - Ayah suka belajar dalam pembelajaran matematika sambil menggambar
  - Anna suka belajar membaca cerita sambil memecahkan masalah matematika.

Figure 8. Results of Group Discussion 3

The results of the activities of group 3 are documented in Figure 8. Group 3 describes the weakness of the

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old SAS design. Namely, SAS is challenging to learn by students and taught by teachers. SAS assesses the content, multiple choice, and a description that is too long and does not touch the primary material, namely space. SAS does not have an identity. Learning objectives need to be in the design with reasons. Tools and materials are less functional in application in the classroom. Instructions are clear in use and follow the type of question. Multiple choice questions only measure low ability. Pictures are sometimes present but are not related to the material. SAS needs practice in class and projects to make it easier to understand space material.

The group is more supportive of the media in the SAS so that students understand the material from the teacher so that if there is complex material, it is easier to master the material. The three students have different preferences, but all three want learning media in the classroom and logical learning rules. The process of designing the adaptive SAS was obtained based on the discussion of the three groups, followed by inter-group dialogue. First, students and teachers conduct a conversation with the AaL approach to design SAS, where students or teachers record the dialogue results to document the discussion results. Second, from the nine MIs, they went through a discussion process with the AaL approach in a convergent manner, referring to three parts, namely linguistic, spatial, and logical mathematics. Third, the space material consists of two parts, namely blocks and cubes, which are called class V material. It has become dominant, so MI-based SAS with AaL approach is leaner but still contains core content.

Fourth, SAS does not focus on the material but on how to work according to student creativity so that SAS is more flexible according to student activity, not SAS directs. Fifth, practice as part of the material, not as a separate part. Exercises can be in the form of multiple choice, filling or essays, scales, questionnaires, or others. Sixth, the results of the SAS design are more about the process of making adaptive SASs rather than the final product. Therefore, these parts of the design are a dialogue process between students and teachers with the AaL approach to making adaptive SASs, not the final product in the form of SAS, even though the design produces SAS product designs, namely the design of adaptive SAS. SAS does not focus on the material but on how to work according to student creativity so that SAS is more flexible according to student activity, not SAS directs. Fifth, practice as part of the material, not as a separate part. Exercises can be in the form of multiple choice, filling or essays, scales, questionnaires, or others. Sixth, the results of the SAS design are more about the process of making adaptive SASs rather than the final product. Therefore, these parts of the invention are a dialogue process between students and teachers with the AaL approach to making adaptive SASs, not the final product in the form of SAS, even though the design produces SAS product designs, namely the design of adaptive SAS. SAS does not focus on the material but on how to work according to student creativity so that SAS is more flexible according to student activity, not SAS directs. Fifth, practice as part of the material, not as a separate part. Exercises can be in the form of multiple choice, filling or essays, scales, questionnaires, or others.



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Materials and learning media allow students to be creative according to their abilities. It can increase retention (Tharayil et al., 2018, Lombardi et al., 2021). The design of the adaptive SAS with the AaL

approach is a learning guide in the form of materials or work processes according to student activity and creativity so that the adaptive SAS is not too standard operational to stifle student creativity. SAS is an operating unit between materials and exercises to foster students' critical thinking (Hairun et al., 2020)

The material in the adaptive SAS is the core material so that the block and cube space material becomes the space material. The core content is material that includes some material but extracts from its component material. The component material is a detailed description of the core material. Learning core content and component materials are similar but differ (Collins et al., 2011). Component material is part of the core material with detailed stages of the learning process but requires several meetings to complete. On the other hand, the learning process on the core material is less complicated but takes the main points of the material, so it only takes one meeting. It encourages adaptive SAS.

The core material does not eliminate other materials but only examines the main things. It is essential and strategic in learning with much material or requiring several new meetings to be completed. The core learning indicators include sub-indicators of component materials so that conceptually it does not eliminate the spirit of a material to be delivered to students. As a result, training becomes more flexible and adaptive with these indicators.

The exercises in the adaptive SAS are not separate assessments from the learning process. Practices can include multiple choice essays, descriptions, observation sheets, self-assessments, and others. The selection of training

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forms is adjusted dynamically in the learning process. Exercise can be done at the beginning, middle, or end. Therefore, practice is a learning process in adaptive SAS. It is a differentiator from other SASs where the SAS is similar to the lesson plan, and even if the SAS is not adaptive to following students' creativity, it can slowly turn off student creativity. Such SAS is certainly not following the guidelines of RI 4.0.

RI 4.0 has the characteristics of continuous and unpredictable changes (Cotet et al., 2020, Gürdür Broo et al., 2022). For example, digital, biological, and physical technology are included in the education field in students' learning process. Industries are evolving to create global economic reforms, including artificial intelligence, genomics, and virtual reality. It requires a capability to match it by strengthening the weaknesses of Artificial Intelligence (AI) to support AI (Shaderkins, 2021, Dobbelaere et al., 2021). The shortcomings in AI include the following. First is flexible understanding, where AI has limitations in learning every second from second to second. Second, social negotiation is a human ability that can make negotiations and social interactions more efficient. Adaptive SAS with the AaL approach can foster social interaction and humanist dialogue. Third, creativity and innovation are human behaviour or actions that are dynamic and adaptive. Adaptive SAS accommodates these characters according to the AaL approach, where students and teachers take and give each other in designing SAS. Fourth, emotional intelligence is part of human character, whereas AI is less adaptable except for intellectuals.

MI in adaptive SAS includes multiple intelligences influencing student learning outcomes (Inan & Erkus, 2017). However, the nine-component MI is too general to be compressed during dialogue with the AaL approach. The compression results narrowed from nine to three, namely linguistic, spatial, and logical mathematics. It is said to be the dominant MI. The MI component exists in each student or group of students. Among these components, one is dominant in each student or class, so the dominant MI needs to be maximized by the teacher in class. The adaptive SAS accommodates the dominant MI.

The design of the adaptive SAS has features that are not the same in name and function as the teacher-made SAS. Teachers make teacher-made worksheets without involving students. The teacher-made SAS ignores MI. Teacher-made SAS is more operational in practice, so sometimes, it directs students without paying attention to student creativity. Teacher-made SAS has similarities with the lesson plan, where the material, process, and exercises are separate. The teacher-made SAS refers to the subject or sub-topic so that the target is the achievement. It has advantages but opens up many weaknesses. For example, students are forced to achieve targets so that they place more emphasis on results rather than processes. Thus the teacher-made SAS differs from the adaptive SAS with various features to enhance creativity according to RI 4.0 (Iqbal et al., 2018), but the SAS did not involve students in the design. Another worksheet with a discovery learning model equipped with AR video (Bakri et al., 2020) does not include students. Likewise, HOTS-based SAS (Sutama et al., 2021) nor does involve students.

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Furthermore, several studies have similarities with adaptive SAS, namely MI-based SAS, by specifying five of the nine multiple intelligences (Goddess & Martini, 2020), the preparation of SAS according to different fields of student intelligence can have a positive effect on student achievement (Inan & Erkus, 2017). The SAS based on MI optimizes students' creative thinking (Luthfiana et al., 2019), and SAS trains students to learn independently (Sustainable & Nisa, 2018). That is, adaptive SAS is a SAS designed by students and teachers so that it is more appropriate to the needs and style of the user where there has never been a study on this.

However, the study involved students and teachers during dialogues with the AaL approach but was unfamiliar with the characteristics of AaL, so strict guidelines were needed when discussing teacher-made worksheets and MI materials and components. In addition, the design of the adaptive SAS has limitations in terms of minimal implementation time. The student's knowledge of the material on the flat plane is still limited, so it affects the ability and dialogue of the space material. The final result of the study is the design of an adaptive SAS to be a reference in conducting product trials. However, the process and results of the trial of MI-based SAS products are outside of the study.

## CONCLUSION AND SUGGESTION

The design of SAS based on adaptive intelligence with the AaL approach has the following process stages. First, each group of students and teachers discussed the AaL approach to reviewing the old SAS for 15 minutes. Each group consists of three students and one teacher. Second, MI from nine becomes dominant in three parts:

linguistic, spatial, and logical mathematics. Third, the material of space is the core content derived from the blocks and cubes. Fourth, SAS does not focus on the result. But, how to work according to student creativity so that it does not direct. Fifth, exercise is part of the core content learning process, not a separate component. Sixth, the results of the SAS design are more about the process of making adaptive SASs rather than the final product. Therefore, these parts of the invention are a dialogue process with the AaL approach to designing adaptive SASs. The design study SAS has not yet undergone expert validation and field trials.

The results of the study in the form of student worksheets can be tested again on a larger sample. Likewise, other researchers can use other material in mathematics or other subjects outside of mathematics.

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