

GROUP EXPLORATORY DIALOGUE ON THE SUBJECT OF ARITHMETIC SERIES

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ABSTRACT

The purpose of this research is to find out how the exploratory dialogue process in group discussions conducted in class XI IPS 4 SMA Negeri 2 Kota Pasuruan. This research uses a qualitative approach with the type of phenomenological research. The method of data collection in this research is using test method and group video recording. Data collection was conducted in class XI IPS 4 which numbered 24 students and divided into 4 groups, each group consisting of 6 members. The results showed that the dialogue of the video-recorded discussion and the transcript of the video recording showed that the exploratory dialogue process had been carried out consciously or unconsciously. Thus, the exploratory dialogue shown through group discussion activities of all group subjects met all the criteria for exploratory dialogue where students play an active role, opinions are offered, critical and constructive and decisions are made together.

Keywords: Discussion Method, Exploratory Dialogue.

1. Introduction

21st century learning has several skills that must be possessed by students, namely 4C which consists of critical thinking and problem solving, creativity, communication skills, and collaboration (Nurjanah, 2019). By integrating 21st century learning skills in the curriculum, the government can help change the learning approach to be more learner-centred, preparing them for success in the ever-changing and complex world of the 21st century era.

21st century learning can be developed with various learning methods and strategies based on activities that are suitable for the character of competencies and learning materials. Learning methods are used in the interaction between learners and educators to implement plans that have been prepared in the form of real and practical activities to achieve learning objectives. One of the learning methods that can be used is the discussion learning method.

The discussion method is a learning delivery where the teacher directs learners to solve a problem by gathering opinions, organising problem solving, and making conclusions (Nurhayati, 2019). This method is an effective tool in developing 21st century learning skills and can be an integral part of a curriculum that focuses on character development, creativity, critical

thinking, and communication skills. Basically, discussions are held face-to-face involving all group members and actively expressing their opinions. This interaction process involves individuals physically and psychologically which then results in dialogue between individuals.

Alexander in (Muhonen et al., 2016) said that dialogue is an exchange where students ask questions, explain problem points from their point of view, and comment on further ideas. Dialogue in mathematics learning is one way to improve critical thinking skills that are very important for students to have because it is one of the 21st century skills (Nugraheni & Wati, 2022). Mercer in (Phillipson & Wegerif, 2019) classifies the types of dialogue in learning into three, namely, disputational dialogue, cumulative dialogue, and exploratory dialogue.

Exploratory dialogue is very much in line with the development of 4C skills. Combining these two concepts can create a very effective learning environment. In addition to the 4C skills, the ground rules in exploratory dialogue are also very important to ensure the dialogue goes well. Ensuring all relevant information is properly shared, encouraging reasoned thinking, welcoming constructive debate, considering alternative options, and accepting collective responsibility for decisions are principles that help

create a productive dialogue environment. By combining the 4C skills and the principles of exploratory dialogue, learners can learn to think critically, communicate effectively, work collaboratively, and generate creative ideas, all of which are essential skills in the 21st century. It also helps create a more dynamic learning atmosphere and supports the development of students' ability to think independently and actively participate in dialogue and collaboration.

The dialogue process in the group discussions conducted, students were found to be involved in debates or critical conversations. The type of problem that can be given is a contextual problem, where group members discuss to solve related problems given to the group. One of the materials that can be used is arithmetic sequence material, where in this study students are given proof problems that require students to conduct discussions to determine the correct proof answer.

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Based on observations made by researchers on learning with discussion methods conducted by teachers of SMA Negeri 2 Pasuruan City in class XI IPS 4, there is a problem that students who conduct dialogue in groups tend to be dominated by active students only. So as to create dialogue in the discussion is still less visible in each group. Based on the problems that have been described, this study aims to determine the process of group exploratory dialogue in solving problems on the subject matter of arithmetic series.

2. Research Methods

This study uses a qualitative approach where researchers describe the student discussion process recorded using a recording device in the form of a cellphone which is then transcribed into dialogue transcripts. The type of research used is phenomenology, where this type of phenomenological research leads to describing in detail about an event in a person's life and can be used in qualitative research if a researcher wants to understand an event (Kaharuddin, 2020). The presence of the researcher is the main instrument

that cannot be replaced by others (Yanuardianto, 2022).

Before the researcher went to class, the researcher first conducted an unstructured interview with the subject teacher to choose which class would be the research subject. The class selection was carried out based on the criteria that the teacher had during teaching mathematics in several XI classes of SMA Negeri 2 Kota Pasuruan. After the class was selected, the researcher assisted by the subject teacher went to the subject class which then divided the discussion group. The discussion groups were also assisted by the teacher in grouping them in order to equally divide the members for each group. One class was divided into 4 groups, each group consisting of 6 members.

After the groups were formed, the researchers divided the questions and gave recording devices to each group. Before starting the discussion, the researcher first explained the procedures during the discussion. The time given by the researcher for the discussion process was 60 minutes. Researchers obtained data sources and results from discussions conducted by XI IPS 4 students.

After the field data sources were successfully collected, researchers conducted data analysis to simplify and process the data that had been obtained. Researchers conducted video analysis and then transcribed it into dialogue transcripts. In the final stage, conclusions were drawn.

3. Results and Discussion

Result

After conducting observations and unstructured interviews with subject teachers, information was obtained that in discussions between teachers and students who were actively involved only a few students who were dominant in the class. The researcher took a step by equally distributing some of these active students to each group. Where the even distribution of active students aims to provoke other members who are still passive so that they can follow the course of the discussion properly.

To find out the dialogue process carried out in the discussion, the researcher tried to transcribe the video recording of the discussion when the group tried to solve the proof of the arithmetic sequence. The following are the results of the analysis on the four discussion groups regarding the dialogue process carried out:

1) Exploratory Dialogue Process in Group 1

Starting the dialogue in group 1, NA restated the problem she was going to prove. She continued by assuming that the sum of three consecutive positive numbers in the problem had the same difference. MY responded with an agreement sentence and asked about the continuation of NA's argument. After NA said her explanation, YS immediately gave a rebuttal to the statement "the difference is 3,3,3", that "isn't the difference from $1+2+3$ 1,1,1?". Without engaging in a lengthy dialogue, NA realised that her statement was wrong and restated her statement that "Wait a minute, let me google it. It's there, but I'm not sure. Look in your notebooks." NA directly instructed the other group 1 members to look back at the notes in their books.

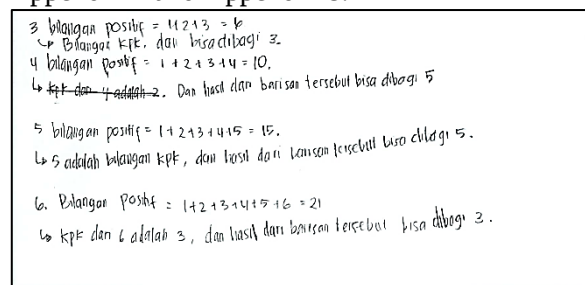
After NA's instruction, MA gave her statement. DH immediately gave a rebuttal to MA's statement "If this can be included in numeracy, can't it? (while looking at the problem again)" that "I think not. Because we have a step to find definitions and theorems related to addition".

Following DH's rebuttal, the group had a moment of silence. NA then asked a question to the group, "In arithmetic, it's called a tribe, right?" to which MA immediately replied "yes". NA then gave a statement of a theorem that "the sum of three positive integers is a multiple of three". YS responded to the statement and said "can it be proven?" and NA answered "not yet anyway" with doubt and looked like she was not sure about the theorem statement she conveyed.

Because NA was not sure about the proof using the theorem, MF gave a statement "Didn't you try using S_n 's formula to prove it?" which turned out that YS had proven it and said "I tried this. I can do it". The group fell silent, indicating that they were still unsure of the new proof solution presented by MF and supported by YS.

Then MA gave another solution "What is the correct reason, was it related to kpk?" which then got a response from NA "What is KPK?". In the question that NA asked, indicating that he forgot about KPK material. DH gave the answer that KPK is "the smallest common multiple". In the video recording, NA was seen nodding her head when she heard DH's answer. NA then told the group the form of solution she had tried "If for example 4 integers are added together, it can be a multiple of 2. Because $1+2+3+4=10$. Then if 3 positive integers are added together $1+2+3=6$. 6 divided by 2 equals 3. 3 is the LCM because it

can't be divided anymore" which then YS added "And try if $1+2+3+4+5+6=21$. 21 can also be divided by 3". From the attempted solution that NA presented and received additional support from YS, NA again gave a statement that referred to the conclusion that "Oh this, I understand. So like this, 3 is a KPK number because it cannot be divided by anything other than itself. So $1+2+3=6$, and if the sum is 4, $1+2+3+4=10$ then the LCM number is 2. The sum can be divided by 2. Now while if the sum is 5, $1+2+3+4+5=15$ the LCM number is 5. Because the sum can be divided by 5. Is that right?". The full proof answers and transcripts of the group dialogues are presented in Appendix 7 and Appendix 8.



3 bilangan positif = $1+2+3 = 6$
 ↳ Bilangan kpk, dan bisa dibagi 3.
 4 bilangan positif = $1+2+3+4 = 10$
 ↳ kpk dan 4 adalah 2. Dan hasil dari barisan tersebut bisa dibagi 5.
 5 bilangan positif = $1+2+3+4+5 = 15$
 ↳ 5 adalah bilangan kpk, dan hasil dari barisan tersebut bisa dibagi 5.
 6. Bilangan positif = $1+2+3+4+5+6 = 21$
 ↳ kpk dan 6 adalah 3, dan hasil dari barisan tersebut bisa dibagi 3.

Figure 1 Proof results after group dialogue

From the conclusions presented earlier, NA took the final conclusion that "So, $1+2+3=6$ is always a multiple of 3" which was agreed by several other members of group 1 subjects.

2) Exploratory Dialogue Process in Group 2

Group 2 subjects started their dialogue with AA reciting the first proof to be carried out by his group. Followed by CR who gave his statement "This means that U_1 is 6, U_2 is 15, U_3 is 24. Right?" and received approval from SS.

Then CR reread the second proof that would be done by his group. However, there was no immediate response from the other group 2 subject members. The group subjects were still thinking and trying the existing references for the second proof.

After a few minutes of group thinking, IW said her argument "This means that the result of 6 can be 2×3 then the 15 is 5×3 , then the 24 is 8×3 . That means they are multiples of 3 from the middle step, right? What does that mean?" which received additional evidence from IR that "At first glance, $1+2+3=6$ where 6 can be from 2×3 . $4+5+6=15$, 5×3 . In my opinion, yes. It's the same with the middle number, just multiply by 3". CR immediately agreed and gave a statement "But shouldn't we find the difference first?" and the group did not immediately respond to CR's statement. LZ said "Better we just write the

answer directly", not without reason giving the statement, but LZ also considered time and was afraid of forgetting the solution sought by her friends.

CR hesitantly said "Does this mean we use U_n ? Try to find references on google. This is for example $a=1$ and then the difference is 1. From $2 - 1 = 1$ " indirectly CR responded to the previous statement from LZ to find the difference first. IR then showed the theory she found on one of the websites to the other members of group 2 subjects and also said that "This means it's always right?" and immediately got CR's approval. The complete theories and answers of group 2 subjects as well as the dialogue transcripts can be seen in the appendix.

From the theory presented by IR previously, IW tried hit with number that "If you try number more $10+11+12=33$. 33 can right shared with 3?" and got agreement direct from AA and CR said "Meaning We stay continue Just the sum yeah. Wis, come on We write". Final conclusion from solution IW's evidence says "Yes. Then, write Again based on what is processed from steps A and B add 3 numbers number become One results addition $1+2+3=6$. One to two _ the difference is 1, 2 to 3 the difference is 1. The pattern The same at each the number" and straight away written by CR on the sheet answer. Answer complete proof and transcript of group dialogue presented in Appendix 11 and Appendix 12.

3) Exploratory Dialogue Process in Group 3

CH started the dialogue with direct give conclusion answer that "this the main thing is the result Can divided by 3 right" which is direct get agreement from member subject the other group 3. MM straight away try addition of 3 numbers round positive other than the one in question For strengthen statement by CH. CH is back give conclusion that "means from question this is the answer always yes" and got approval by MM.

CH continues return the dialogue with read question second proof. _ MM straight away respond and direct member subject group 3 others for open return each of your notes. NN found theory on one of the websites "If the difference between ethnic group to 1 with ethnic group 2nd and so on the same" then "If from question, term 1 _ what do you use?" and MM explained his opinion that "Use that $1+2+3$ first. Means The 1st term is 1, the 2nd term is 2. Then it's different his his That $U_2 - U_1, 2-1=1$ then $3-2=1$. Yes, this is

the same difference." AM came to the conclusion that "this means that this can be said to be an arithmetic series" which was clarified Again with CH's findings on one of the websites stated "Theorem base row arithmetic is amount all over the terms in the row arithmetic". For write it down in a way complete on sheet CH's answer added "Oh yeah Don't forget for example, others are also written as proof. $13 + 14 + 15 = 42$, the result 42 is the result of adding these 3 numbers which can also be divided by 3 and the difference between each term is 1". Complete completion forms and dialogue transcripts from group 3 subjects can be seen in Appendix 15 and Appendix 16.

4) Exploratory Dialogue Process in Group 4

RR initiate group dialogue with say that "the sum of 3 number positive the including in 3" twinkle however No know the reason that will be delivered Why he take conclusion that. Then DI said his opinion that "you can show results multiple of 3 because 6, 15, and 24" which received approval from AN. AN saying "what is 6 from 3^2 which means $3 \times 3 = 9$ ". However, this statement received a rebuttal from the AD that "6 from 3×2 ". Then MI say Again that " $\sqrt{9}$ it's 3".

IN refute statement submitted by MI that "in question No someone pointed out yield 9". Then MI changed his argument from the answer "always" to "no. always". AD say that He find understanding on Google so He say that question the is multiples of 3. MI interprets from what AD found that " $3 + 3 = 6 + 3 = 9$ " who then said that " $\sqrt{9} = 3$ ". AD agreed to this, but AD also added example 3, 6, 9, 12, 15, 18, 21, ... itu $U_1 = 3, b = 6 - 3$ where to enter a and b use the formula $U_n = a + (n - 1)b$ and add RR, just say n how much it is. AD say Again that from the question you are looking for that is amount from three number positive is always / never always multiple three and he assume that No Certain always multiple three Because multiples that is 3, 6, 9, 12, MI denies it statement the with say that's what you're looking for from question is $1 + 2 + 3, 4 + 5 + 6$, dan $7 + 8 + 9$ that's just what the results look like. AD denied it Again the results of the arguments presented by MI, that he Already tried and true that the result That multiples of 3. For convincing MI, AD told him to For use the formula presented by the AD earlier, and replace it n by entering any number. EL makes suggestions for enter number $n = 97$ The result of the arithmetic operation is 291 which is then

divided by 3 to get the result 97. RR said that Correct Can Divided by 3 means the result show multiple of 3. Shape test proof carried out by MI can seen in Figure 4.2 below ,

Handwritten mathematical proof by MI:

$$\begin{aligned}
 & \text{3, 6, 9, 12, 15, 18, 21, 24, ...} \\
 & u_1 = 3 = a \\
 & b = 6 - 3 = 3 \\
 & u_n = a + (n-1)b \\
 & u_{97} = 3 + (97-1)3 \\
 & = 3 + 96 \cdot 3 \\
 & = 3 + 288 \\
 & = 291 : 3 = 97
 \end{aligned}$$

Figure 1 Proof Trial by MI

Then , *MI* tried convincing return to member group 4 others regarding new results _ just He get . *MI* explained that at first he use $n = 97$, then in the formula there is $(n - 1)$ something that means $97-1=96$ and multiplied by the difference. The difference is that he got it from $U_2 - U_1 = 6 - 3 = 3$. Then he operated $U_{97} = 3 + 96 \cdot 3 = 291 \div 3 = 97$.

From *MI*'s explanation , group No direct take results conclusion from *MI*'s argument . *EL* tries give the argument that Can use formula row arithmetic that is $S_1, S_2, \dots S_n = \frac{n}{2} (2a + (n - 1)b)$. *AD* makes suggestions for *n* still using 97. *EL* entered known numbers _ into the formula so that get $S_{97} = \frac{97}{2} (2 \cdot 3 + (97 - 1)3) = 14259$, which then results $14259 \div 3 = 4753$ which shows that it is included in the multiple of 3. Form test what *EL* can do next seen in Figure 4.3 below ,

Handwritten mathematical proof by EL:

$$\begin{aligned}
 & \frac{97}{2} (2 \cdot 3 + (97-1)3) \\
 & 98,5 (6 + 96 \cdot 3) \\
 & 98,5 (6 + 288) \\
 & 98,5 (294) \\
 & = 14,259 : 3 \\
 & = 4,753
 \end{aligned}$$

Figure 2 Proof Experiment by EL

For prove Correct or wrong, *MI* uses $n = 3$ according to what the question asked $1 + 2 + 3 = 6$ so that for $a = 1, b = 1, n = 3$. Reasons *MI*

uses $n = 3$ is because the sum of the terms asked in the question is 3, then *MI* enters it everything that is known into the formula so that get $S_3 = \frac{3}{2} (2 \cdot 1 + (3 - 1)1) = 6$. From these results *MI* said that Correct $1 + 2 + 3 = 6$ can be categorized as an arithmetic series by proving it using the arithmetic series formula. The group agreed with the arguments explained by *MI*. Proof results complete and transcript of the subject dialogue group 4 can seen in Appendix 19 and Appendix 20.

Discussion

learning process that uses method discussion Certain will trigger there is dialogue between student as according to (Aswad, 2019) that method discussion own role in the learning and training process student For dialogue emit opinion them . Intermediate dialogue students who showed up at the time learning discussion something is loading learning and there is also dialogue that is not load material learning . Loading dialog material learning categorized as into 3, one of which is exploratory dialogue .

Exploratory dialogue that occurs with students form opinion given For interest together , critical and constructive , and existence decision together . Third circumstances in exploratory dialogue the according to (Mercer & Littleton, 2007) is characteristics of exploratory dialogue that is, dialogue partners participate in a way active , and opinions put forward and considered before decision made together . Exploratory dialogue type is expected type of dialogue Lots came up in the discussion students , because this type of dialogue show that student role active in activity that .

Phillipson & Wegerif (2019) say distribution groups and giving assignments to groups as means room mediation For open room dialogic with possible member group For discuss and collaborate while look for solution solution For Work The same group them . Interestingly , the findings in the research This highlighting characteristics of the dialogue involved in giving opinion For interest together , critical and constructive and existence consideration For take decision together .

Snippets of dialogue on the subject group show exists beginning from dialogue participants . Open to each other For convey each other's opinions and get started dialogue space . In this dialogue , someone is on duty try open dialogue space for start solution . Search information is also

carried out members of each subject group . Activities This reflect contribution to the opening room dialogical more wide . Search information the get response by members group If seen from recorded videos , Search information signify exists collaboration in space their dialogue _ create , in order to discover step what 's right For finish .

Various sources give information to improving group _ degrees difference between perspective and with thereby expand room dialogic . This thing make group explore difference that . Opinions offered For get it results final decision _ in a way together .

In overcoming originating conflict _ from difference between One each other and integrate opposing ideas in channel story use talks constructive . Exploratory dialogue they , bring out denial critical , and showing release tension between perspective they are different . Intensity tension consequence debate is also possible handled by the group . Although in the process of exploratory dialogue group had time experience debate For combining ideas from each member . However , things like that That precisely help group in process argument individual . More analysis _ in about interaction collaborating groups _ in solution question disclose aspect more reflection _ critical around development knowledge collaborative .

4. Conclusions

Study regarding activities discussion groups of students class XI SMA Negeri 2 Pasuruan City with see recorded video results discussions and transcripts of recorded videos show that the process of exploratory dialogue has done in a way aware nor no . Demonstrated exploratory dialogue past activity discussion group all subject group fulfil all criteria in exploratory dialogue Where student role active , opinions offered , critical and constructive decisions taken together . This thing prove that Work the same one that was built in activity discussion group help student in develop dialogue skills students and create student more think critical in finish proof . Apart from that , dialogue is built in group help less students active So capable contribute .

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