

The Development of Socratic-Based Hand Out for Teaching Mathematical Statistics Course

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Abstract. *One of the skills needed in the 21st century globalization era is critical thinking skills. These skills can develop through learning experiences. Therefore, we need learning resources that can stimulate the development of students' critical thinking skills. The aims of the research were to develop a Socrates-based Hand Out for Teaching mathematical statistics course. In terms of its validity, practicality and effectiveness. The research design uses 4D model development research with the Define, Design, Develop, and Dissemination stages. The research was carried out in semester IV at one university in Pontianak, Indonesia. The research instruments were validation sheets, questionnaires, learning achievement tests of critical thinking and interview guidelines. The results of the study are: (1) Socrates-based mathematical statistics Hand Out has high category validity; 2) student responses are classified as positive and meet the practical criteria; (3) student learning outcomes after using Hand Outs based on Socrates are classified as high and meet the effectiveness criteria. The conclusion of the study is that the Hand Out developed was feasible, practical and effective for use in learning mathematics statistics to develop students' critical thinking skills.*

Keywords: *critical thinking development, mathematical statistics hand out, socratic method*

Introduction

Welcoming an era full of challenges in various aspects of life, it takes a young generation who is critical, creative, innovative, resilient and highly motivated. The US-based Apollo Education Group identifies ten skills needed by young people to work in the 21st century, one of which is critical thinking skills (Afriyani, Sa'dijah, Subanji, & Muksar, 2018; Averill, 2013). Assessment and Teaching of 21st Century Skills (ATC21S) categorizes 21st century skills into 4 categories, namely way of thinking, way of working, tools for working and skills for living in the world. Way of thinking includes creativity, innovation, critical thinking, problem solving, and decision making. Likewise the US-based Partnership for 21st Century Skills (P21), recognizes the competencies needed in the 21st century, namely "The 4Cs" communication, collaboration, critical thinking, and creativity (Bringula, Reguyal, Tan, & Ulfa, 2021; Tan, Zou, & Wijaya, 2021). From these sources, it is clear that the ability to think critically is needed in facing the era of globalization which is characterized by various kinds of intense competition. Therefore, critical thinking skills are one of the competencies that must be fostered both in education at the elementary, secondary and tertiary levels in order to prepare young people who excel and are able to compete in the future.

Critical thinking skills are skills to carry out various analyses, assessments, evaluations, reconstructions, decision making that lead to rational and logical actions (Monteleone, Miller, & Warren, 2023; Yohannes, Juandi, & Tamur, 2021). The learning experience given to students should be directed to think innovatively, involve new ways of thinking, convey new ideas and solutions to a problem and get used to asking unusual questions, and be trained in asking hypotheses. All skills as described above, including critical thinking skills, are not acquired from birth but are obtained through a process of practice and learning experience.

The learning process, especially in the Mathematical Statistics course which is carried out in semester IV at the Mathematics Education Study Program, FKIP, Tangjungpura University has so far been conventional. The method used is more dominant lecture and assignment methods. Lectures tend to be centered on the lecturer. The learning resources used by students are printed books and course articles related to mathematical statistics which are downloaded from the internet. The Hand Outs used are still conventional, containing only course descriptions, examples of problems and practice questions more directed at honing the ability to remember, understand and apply. The weakness of the Hand Out is that it provides more problem solving information and does not refer to efforts to develop critical thinking skills, because it is very minimal with questions that evoke the emergence of thinking processes of interpreting, analyzing, evaluating and making decisions. According to Incikabi, Tuna, and Biber (2013) and Yorgancı (2016), conventional Hand Outs are no longer relevant to the demands of life in the 21st century.

Such a lecture process is thought to have an impact on the low critical thinking skills of students. This situation is indicated by the average test results of Higher Order Thinking Skill (HOTS) questions on mathematical statistics course for student at semester IV which students achieved was relatively low. The ability to solve HOTS problems or questions is an illustration of students' critical thinking skills. This is in line with opinion (Lai, Auhl, & Hastings, 2015; Sukmarini, M. A., & Hermanto, 2021), that critical thinking skills include Higher Level Thinking competence (HOTS) abilities and are very important skills to be prepared by teachers in education in the 20th century 21 (Aizikovitsh-Udi & Star, 2011; Afniandari, Supardi, & Asikin, 2021).

Seeing this fact, it is necessary to carry out special learning innovations in mathematics statistics lectures that emphasize the formation of students' critical thinking skills. The Hand Outs used should refer to learning activities that can build the ability to interpret, analyze, evaluate, create or initiate processes and make decisions. Therefore, Hand Outs that can facilitate students in realizing optimal achievement of critical thinking skills are Hand Outs based on Socrates. Expression (Efendi, Cheng, Sa'diyah, Wulandari, Qosyim, & Suprpto, 2020; Kurniasari & Setyaningsih, 2020), the socratic method contains questions to stimulate students' critical thinking skills. Hand Outs are subject matter that is arranged systematically, which displays a complete

picture of the competencies that will be mastered by students and used in the learning process (Snaprud & Helmikstøl, 2015; Ozturk, 2021). So, Hand Outs are teaching courses that are arranged systematically which enable students to study independently and are designed according to the applicable curriculum to achieve the desired competencies.

A critical thinker who contributes to the development of critical thinking skills is Socrates (Sahamid, 2016). The Socrates Hand Out contains sequential stages of questions that can stimulate students to provide explanations for each step of the question in order to build their own knowledge. According (Hogg, McKean, & Craig, 2013; Walpole, 2005), Socrates' Hand Out is a Hand Out that contains questions that stimulate students to think by asking for explanations through small steps. The character of Socrates' questions is digging to get the validity of students' answers with the types of clarifying questions, questions about assumptions, questions about reasons, questions about perspectives and questions about conclusions. Furthermore, Nurkhayati, Yunarti, and Sutiarto (2018) in stated, Socrates' questions consisted of six types, namely types of questions about questions, questions about clarifications, questions about assumptions, questions about reasons, questions about perspectives, and questions about implications and conclusions. The Socratic method contains a variety of simple to complex questions, which are used to test the validity of students' beliefs about the truth of a problem (Ismah & Muthmainnah, 2021).

Some research results claim that there is a close relationship between critical thinking skills and Socrates' questions. Study (Snaprud & Helmikstøl, 2015), concluded that Socrates' questions in the learning process can foster markers of students' critical thinking abilities emerging. In line with the results of the study (Lintangsari, Emaliana, & Kusumawardani, 2022; Roth, 2016), found that more dominant indicators of critical thinking skills appeared in scientific Socrates learning. Other research related to the application of the Socratic method in learning Mathematics and its relation to the development of students' critical thinking skills is research conducted by (Prilanita & Susilowati, 2022; Krismadinata, Verawardina, Jlinus, Lubis, & Ramadhani, 2021), which the results of his research concluded that learning with the Socratic method can improve students' critical thinking skills in learning mathematics. Likewise with research conducted by (Prilanita & Susilowati, 2022), that, the Socratic learning method studied from the cognitive style in learning basic statistics is effective in improving student learning outcomes.

From some of the previous studies, research on the development of Socrates-based Hand Outs on mathematics course and especially mathematical statistics taught in universities has not been found. Therefore, this study aims to develop a Socrates-based Hand Out as a learning resource so that students' critical thinking skills can be increased.

Method

The research design uses a 4-D model development research, which includes four stages, namely the define, design, develop, and dissemination stages (Thiagarajan, 1974). The 4D model was chosen because this model is clear, detailed and simple in every step, systematic and suitable for the development of learning tools including Hand Outs. The development of Hand Outs in this study only reached the development stage with limited trials. While the dissemination stage will be carried out in the next stage of research with extensive trials.

The quality of hand out products refers to Plomp and Nieveen (2013), which include validity, practicality and effectiveness. (1) The validity of the Hand Out is based on the review and assessment of experts. A product is said to have good quality if it is developed according to its course and all components are connected to each other in a consistent manner. A learning device is said to be valid if it is declared fit for use with revision or without revision by the validator. Feasibility is assessed from four aspects, namely content feasibility, linguistic feasibility, presentation feasibility and graphic feasibility. In this study, the eligibility assessed included content feasibility and presentation feasibility. Socrates' Hand Out is declared valid if the validity of the suitability of the panelists/experts is at least in the valid category. The formula used to determine the suitability validity of the panelists/experts is the Aiken formulation $V = \frac{\sum ni|i-r|}{N(t-1)}$; (2) The practicality of Hand Outs is measured based on students' views of the Hand

Outs being developed. The practical aspect of a product refers to two things, namely practitioners or experts state that the product being developed is useful for users and easy to implement in the field. Hand Outs are said to be practical if students respond positively to the usefulness and convenience of Hand Outs. (3) Effectiveness is measured based on student learning outcomes. Learning tools are said to be effective if students can understand the tools being developed and significantly influence the results of the formative evaluation to be achieved. In this study, learning outcomes are scores of critical thinking skills obtained based on the results of independent assignments and midterm examterm exam results on mathematical statistics course. Hand Outs are declared effective if the average score achieved by students is at least in the high category.

The research was carried out in the at one university in Pontianak, Indonesia. The research subjects were fourth semester students who the mathematical statistiss course which consisted of 17 students. The instruments used were (a) Hand Out validation sheets consisting of validator review sheets and validator assessment sheets, (b) response questionnaires for students, namely closed questionnaires with a Likert scale (strongly agree = 5), (agree = 4), (doubt -doubt = 3), (disagree = 2), (strongly disagree = 1) and a narrative open questionnaire, (c) a learning achievement test consisting of independent worksheets and critical thinking skills questions, (d)

an interview guide for obtain a direct picture in a narrative manner with the aim of completing data related to student responses to the weaknesses and strengths of Socrates' Hand Out. Data analysis was carried out on the characteristics of students by analyzing their critical thinking skills in terms of understanding and elements of opportunity descriptively.

Results and Discussion

The development stage of Socrates-based mathematical statistics teaching courses was developed using a 4-D model with 4 stages carried out sequentially, namely:

Define

When talking about the 4-D model, the first step that must be taken is the stage of defining development needs which is adjusted to the need's analysis. In developing a product, it is necessary to refer to the development needs themselves, then analyze and collect information related to the extent to which we need to undergo development. At the stage of defining or analyzing needs can be done through various analyzes of research or previous literature. There are five activities that can be carried out at the defining stage, namely:

Front-end analysis

Preliminary analysis was carried out to find out the fundamental problems in the development of Socrates-based mathematical statistics Hand Outs. The researcher assessed the existing semester lesson plans that have been used so far in teaching mathematics and statistics. Furthermore, observations were made in statistics lectures in all parallel classes. The observation results obtained information that the lecture began with the lecturer's explanation regarding the course discussed with the help of PowerPoint media, presenting examples of problems and their discussion. The lecture was closed by doing some practice questions. Based on the results of interviews with several students, information was obtained that the Hand Outs used were Hand Outs that had been made by previous lecturers for a long time. There are some courses that are no longer relevant to the course being studied. In general, students use reference courses downloaded from the Google application. The next step in this stage is to look for literature and references that will be used in the development of Hand Outs in the form of journals that are relevant to the problem and the theory of the Socratic method in learning and supporting courses related to mathematical statistics.

Learner Analysis

Preliminary research conducted an analysis of the characteristics of students by analyzing students' critical thinking skills for the course understanding of mathematical statistical opportunities. The following data are the results of Preliminary test for mathematical statistics course in the mathematics statistics course, namely elements of opportunity.

Table 1. Critical thinking ability

Critical Thinking Ability Indicator	Correct answer	
	Question 1	Question 2
Interpretation	28,4%	30,3%
Analysis	27,6%	29,7%
Evaluation	20,5%	23,8%
Decision-making	21,6%	19,7%
Average	23,05%	20,87%

Based on the data analysis in table 1, the average student who answered correctly from the two questions was 21.96%. The average ability to interpret is 22.85. The average ability to analyze 25.15%. The average ability to evaluate 19.15%. The average decision-making ability is 20.65%. This phenomenon shows that the critical thinking ability of mathematics students is included in the very low category, especially in the mathematical statistics course.

The following is the interpretation of students' critical thinking skills in question 1. A point is chosen at random from within square ABCD, with a point A (-1,-1), B(-1,1), C(1,1) and D(1,-1). Suppose P is the event that the sum of the abscissa & ordinate of the point is not more than 1/2.

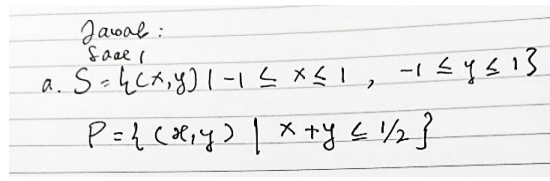
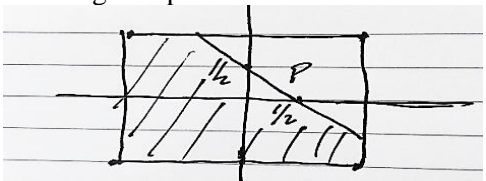
<p>a. How would you express the sample space (S) and events P? Answer: in set form</p> 	<p>b. Can S and P be expressed in another form. Answer: Image shape.</p> 
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Figure 1. Initial interpretation table

Examples of answers to numbers a and b illustrate the ability to interpret, amounting to 28% answered correctly.

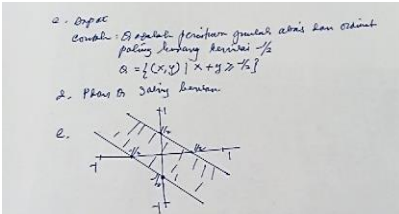
<p>c. Can you give an example of another incident related to the experiment? Example: Q is the event the number of abscissa and ordinate of the point is at least -1/2</p>	<p>d. Jelaskan hubungan yang mungkin terjadi antara kedua peristiwa tersebut? Example: The two events P and Q overlap</p>	<p>e. Show me the truth</p> 
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Figure 2. Advanced interpretation table

Example answer number c describes the ability to analyze, 27.6% answered correctly. Example of answer number d illustrates the ability to evaluate, amounting to 20.5% answered correctly. Example answer number e illustrates the ability to make decisions, amounting to 21.6% answered correctly. Based on the appearance of the data in the figural, it shows that the critical

thinking skills of mathematics students are included in the very low category, especially in mathematical statistics courses.

Task Analysis

This task analysis is related to identifying the tasks to be carried out by students, namely analyzing discussion courses, problem solving exercises and making conclusions of course according to the learning outcomes formulated in the Hand Outs to be developed. This activity was carried out by discussing with the research team.

Concept Analysis

In this activity the research team discussed concept analysis, namely the activity of determining the content of the course contained in the developed Hand Outs referring to the applicable curriculum. The course discussed in the developed Hand Out is the notion of probability, arithmetic techniques (permutation and combination concepts), conditional probability, probability interpretation, distribution of random variables, probability density functions, distribution functions, mathematical expectations, types of mathematical expectations and Chebyshev inequality.

Specyfing Instructional Objectives

Discussion and brainstorming between research teams in this activity to determine indicators of learning outcomes based on course analysis and curriculum analysis. In analyzing learning objectives, it is necessary to determine various indicators of learning achievement based on course and curriculum analysis. By writing down learning objectives, researchers can find out what studies can be carried out when compiling Hand Outs, when determining assessment instruments, and ultimately determining the criteria for achieving goals. Analysis of learning objectives is an activity to formulate learning outcomes in each course as a basis for developing Hand Outs.

Design

After getting information about the problem at the definition stage, the next stage is the design stage. This design stage aims to design Socrates-based Mathematics Statistics teaching courses. The design phase includes:

Preparation of Teaching Courses

Develop an outline of the content or course that will be described in the Hand Out and adapted to the semester learning plan (RPS). Next, identify the formulation of Socrates' questions that meet the indicators of critical thinking skills, namely interpretation, analysis, evaluation and decision making. Socrates' questions are formulated in the components of discussion course and practice questions on each course discussed.

Experiment: Bounce two currencies 1 time

a. What do you imagine with the experimental results?

 Take note of what might have happened?

b. How do you declare a Sample Room?

 Can you give more than one example of an event related to the random experiment?
 If so, write down the results?

 If not, what's the reason?

Figure 3. Socratic question example

Writing Teaching Courses

Hand Out development is carried out according to learning needs. Considering that students' critical thinking skills are still very low, the developed Hand Outs refer to improving students' critical thinking skills. In this case the appropriate Hand Out was selected, namely the Socrates-based Mathematical Statistics Hand Out. The Hand Out components consist of definitions, characteristics, axioms, discussion courses, practice questions and conclusions.

Definition, and Theorem

Definition:
 Let S be the sample space of a random experiment. A is the set of all occurrences of S. Probability is a function P of A into [0 , 1] which satisfies the property:
 (i) $P(A) \geq 0$, for every A in A
 (ii) $P(S) = 1$
 (iii) if A_1, A_2, \dots Is a mutually exclusive event where $A_i \cap A_j = \emptyset$ for $i \neq j$, then $P(A_1 \cup A_2 \cup A_3 \cup \dots \cup A_k) = P(A_1) + P(A_2) + \dots + P(A_k)$.

Theorem:
 Theorem 1. For every event A, $P(A) = 1 - P(A^c)$
 Theorem 2. $P(\emptyset) = 0$
 Theorem 3. If the events A and B are such that $A \subset B$, then $P(A) \leq P(B)$
 Theorem 4. For every event A, $P(A) \leq 1$ applies
 Theorem 5. If A and B are arbitrary events then:
 $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

Properties, Axioms, Discussion Courses, Practice Questions and Conclusions

Discussion course:
 1. Show how to prove theorem 1 to 5?

2. Formulate at least 2 examples of a problem related to everyday life.
 a. Finish by applying the definition and axioms of probability
 Completion

b. Are you sure about the answer?
 Give a reason

Based on the previous discussion. Make a summary of the course in the following column.
 Exercise:
 1. A currency is bounced many times until the face appears
 If A: Event required at most 5 repetitions, and
 B: The event requires a minimum of 4 rebounds and a maximum of 7 repetitions.
 a. What do you think about this random experiment?
 b. Record all the possible outcomes of a random experiment?

c. Are you sure about the answer?

d. If unsure, give reasons

e. What do you imagine with event A and event B?
 Explain

f. What value opportunities can you find? How to determine the opportunity values?
 Are you sure about the answer?
 If unsure, give reasons.....

g. What is the possible relationship between event A and event B? finding the value of the opportunity

Figure 4. Example definition, theorem, properties, axioms, discussion courses, practice questions and conclusions

Format Selection

Furthermore, the writing of teaching courses uses a Socrates-based format and is in accordance with the learning outcomes of mathematical statistics course so that the initial design is drafted which is the 1st draft teaching course.

Initial Design

The initial design is the initial design or draft of Socrates-based Mathematical Statistics Teaching Courses. Then revise the product based on various validator suggestions and product trial results.

Develop

The development stage activity is validating Hand Outs by experts followed by revising. Then the validation fit test between validators, practicality analysis and effectiveness analysis was carried out. The steps in this development stage are as follows.

Hand Out Validation

Expert Validation

The mathematics statistics Hand Out developed has been validated by 5 experts, namely 3 experts in the field of mathematics and 2 experts in the field of evaluation. Five experts provided Hand Out reviews through comments, suggestions or feedback

A point is chosen at random from inside the square ABCD, with points A (-1,-1), B(-1,1), C(1,1) and D(1,-1). Let P be the event that the sum of the abscissa & ordinate of the point is not more than $\frac{1}{2}$.

a. How do you express S and P?

b. Apart from these forms, is there another form to express S and P

 If not, what's the reason?

c. Are you sure the answer is correct?

d. Can you give an example of an event related to the experiment?

 Are you sure about the example of the event you are describing?
 Write down the results!

Figure 5. Example of expert validation repair results

In addition to studying qualitative teaching courses, a quantitative assessment was also carried out by an expert validator by giving scores on several aspects of the assessment. The summary of the results of the assessment is as follows.

Table 2. Summary of expert assessment analysis results

Rated aspect	Assessment Indicator	Number of items	Average Aiken Coefficient	Information
Content eligibility	The suitability of the course with learning outcomes	3	0,83	High
	Course accuracy	3	0,82	Very High
	Encourage critical thinking skills	2	0,84	Very High
Average			0,83	
Presentation eligibility	Serving technique	6	0,83	High
	Presentation support	2	0,79	High
	Socratic aspect	4	0,84	Very High
Average			0,82	
Average 1 + 2			0,825	High

Based on the results of the panelist/expert suitability validity data analysis as listed in the table above, information is obtained that all indicators of the feasibility of content and presentation feasibility aspects show a high and very high level of validity. This illustrates that the consistency of the assessment results between experts/panelists on Hand Outs is in the high category. Thus, it can be concluded that the Hand Out based on Socrates is declared valid.

Product Trial

The product trial was carried out after making revisions based on the comments and suggestions of expert validators so as to produce draft II teaching courses. The trial was carried out in class A1 which consisted of 17 students at the time of learning mathematics statistics. Learning begins with the lecturer's explanation regarding the prerequisite course. The lecturer conveys the reference for the learning activities that will take place. Furthermore, students are asked to learn independently to understand the description of the course in the teaching courses. Solve discussion problems. Conducting questions and answers for students who have difficulties or misconceptions. At the end of each course, students are required to make a summary of the course followed by completing practice questions. The results obtained at this stage are the revised Socrates-based Mathematics Statistics teaching course.

Additional completeness is also in the discussion course section, namely asking students to make daily life problems in which the solutions apply concepts and probability theorems

1. Show how to prove theorem 1 to theorem 5?
.....
 2. Formulate at least 2 examples of a problem related to everyday life.
 - a. Solve by applying the definitions and axioms of probability
Resolution.....
 - b. Are you sure about the answer?
Give the reason.....
Write down the results!.....

Figure 6. Testing of teaching courses and discussion courses

Disseminate

After revising the Hand Out based on the results of the limited trial, the next stage is the dissemination stage. This stage aims to disseminate Socrates-based Mathematical Statistics Hand Out products. In this study, only limited socialization was carried out, namely by disseminating and promoting the final product of Hand Outs to class A1 students and lecturers who teach mathematics statistics courses in the Mathematics Education Study Program, FKIP Untan. The dissemination stage was not carried out at this stage of the research due to time constraints, but will be carried out in further research in the form of a broad application of Hand Out products based on the Socratic method.

Student Response Results Data

The practicality of Hand Outs is measured based on student responses to the usefulness and ease of understanding Hand Outs. The response instrument consists of indicators (1) clarity of course description, (2) use of language, (3) discussion activities, (4) Questions develop critical thinking. Overall there are 20 statement items with 17 student subjects.

The recapitulation of the closed questionnaire response calculation results for each indicator is summarized in the following table.

Table 3. Recapitulation of independent task results

Indicator	Item Number	Score					Average
		SS	S	R	TS	STS	
Clarity Description of the material		5	4	3	2	1	
	Total	38,7%	42%	8%	6,7%	4,2%	28.235
		Average 1					4.03
Use of Indonesian	Total	32,3%	50%	11,8%	5,8%	2,9%	8.059
		Average 2					4.029
	Discussion activity	Total	35,3%	45,1%	5,9%	10,7%	3,9%
		Average 3					4.00
Questions- develop critical thinking		Total	38,8%	44,7%	7%	4,7%	4,7%
		Average 4					4.082
	Average 1 + 2 + 3 + 4	36,28%	45,45%	8,1%	6,9%	3,9%	4.036

Based on the table, the average score of the Clarity of Material Description indicator is 4,034 or if converted on a scale of 1-100, a value of 80.68 is obtained. The average indicator score for language use is 4,029 or if it is converted on a scale of 1 to 100, a value of 80.58 is obtained. The average discussion activity indicator is 4.00 or if it is converted in this scale it is obtained a value of 80. Meanwhile, the average indicator of questions- developing critical thinking is 4.082 or if it is converted in this scale it is obtained a value of 81.64. The data shown in the table also provides information on the percentage of the number of subjects who responded strongly agreed (SS), agreed (S), undecided (R), disagreed (TS) and strongly disagreed (STS) on each response indicator.

Student Learning Result Data

The effectiveness of teaching materials is measured based on student learning outcomes. The learning outcomes analyzed were the results of independent assignments and midterm exam results. The learning outcomes are in the form of scores of students' critical thinking skills. As an independent task, students make examples of problems in everyday life and their solutions which refer to indicators of critical thinking skills.

Table 4. Recapitulation of independent task results

Score	Frequency (fi)	Class Mark (Xi)	(fi)(Xi)	Category
51- 60	1	55,5	55,5	
61 - 70	1	65,5	65,5	
71 - 80	3	75,5	226,5	
81 – 90	7	85,5	598,5	
91 - 100	5	95,5	477,5	
Amount	17		1.423,5	
Average			83,74	High

While the results of the midterm exam also showed a score of critical thinking skills.

Table 5. Recapitulation of midterm exam results

Score	Frequency (fi)	Class Mark (Xi)	(fi)(Xi)	Category
51- 60	1	55,5	55,5	
61 – 70	2	65,5	196,5	
71 – 80	5	75,5	377,5	
81 – 90	6	85,5	513	
91 – 100	3	95,5	286,5	
Total	17		1.339,5	
Average			78,8	High

The information obtained from the table is that the average independent task result of 83.74 is classified as a very high category. While the data contained in the next table is the average midterm exam result of 78.8 belonging to the high category. The average learning outcomes of the two components is 78.43 which is classified as high. This situation indicates that the teaching materials developed meet effectiveness criteria.

The ability to think critically plays an important role in the survival of students to deal with various problems that occur in the future. Therefore, educators should facilitate learning processes that can develop critical thinking habits for students. Critical thinking skills can help students become thinkers who are reliable in solving the problems they face and are able to make conclusions about the information received and make decisions. One of the tools that needs to be developed is a Hand Out oriented to Socrates' questions. Because indicators of critical thinking include being able to interpret, analyze, evaluate, and make a decision in solving a problem with high self-confidence, curiosity, in the search for truth through Socrates' questions.

The good quality of Hand Outs has been shown based on the results of expert assessments which are indicated by the panelist/expert suitability validity coefficient which is classified as high. This is seen from the mean validity of the suitability of the panelists/experts on the feasibility

aspect indicator of Hand Out content of 0.83 and the average validity of the suitability of panelists/experts on the feasibility aspect indicator of Hand Out course presentation of 0.82. Overall, the mean validity of the suitability of panelists/experts is 0.825. This figure belongs to the high category. Information on the consistency of five expert validators' assessment of the eligibility of Hand Outs towards valid criteria is high, indicating that Socrates-based Hand Outs can contribute to learning experiences and the development of critical thinking skills for students. Regarding the quality of the product which is categorized as very good and only needs a little revision, namely at the level of achievement of 85-100%. (Dalim, Ishak, & Hamzah, 2022; Wortel & Verweij, 2008).

The results of the analysis of student responses as a basis for information on the quality of Hand Outs are related to practical aspects. The mean value of the Clarity of Course Description indicator is 80.68. The average indicator value for language use is 80.58. The mean value of the discussion activity indicator is 80. Meanwhile, the mean value of the question-developing critical thinking indicator is 81.64. The average value of the four response indicators is 80.73. Judging from the acquisition of the average student response value as a whole, it can be concluded that the Socrates Hand Out product meets the very practical criteria.

From the table it was also obtained information that students who chose strongly agreed (SS) and agreed (S) on the indicator of clarity of course description were 80.7%. Students who choose strongly agree (SS) and agree (S) on the language use indicator are 82.3%. Students who chose strongly agreed (SS) and agreed (S) on the discussion activity indicator were 80.4%. Meanwhile, students who chose strongly agree (SS) and agree (S) on the question indicator developed critical thinking by 83.5%. This information illustrates the consistency of the tendency for the responses given by students to each statement to strongly agree (SS) and agree (S). So it can be stated that most students tend to give positive responses to Hand Outs based on Socrates. The measure of value acquisition ($X \geq 80\%$) is classified as very high. So the percentage of numbers that give positive responses of more than 80% is categorized as very high. Based on this description, it can be concluded that the Socrates-based mathematics statistics Hand Out has high practicality criteria (Boa, Wattanatorn, & Tagong, 2018; Sahamid, 2016).

Based on the information obtained from the summary of the response questionnaire data, it showed that 81.73% of students gave a good response to the Hand Outs that were developed. In general, students' responses responded well to Socrates' Hand Out, including; (1) The presentation of the course is easy to understand, the questions asked are to guide the thinking process towards a higher level of thinking in building understanding, meaning, understanding, finding solutions to problems, drawing conclusions and making decisions. As expressed by

(Nirwanto, 2017; Rohayati, Rustandi, & Ijudin, 2022), Socratic questions are a form of questions that direct students to develop critical thinking skills

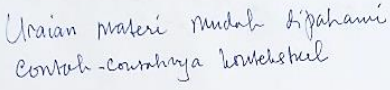
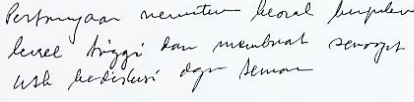
	
Describe the material easily understood and the examples contextually	Questions require students to think at a higher level and get them excited about discussing with their colleagues

Figure 7. Student written statement

Subsequent responses regarding Socrates' teaching courses are: (2) the questions presented are inductive in nature providing guidance from simple questions to more complex questions so as to make students curious and encouraged to think harder and be creative in finding solutions to problems (Makhene, 2019; Rahmawati & Suwarjo, 2021), who stated that Socrates' questions were not just "questions" but what resulted from these questions, which stimulated people to think and work.

This response gives a signal that Socrates-based mathematical statistics Hand Outs have high practicality in lectures. Remembering the statements conveyed refer to aspects of ease of understanding, clarity, activity, increasing self-confidence in increasing the ability to think at a higher level. (Kurniasari & Setyaningsih, 2020; Rusmana, Suryana, & Utama, 2019). Student learning outcomes are obtained from independent assignment scores and midterm exam scores for the mathematics statistics course. The average independent task obtained is 83.74. Meanwhile, the average Semester midterm exam result was 78.82. If the assignment score and midterm exam score are averaged, the average value is 81.27. Acquisition of the average student learning outcomes classified as high criteria. The achievement of learning outcomes illustrates the quality of the effectiveness of Hand Outs, with the hope that their use can improve higher-level thinking skills. Presentation of Hand Outs that are good, communicative and make it easy for students to understand the course optimally will also provide maximum learning outcomes. In line with the results of research, concluded that the application of the Socratic contextual learning method is effective in improving student learning outcomes. Thus, through Hand Outs that have good presentation quality, students are more helped to be able to solve factual life problems through the mathematical statistical concepts presented in Hand Outs based on Socrates. Teaching courses that are easy to understand will invite readers to learn more deeply, be happy and entertained.

Referring to the explanation above, it can be concluded that Socrates-based Hand Outs are Hand Outs equipped with course descriptions and inductive questions that can stimulate a person's thinking process to build their own understanding through resolved cognitive conflicts, so that it

can lead to the development of skills. critical thinking in the framework of problem solving which begins with the analysis of arguments to conclusions and decision making.

<p>Questions are asked from simple to complex so that their thinking processes become systematic</p>	<p>The questions are curious, making students think thoroughly about all possible answers</p>	<p>The questions are very challenging so that it fosters a spirit of curiosity to know the results and high discussion skills with colleagues</p>

Figure 8. Conclusion of student opinion

Conclusion

Referring to the analysis of the findings, it can be concluded that: 1) the quality of Socrates-based mathematics Hand Outs in terms of content validity is: a) the suitability validity of the panelist/expert assessment on the content feasibility aspect which consists of indicators of suitability of course with learning outcomes, indicators of course accuracy, and indicators of encouraging critical thinking skills are classified as very high. This explanation shows that the consistency of the expert's assessment of the indicators of the feasibility aspect of the content is very high; b) the suitability validity of the panelists/experts' assessment of the presentation feasibility aspect consisting of presentation technique indicators, presentation supporting indicators, and Socratic aspect indicators is classified as very high. This means that the consistency of the expert's assessment of the presentation feasibility aspect indicators is in the very high category; 2) the quality of Hand Outs in terms of practicality, namely the students' responses were very good towards the Hand Outs that were developed, resulting in the conclusion that Hand Outs based on Socrates have a high practicality function; (3) The quality of the Hand Out in terms of effectiveness is that the learning outcomes of students who have used the Socrates-based mathematics Hand Out are classified as high category, so it can be concluded that the Hand Out developed is effective in improving mathematical understanding abilities.

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