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## The Development of Mathematics Teaching and Learning Process: An Application of Action Research

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**Abstract.** The purpose is to implement action research in mathematics teaching and learning process. The questions addressed are: (1) Is the teaching and learning process compatible with the management standard? And (2) how does the teaching and learning process influence the ability to handle varies needs of students? The research procedure is the researcher observed by the lecturers of mathematics through survey about the knowledge and experience based on the standard. The implementation directed at improving student learning outcomes and the improvements to the didactical, methodical and pedagogical components. Through the research activity: (1) directly involved in providing action; (2) to learn and apply the knowledge and thoughts; (3) get social measures; (4) openly justified biases to students; (5) get a permanent effect on the groups; and (6) to contribute to the desired changes. The data is qualitative and quantitative and analyzed descriptively. The results are: (a) the compatible with teaching standard, i.e., more benefit, practical, valid and reliable and (b) the teaching and learning process accomodated to vary of the student needs.

Keywords: action research; compatible; didactical; pedagogical; methodical

Teaching and learning programs as the form of action research are often a means of professional development or educators career [1]. In this view, the critical one is investigating ideas, experiences, values, meanings, and learning practices that produce a different learning climate. The essence is solving problems or problems resolved, corrected and developed to a new solution.

Through teaching and learning program, the information obtains a problem and a new knowledge for improving the quality of the outcomes. That is the educators and the students recognize the problem or something to complete and assess the efforts or try again [2].

The teaching and learning forms of action research refer to problem-based activities that match student learning outcomes. The goal is to improve learning outcomes or to understand the learning process. Therefore, this research is a tool for researchers in mathematical content knowledge and pedagogical knowledge.

In implementing the programs, the students collaboratively carry out action research in the

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classroom. The programs provide information about: benefits, the practicality of learning programs, the reliability and validity of the implementation of learning, the efforts and ideas of continuing the learning program in the form of action research, and the development of teaching quality.

The programs are productive because the researcher describes the overall structure of the research in full. Through questions, find ways to touch the students, and help them appropriately. The researcher examines the entire program as a valuable and obtain results regarding the interests of learning.

The learning process emphasized the scholarship, where the researcher study the problem systematically and ensure that through learning the form of action research can be conveyed constructive theoretic. The researchers need to improve methodological to fit the needs of the diversity of situations. Also, in learning, researchers collect, analyze, and present data continuously, and cycle repetition is part of the learning work in the form of action research.

Jablonka[3] in a review of the relationship between mathematical and mathematical literacy, states that mathematics educators include the social dimension of learning. The point is from learning forms of action research recognize that teaching and learning experiences become useful. Through a project approach, educators and students reflect and understand deeply about teaching and learning students. And, conducting learning in the form of action research is an effort to create a classroom climate and curriculum design because it is a philosophy of the experience of educators.

#### LITERATURE REVIEW

The main themes of learning in the form of action research are benefits, practicality, validity, and continuity. Research conducted is based on class namely: (a) review situations, of quality improvement [4]; (b) the reflective inquiry to improve rationality and fairness of learning using a collaborative approach through critical actions by individuals in student groups [5]; and (c) the quality approach of teaching begins with the problems faced through the stages of reflection, planning, action, and observation [6].

In carrying out teaching and learning of action research, researchers analogize Elliot [7], namely the researcher carries out pedagogical purpose, containing idealism with student participation. The focus is on the quality of teaching and learning to suit pedagogical. A mismatch between desire and practice did in assumptions and theories applied. The involvement of researchers includes the process of generalizing and testing new forms of action to realize class expectations. Therefore, learning is possible through the reconstruction of practical pedagogical theories.

Grundy [8] explains that the quality of teaching and learning is an understanding and a

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responsibility of as a whole. These are related to the finding that the learning environment is the key to continuous learning. The creation of a learning environment improves the performance of educators individually when conduct teaching. One form of improvement effort includes action research.

Researchers need to emphasize that learning in the form of action research offers a set of principles by which work to improve the learning environment can grow. Researchers also view that the overall learning form of action research is the first step that contains possibilities and problems that require action, both at the class level or study program and faculty.

The researcher found problems related to learning in the form of known action research at the beginning of the learning process [9]. The problem found is confidence, satisfaction, and confidence, both for researchers and students. For example: (1) McCoy [10] reported from multiple regression analysis it was found that knowledge of certain mathematical contents of prospective teacher students significantly increased during lecture methods/contents; general mathematics content knowledge, self-confidence, and expectations of mathematics teaching outcomes also increased during college: and mathematical content knowledge is significantly correlated with selfconfidence but does not significantly predict the growth of self-confidence experienced during the semester of lecture, (2) Learning content knowledge is a reliable and valid measure of mathematics satisfaction for prospective teacher students; satisfaction instrument is an important stage as a measure of knowledge of prospective teachers; satisfaction instruments assess the design of pedagogy for prospective teachers and teachers to think mathematically [11]; [12], and [13] concluded that significant changes were in the beliefs of prospective teacher students who tended towards conceptual views or thinking.

The researcher found: (1) mathematics knowledge significantly increased; (2) the content, self-confidence, and the expectations increased; (3) the content correlated with self-confidence; (4) the satisfaction instrument measure the content knowledge; (5) the instruments assess the pedagogy design of thinking mathematically; and (7) the learning is in the conceptual thinking.

Referred to Bahr and Monroe, the changes of learning experienced by the students [14] during the action research. Lectures contents, method, and practicum are integrated components [15], namely, showing the changes in students' conceptualization of learning math. The explanation is an interaction as a change of belief [16]. The changes explain a level of the methods used by the students. That is, [17] states the increase of the students' strength and consistency.

Therefore, this research aim at students' beliefs and the problems before the causal relationship between learning-based mathematical methods in

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the form of action research and changes in student beliefs that view teaching mathematical concepts need strengthening. The overall substance is to emphasize further research on the effectiveness of action research-based learning methods that show changes in student-teacher confidence.

Like other studies, important looking at possible outcomes from a variety of different perspectives and think critically about the impact of involvement in learning forms of action research. By the learning in the busy schedule of education assignments, the educators can position themselves professionally and emphasize to do so. When educators are involved in solving problems in class, the gained is bigger and amazing.

Mills [18] notes that educators can provide important information by paying attention to the suitability of the topic and the effectiveness of selfdevelopment. Action research is an example of an evaluation process that can be carried out by educators or study programs. Kolb [19] states that action research allows educators to carry out professional development, find problem-solving models for students and their colleagues, improve records of professional development plans, and develop higher levels of experience in selecting areas of curriculum, learning, and management.

In research [20], it found that collaborative action research projects influence the professional development of prospective educators while working with their educators [21]. That experience helps prospective educators get valuable insights about themselves as, as students, about the curriculum, teaching activities, and the roles and responsibilities of an educator.

Experience through learning in the form of action research supports the notion that educators play a role in the topic selection or bring up part of the topic. The process used as conditions for learning reform and educators understands the learning for class reform and what should do. That is the best way of reforming at work [22].

Learning in the form of action research is on the discussion, i.e., at the class, study program, faculty, academic seminars, or in thesis examination. That is, educators and students discussed concepts, namely: (1) a piece of knowledge must be respected; (2) everyone has a contribution as a point of view of the class; (3) there is an opportunity to discuss knowledge; and (4) the learning encouraged discussion [23].

The review of the material is the gap between educators and the students' thinking. Dialogue and communication raised in the learning and must be a bridge of collaboration and for improvement of education. That is, the researcher reflects actions and works with students. The aim is to improve the quality of teaching, the relationships, and the aspect for continuous development.

The barriers and challenges of implementing learning in the form of action research are a stimulus towards standards, emphasis on assessment

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and accountability, magnitude and depth of teaching material, and time. The situation is a professional satisfaction that should exceed obstacles in the classroom. The researcher associates with something that can be recognized, active, conduct an inquiry, and supports students, as a condition so become independence. Researchers can also provide the conditions in learning to become part of their professional life.

Researchers develop work that does not neglect efforts to carry out learning. Educators seek a research climate, realizing that what done an ongoing, ongoing and related effort. The researcher included activities to show real professional findings in the classroom, fostering the power of learning as the core of learning.

The idea relates a "lesson study" which introduced in the literature of the Trends of International Mathematics and Science Study [24], where educators create, test, and improve learning. If action research is part of teaching, much of the learning activities obtained by educators, students, and the education community. If the action research is as monitoring and adjusting teaching activities, it maintained with a little effort [25].

For researchers, extra effort is to arrange learning scenarios with limited scope according to the time and learning resources. The learning resources used are only about mathematics. That obtained from literature and the reviews. The review is about the characteristics of mathematics.

#### METHOD

#### A. Road Map

Learning events start from class problems, namely from the delivery of material by the researcher and student responses from various jobs or assignments given to them. The researcher noted the achievements of student learning during learning, qualitatively and quantitatively. Then, the researcher learns the form of action research by putting the level of knowledge as stated in the learning achievement indicators and providing new test instruments based on the consistency of the offerings that appear in the class. The researcher observes the results, reflects and finds the cause of each situation that arises. Then do iterations, conduct discussions and explain the results obtained.

The implementation of the learning process forms the research directed at improving student learning outcomes. Learning outcomes are breadth and depth of material. Meanwhile, the researcher also made improvements to the didactical, methodical and pedagogical components. The researcher made a strategy from the researchers' bias in working together in class to find real problems and their completion. Through the action research activity: (1) directly involved in providing action; (2) to learn and want to apply the knowledge and thoughts; (3) get social measures that do not appear so far; (4) goals not maintained; (5) can be openly justified biases to students; (6) get a permanent

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effect on the groups involved that occur such as modification of behavior; and (7) find a way to contribute to the desired changes.

The context and focus of the study are increasing the validity and reliability of learning, through gathering various types of data and discussing them with students. The description of the research is transformational, to bring about the process and implementation of changes in teaching. The learning includes the ability to discuss, plan, and obtain learning models in the form of action research in the classroom.

The position of the researcher is to act independently and build self-confidence in learning. The researcher further investigates certain impressions or competencies. The researcher examines cases and learning components, the results based on direct observation, project approaches, and class interviews. Class interviews are exploratory and explanatory. The position of researchers is like external evaluators in assessing the implementation of learning programs. This position is an inquiry into the experience of educators and students as well as conformity with learning resources.

The hypothesis is the learning emerges as a problem-solving tool, to change teaching practices, to increase trust, and to practice effectively. Students involved in the learning review and to deliver from various perspectives. The reliability of perceptions calculated from the data.

#### B. Terminology

Learning forms of action research is an inquiry in the context of efforts centered on improving quality and learning performance. In particular, learning designed by the researcher is on the consistency of knowledge and associated with improving the quality, and based on class problems. The aim is to improve student learning outcomes and enhancing the researcher's understanding of the process.

Theresarcher and the students collaboratively conduct the learning, by collecting and analyzing data used as reports on learning activities, improving student learning, and intensifying reflection.

The level of knowledge is an effort to rank the breadth and depth of the material by paying attention to the characteristics of mathematics and the consistency of thinking of the researcher and students.

#### C. Design and Instrument

The design of the study includes a description of the researcher that carry out learning at TanjungpuraUniversity Pontianak, Undergraduate Mathematics Education Study Program. The researcher's description discussed with other educators to obtain the feasibility and suitability aspects of the implementation from the initial survey instrument. The instruments prepared and weighed by the researcher and by other educators through survey and the discussions to obtain data validity from their knowledge and experience.

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The validity of the instruments for the survey is the content and the face. The content related to the suitability with the experience and done by the educator in learning. Face validity is measuring aspects of the benefits and practicality of learning. The results of the validation form the basis for the preparation of learning designs in the learning.

Teaching and learning design in the form of action research carried out through the process of collecting data from problem-solving and discussion and using a project approach related to learning outcomes. Class interviews have conducted during and illustrated through specific questions to solve problems in class.

The method is explanatory that followed [26]. This research combines quantitative and qualitative methodologies to explain and describes the learning situation. The implementation is the same as the case study definition [27], namely, in-depth analysis of one or more events, its settings, learning programs, and student learning.

In this study, the qualitative data used enriched the description of the quantitative. The dataobtained from direct observation, class interviews, through a project approach. The validation procedure of the data is: (1) the outlier of qualitative data explored and the quantitative examined for the insight of the outlier from other cases; (2) the development of the instrument gained by the researcheraccording to a theme and based on the observation of the researcher' experiences. The instrument validated by other educators in the same study program; and(3)examination of multiple levels conducting the model of [28] that is, the researcher collects data and then carry out class interviews during the learning process to explore responses. The action research conducted by students is a variety of actions to obtain learning outcomes as they appear in the class.

After examination and discussion, the researcher examines the learning design. Regarding new terminology, the researcher observes the learning in the class. That provides portraits from educators' and students' perspectives, i.e., the benefits and the practicality, the activity to issues of the validity, the learning barriers, the educators changed, and the learning of the diverse needs. The results used to construct the learning design.

Then class interviews developed from the survey, and the rationality directed to a further understanding of the quality of the learning. From quantitative and qualitative data, the researcher wants to get an understanding of the phenomenon during the learning, and used in explaining and ascertaining conclusions.

The learning imposed on students of mathematics education study programs, namely regarding the application of mathematics education, the provision and development of teaching quality, and the development of school mathematics curricula. The prescription of mathematics education is an attempt to plug in more axiological characteristics of

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mathematics education in improving learning outcomes. Provision and development of teaching quality is an effort to get predictive learning insights into mathematical literacy.

The emphasis area includes the resarcher' teaching preparation, the teaching itself, a technology supported, problem-based learning method, and the development of a mathematics curriculum. Although assuming the description of the learning state is difficult, the researcher made what educators should know. The researcher reinforces knowing, paying attention to the teaching, and looking for the learning. The researcher discusses challenges, including testing

hypotheses and teaching situations. The researcher constructs a research design that reflects itself correctly. The researcher did it using four methods, namely: triangulation, construct validity, face validity, and catalytic validity [29].

#### RESULT

#### D. The survey

The results of the benefits of the learning in two yearspresented in Table I. The table shows quantitative statements and frequency of each statement.

#### **TABEL I. BENEFITS ASPECTS**

		Benefit				
Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
The researcher becomes better problem solver when carrying out the learning.	0	3	8	23	11	
The resarcher is confident when conducting the learning.	0	1	8	17	19	
The researcher getsbenefit itself and with other stakeholders.	0	1	12	12	20	
The desire of the researcherfor better understand in teaching activities is fulfilled when conducting the learning.	2	1	4	19	19	
The researcher related to quality based on the changing through the learning.	1	2	7	22	13	
The researcher has opportunity to work with studentstowards a common goal.	0	3	8	16	17	

The summarized respon from the table: (1) the researcher gets benefits expressed according to mathematics concepts; (2) helping the researcher understands the students' needs; (3) the researcher' belief is better because of students participation; and (3) the researcher finds information and did for students, for instance, a wrong concept discovered due to the tightness in constructing the hierarchy.

The researcher shows mathematics reputations, i.e., In thetrying logical possibilities saturatedly. The material or content knowledge obey the system of mathematics. For instance, through asking questions, so the system reduced to minimize memory.

Other educators stated that the learning in carried out by the researcher helps to teach better and have more knowledge in their fields. For example,

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teaching  $-1 \times -1$  turns out to be explained in depth related to the understanding of concepts, not just memorized as is usual in every learning. This statement is beneficial to students where conceptual understanding raised through the learning. Another example is an understanding of the nature of the sequence of real numbers that interpreted, not just understood.

The results of the practicality of the learning presented in Table II.

Statement .	Practicality				
Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The learning done to improve the professional culture.	1	8	16	16	4
The learning is worth the time because it brings a new spirit to the work of the researcher.	0	1	6	23	15
The researcher motivated in teaching practice.	1	3	9	15	17
The researcher is more reflective from the learning.	0	2	5	17	21

#### **TABEL II. PRACTICALITY ASPECT**

Practicality refers to appropriate efforts, such as effectiveness. For example, a remedial program turns out to perpetuate the notion of mathematics. The remedial is improving the students' thinking skills, reported by 65.3% of the educators. That is lower than practical aspects related to class priority and professional culture on campus. The average of the practicality is 3.2 for the educators, and 3.81 for the students.

Almost all educators respond positively to the statement: the learning is a practical way to get the various needs of the students. For example, it brought up: Through the learning allows the researcher to choose the topics and related problems, not random topics passed. The researcher applies the learning so that not theoretical, but practical. That is what later led to the transactional approach.

Other educators stated, the learning strengthens the teaching to each student's style. So far, the main student learning style is to imitate the showing by the educators. So, when conducting transactional learning, it sustains the diversity of the students. That is an example of the practicality for students.

For the statement: the researcher shows the learning research is impractical, the overall educators take into account time constraints. But, in some cases, the researcher provides time because of the importance. For example, when appeared outside the context in solving problems, the researcher resolves it by the learning.

The researcher recognizes the effect of time constraints by involved the students in a group that appear in enhancing the quality of the learning. The researcher maintain action research and make

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changes gradually because of the flexibility of the learning and more practical.

The results of the survey on the validity of the learning presented in Table III.

TABEL III.VALID	ITY ASPECT				
		Valid	lity Aspect	;	
Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The researcher records results, expectations and unexpected ones.	1	1	2	11	29
The researcher obtain data from a different perspectivethrough questions.	1	0	3	17	22
The researcher discusses with a stakeholder who have attended to ensure the validity of the learning.	2	2	7	6	27
The researcher tries to design the learning repeated by other educators	1	4	2	10	27

The validity supports the goals or demands of education. Two-thirds or 65.9% of educatorsor Ninety point seven percents or 90.7% of theeducatorsstated that the researcher obtain more knowledge through research questions

Seventy-five percent or 75% of educators state that the researcher discuss with other stakeholders to ensure that the learning is valid. It revealed that observers said that the researcher always recorded the results, and 25% chose the option usually. 84.1% of educators said that the researcher made the learning imitated by others, namely colleagues, students, and teachers

The results of the continuation of learning presented in Table IV

TABEL IV.	CONTINUITY	ASPECT
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State	Continuity Aspect					
Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
The resarcher looks forcontinuing the learning.	0	1	13	14	17	
The resarcher conducts the learning with the students, not just for themselves.	1	4	7	17	15	
The researcher' research agenda arises from oneself so motivated to do so.	0	1	7	14	22	
The researcher gets more information in making professional decisions	1	1	6	19	17	

The mean is in the range from 2.69 to 4.30. The responses of the option agreement and strongly agree options are 64.4%. The statement shows the highest overall score. The score of the time of the research is 2.69. Only ten respondents or 22%, agreed or the agreed strongly of the researcher performances in the learning.

Regarding the continuation of implementing the learning, the most consistent response is time as an

obstacle. The reason is about the teaching, where the workload of theeducators continues to grow, including class sizes that are always different. Some educators explain that the researcher spends time because the learning is commensurate with efforts to improve quality. But, the educators statedno matter with the work and position to continue the learning.

Most educators tend to choose the positive statement because of their professional development.

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The statement is an external support, i.e., described the learning to encourage the professionality. Educators state the learning is a self-initiated even takes more time than others.

Therefore, according to educators that such learning must be sought after and put into extra time in teaching. An educator explains the encouragement behind the self-initiated learning process, namely, when encountering problems, answers are needed, and learning in the form of action research is a good exercise in getting answers.

Other educators stated that the emergence of good results from teaching so theresearcher and the students really believe in it, and continuously pay attention to research and try new techniques in teaching practice.

In the aspect of change, the combination of responses to individual statements ranges from 3.62 to 4.33. The Agree and Strongly Agree options are 74.2%. The overall average is 3.98. The first two statements related to the understanding and the sharing of ideas and the score is the lowest. The fourth and final statements relate to learning the

form of action research to try something and understanding student learning, and the score is the highest. According to educators, the two statements increase flexibility and understanding, differences in students are different, so that no conclusions drawn.

The survey asks educators to comment on learning in the form of action research. Some educators explain that this learning is a modification to overcome the barriers and increasing the outcomes. On the statement, the researcher determined the structure of the learning program. For example, an educator conveys: already given a structured assignment, and it turns out, expressed as an opportunity to carry out the learning.

Furthermore, if students try to work on each problem, all correct answers will be obtained from all the structured tasks given. Thus, educators cannot state that students tend to habit of not paying attention when examining structured tasks. Distribution of quantitative data on aspects of change is in Table V below.

		Changing Aspect				
Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Educators already have increased sensitivity in conducting action research Educators already have increased sensitivity in conducting action research.	3	4	15	16	7	
Educators can share many ideas with colleagues and students learn from the action research form.	3	2	12	20	8	
Educators know what works and what doesn't from learning forms of action research.	0	0	3	26	15	
Learning the form of action research is a methodology that helps try something new.	0	9	4	22	19	
The quality of teaching by educators has increased because of the learning form of action research.	1	0	9	20	15	
Learning the form of action research is a methodology that helps educators become flexible.	0	1	16	17	11	

#### TABEL V. CHANGING ASPECT

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	Changing Aspect					
Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Educators are more satisfied than teaching activities because they have done action research.	0	2	11	20	12	
Learning forms of action research provide a more understanding of student learning.	0	0	7	16	22	

Researchers direct learning in the form of action research on questions and provide an exploration of the accuracy, depth, and breadth of knowledge to obtain satisfactory learning outcomes. No rating applied to students, that is, it does not distinguish the acquisition of test scores given during learning. Educators prioritize class discussion and dialogue with researchers so that they also directly conduct action research. According to educators, learning forms of action research can change student learning outcomes. Changes in learning outcomes lead to hierarchical thinking consistently and strictly.

Achievement, as intended, is that students achieve better results when reflection on learning and educators can show the construction of student learning itself. Another example that illustrates the change in student learning outcomes is when educators pay more attention to how and what students ask of their knowledge. Example of the depth of the material which was then mastered by students was the growth of mathematical knowledge, which was gradually diminishing practical work in solving problems.

Educators assess ways to improve student knowledge and make choices about better methods. This is an example that shows the effect of teaching activities on students. Educators believe that learning forms of action research really change the overall classroom climate. For example, students are more motivated when observing educators are enthusiastic and have the ability to help them. Educators also observe that students are superior motivated in learning and mathematics.

Educators also records that the researcher makes the students more confident in their ability to learn mathematics. For example, there are many ways in solving problems. Regarding the learning, the desires emerged, which reflected in the researcher response. Educators see the benefits of a structured task for mastering the new knowledge. That is the improving of the student learning. Other educators saw the way the researcher teach to be good problem solvers. This is an idea to attend lectures in class, and how to influence mathematics learning, in general, the students of mathematics education.

The researcher also relates an idea to the learning and observed that "The mathematics class needs exercises, question, answer, correction of tasks, and no guided teaching, which ends in complete practice turns out to be in line with learning. That is, the researcher appears want to: "Put down new information and extract it in the piece of the period of learning".

Two observer or educators share an idea of working with students with diverse needs, namely

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revealing information using own words. For example, the ratio of the two sizes is equal to the concept of fractions. In such circumstances, the researcher passion is to help the diverse needs. Educators state that from the learning is sharing and to inspire various ideas, related to content and management of learning bothly. The content-related ideas include conceptual understanding, while learning management is related to the research activities by each and group of students.

A common theme in the response is that the learning help the researcher becomes excellent in teaching. An educator proposes to take risks and try something new. If something doesn't always go right, share thoughts and ideas to get learning opinions. Another note is that the process of the learning is more important for students than just the output. The learning encourages the researcher to concentrate on many levels, from the lowest to the highest in acting the profession demands. The learning also guides the researcher to study topics that individually characterized deeply and increasing his confidence. For example, a colloquium is the choice of independent assignments.

Another statement is the possibility of the researcher assesses the learning. Observers stated, "through the learning, the researcher is aware of continuing to learn, knowing the important for the skills development, an appropriate and suitable way to learn.

Educators view the whole learning program by the researcher related to the taught, practical and not too theoretical. The researcher teachs actively and follow new trends. Namely, the student share and the researcher learns a lot".

Another special reaction from educators are the high expectations when starting teaching and experiences form research beyond learning expectations. The expectation in general is that evaluation criteria achieved, while through the learning obtained new findings, in the field of mathematics and pedagogical mathematics. also Educators noted that there was an encouragement to collaborate the researcher with colleagues in study programs and faculties in various academic and non-academic forums.

Some educators say the challenges and rewards of the learning are experience, namelythe most exhausting but most interesting for the researcher, and happy to do so and continue like that. Other educators stated that the learning is very difficult and has been done by the researcher, but is most valuable. They also said that the resarcher is more eloquent and grateful for the experience of carrying out action research. That experience is a turning point in the professionalism of the researcher and educators. The researcher will be a big loss if removes the action research component from the learning because of the most significant aspect of the learning and teaching must be in all lectures and their experiences. In addition, the learning greatly

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encourages the researcher and educators to continue An a professional development and broader the learning opportunities. VI.

An analysis of interviewed educators of the learning program to he resarcher presented in Table VI.

Number of Educators	Action Research Form	Qualitative survey	Experience	Facilitated or Not	
2		Н	Х	Х	
4	Х				
7	Х				
12		Н	Х		
13	Х	Н		Х	
15	Х				
17		Н			
22	Х			Х	
23	Х	Х	Х	Х	
25	Х				
27		Х			
29	Х				
31		Н	Х		
34	Х	Х			
37	Х	Х			

T ABEL VI. AN ANALYIS OF INTERVIEWED EDUCATO

In Table VI, symbol X states four factors given to educators. If the educator states more than one response then received as a high rating or symbolized by H.The factors included: learning Forms of Action Research, Qualitative Survey Results, Experienced in implementing the learning of Action Research. Further comparisons were made between the entire group of 45 educators and selected groups, namely nine people invited to discussion and dialogue. It saw in Table VII that the groups are the same according to the average score and standard deviation. This is a further reason that the educators as intended are representations of the entire group.

**TABEL VII.STATISTICS OF INTERVIEWED DATA** 

Aspect	Individual Mean	Standard Deviation	Group Mean	Standard Deviation
Benefit	4.00	1.00	3.93	0.84
	4.00	1.12	4.2	0.81

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Aspect	Individual Mean	Standard Deviation	Group Mean	Standard Deviation
	4.22	0.83	4.13	0.89
	4.22	1.30	4.15	1
	3.89	0.93	3.91	0.92
	4.22	0.97	3.97	0.92
	4.00	0.87	4.07	0.93
	3.22	1.09	3.33	1.07
	3.33	0.71	3.31	0.95
Practicality	4.22	0.83	4.2	0.74
	4.44	1.01	3.98	1.03
	4.56	1.01	4.3	0.84
	4.67	0.50	4.5	0.88
<b>X7 1' 1'</b>	4.56	0.53	4.37	0.82
validity	4.67	0.71	4.23	1.16
	4.56	0.73	4.32	1.07
	4.33	0.71	4.04	0.88
	4.33	1.00	3.93	1.04
Continuation	4.56	0.73	4.3	0.82
	4.22	0.97	4.14	0.9
	3.22	1.20	2.69	1.06
	3.67	1.00	3.4	1.08
	3.78	0.97	3.62	1.05
	4.22	0.44	4.27	0.59
CI.	4.56	0.53	4.33	0.64
Change	4.22	0.83	4.07	0.86
	3.78	1.09	3.84	0.82
	3.78	1.09	3.93	0.84
	4.44	0.53	4.33	0.74

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There is a quantitative statement with a slightly higher response in the discussion group. That is the researcher has time to conduct action research. The average is 3.22 while of all groups is 2.69. Although the different in the reasons presented, it does not contribute to the discussion. That is, there is no statistically significant difference between the themes studied, namely that they carry out continuous learning in the form of research.

### A. Benefit

The researcher worksby combining pedagogical approaches and using mathematics teaching knowledge. The researcher actively strives for work applied in teaching from lecture meetings in the classroom. The researcher provides skills and

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abilities for a variety of the knowledge beyond the usual settings. Drawing on the principles of mathematics education, and develop a useful skillset that includes critical thinking, analysis and research skills. The researcher pursues a career teaching mathematics at the level and working for the department, or pursuing a career in research.

The identified benefits are: there is an acknowledgment of differences in learning a culture, pedagogical development, and content approaches emerge from the tradition of knowing and positively influencing the class, that the hidden knowledge revealed, and the development of Mathematics in Cultural Contexts (MCC) which supplements the mathematics curriculum.

The culture of learning mathematics is the accuracy, rigidity, detail, and the thinking of the student's work appearance. Such a culture of learning mathematics directs the researcher to the model of presenting knowledge that is open to the types of a solution. There was also a strong desire from students to use learning tools, both to get a solution or explore a concept. Exploration carried out included verification and testing. That is one product of this study, namely supplementary learning resources from the mathematics curriculum.

#### B. Practicality

Students jointly present, discuss and demonstrate research actions in the learning. Documents collected are teaching materials that developed by the researcher with students and handouts. The mathematical works are concepts, principles, and algorithms, packed into the study and test activities, development of spoken and critical thinking, intelligence, motivation to write and the development of self-confidence.

The learning supports the notion that the researcher plays a role in topic selection. For example, tracing the understanding of intersections points that appear geometrically, can also be directly used using algebra. The definition of one intersection point of two straight-line presented geometrically and using grid-paper raises the substitution principle which leads to equivalence. Such work relatively does not appear in learning so far.

The beliefs of the researcher and students, principles and the learning processes are conditions for a reform. The researcher appears to understand the reform because of emergingfrom within and bottom up so clearly what other educators should do. That is the best way of reforming at work [30].

Another thing about practicality of learning is in dialogue or discussion, at the classroom level, or mathematics education study programs and faculties, i.e., in an academic seminar forum and in writing a thesis. In discussions, the researcher and students discussed the learning to find or review concepts. The researcher sees the importance of a broad overview of knowledge, where the class has a contribution, no privileged point of view, and the learning activities encouraged dialogue [31].

The gap between the researcher and the students think discussed. Dialogue and discussion raised in the learning and become a bridge of collaboration and improvement of education. Theresearcher reflect on his action and works together based on improving teaching and the quality of relationshipspractically.

### C. Validity

The validity of the learning is a description of the researcher and students regularly, discussing teaching activities, mathematical knowledge, and inquiry activities.For example, paying close attention to those asked students and how they respond to the task and requests of the researcher. The researcher is able to feel success and always want to know whether he does effectively compare to before. For example, through the learning, tracing the understanding of concepts algebraically or analytically in the step of changing the shape of the inverse function to an algebraic function.

The choice of the researcher' is that the data collected guarantees the expected validity of work in mathematics and education. The researcher grasps the emptiness between the uncertainty of observation in teaching and demands on proportional statements before being accepted as knowledge. For example, the work of the researcher in explaining a knowledge is different from the students' understanding. This difference is generally not easily formulated as the main problem. Therefore, the researcher choice is to investigate teaching activities through action research so that a better understanding of the real situation obtained.

The state of the learning is difficult, but it is part of what the researcher must know. The researcher continue to strengthen the desire to know and pay attention to the work, seeking understanding of the educational situation and the reasons for the actions taken. The researcher discusses challenges, including testing hypotheses teaching and situations. The researcher also constructs the learning design in the form of self-reflecting action research. The researcher did it using four methods, namely: triangulation, construct validity, face validity, and catalytic validity [32].

#### D. Continuation

The obstacles and challenges of implementing the learning are an encouragement towards standards, emphasis on assessment and accountability, breadth and depth of teaching material, and time. This situation is a professional satisfaction that exceeds obstacles in the classroom. The researcher associates with something that can be recognized, active, conduct an inquiry and supports students' learning, so that independence becomes fixed. The researchers can also provide the types of conditions needed in learning to become part of their professional life.

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The researcher develops work that does not neglect efforts to carry out the learning. The researcher seeks a research climate, realizing that what done is an ongoing and related effort. The researcher included activities to show real professional findings in the classroom and fostering the core. For example, getting a straight line equation that passes through two points and depicted on paper is not necessary through the formulas that commonly used by students. Apparently, after taking action, the straight-line equation as intended is sufficiently done through substitution in the form of ax + by = c.

The idea resembles a "lesson study" which introduced in the Trends in International Math and Science Study [33], i.e., educators create, test, and improve learning. In the action, the researcher and the students obtained activities of the education community. The action research is as monitoring and adjusting teaching activities, and able to maintained with an effort [34].

The effort made by researchers is to ask students to show all the different work results. When asked, there are at least four different ways of thinking. The different ways of thinking as intended are: simplification of ideas, strengthening manipulative thinking, solving problems routinely or according to usual, and relying on examples from various sources, including from educators. However, the researcher finds that the way shown by students was far from understanding mathematical concepts or objects. Therefore, the researcher perceives the learning continued so that also solve the class problems.

#### E. Change

The four questions in the discussion directly submitted regarding changes, namely: personal or individual, professionalism, curriculum, teaching, and student learning changes. One of the changes is personally, i.e., teaching as a non-rigid learning model.

#### 1) Personal change

The researcher showed as the power of testing theories. These are the increasing confidence, openly conduct discussions and always ready to observe class. The researcher makes the most dramatic change, i.e., to show the students respond. Students also see how the researcher learns and talks further, including to show mistakes in the previous teaching in the hope of future changes. For example, the researcher finds student expectations so that the problems solved in the learning more than working on those.

In particular, students are more open to the resarcher because of dialogue. The researcher also make changes in class, from rigid plans to student performance results. Some educators (22%) discuss the needs of students, and some can connect more and focus on students. The top-down models have deemed inappropriate because mainly based on the researcher thought or presentation in textbooks.

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The findings are in line with Knowles's theory of andragogy. Knowles [35] states that learning for students is an effort to develop the theory of andragogy. Knowles emphasizes that adults are directed by themselves and expect to take responsibility for decisions.

Regarding Knowles' opinion, the researcher carriesout the learning following assumptions: students need to know why they need to learn something (among other things from emerging problems), students learn based on experience, students take learning approaches through problemsolving, and students learn the most both when the subject matter is of direct value.

In the learning, the researcher focuses more on the content taught. That is strategy, i.e., case studies, model building, and self-study evaluations. The researcher mainly acts as a facilitator or source of the learning, not just as an educator or a higher source of knowledge. The learning principles are the explanations to material taught, task-oriented learning not remembering knowledge, consider a wide range of different student backgrounds, different previous experiences, because the students are directed by themselves, must be possible for them to find something for themselves, and provide guidance and help when mistakes occur.

#### 2) Changes in teaching skills

Many changes emerged in teaching skills described by educators as observers. Among other

things is paying attention to something critical when learning takes place and reading more research (33%) before making a decision. In the discussion, it found that the researcher personally thinks of action research in teaching and assessing the learning performance. Thought includes assessment of what done, whether the teaching assignment is good, and whether the learning process that done can produce something new.

The researcher feelshis work respected, even though still unable to carry out more national and international curricula. Some of the reasons that the researcher recognizeshim self in general, not very skilled in the discipline of mathematics taught, textbooks are not standard, not yet breadth and depth of material, not standardizedevaluation and curriculum.

#### 3) Change in teaching

Changes in teaching related to the way the researcher approachs the curriculum through selfmade teaching materials. The focus is different, namely: (1) tending the current teaching fixed, (2) paying attention to the situation before developing teaching materials, (3) centering on conceptual understanding basing self-considerations about assessment, (4) convincing students to truly learn, (5) following methods just from sources presented, (6) using personal curricula, (7) learning but not best from the role of teacher authority, but are directed towards self-reliance and work with peers, and (8) a shift from traditional styles to inquirybased approaches that are running slow.

The focus is a direct result of the learning that teaching methodologies combine where the researcher learn and look at alternative the methods. Themethod is for presentation, lecture, and assignment. After the learning, the researcher pays attention to students' learning goals, make matches to the goals, design lectures so that they are suitable for the purpose, and construct ways of assessing. The result is regarding teaching change where the researcher focuses on student learning goals so exactly knows how to teach and test mastery of goals, rather than just mastering the material. Regarding the researcher performance, the learning started from the students' needs from various perspectives.

The perspective of the student is practical. That is tounderstand what the researcher said. Formerly, the researcher did not get the main learning needs, but during the learning, it found that the students' needs are: the translation of textbooks, the burden of material and the class has not been effective in discussions, and the elaborating of the textbook.

Changes in other teaching fields include improving services, using more ICT in teaching; and more hope from student learning. The researcher use more time to get and know the joy of students in the class. The researcher also discuss class restructuring, which is askingstudents to answer, and understanding deeply about student interpretations of mathematical problems. This change occurs when the researcher tries new strategies, researching and obtaining data and teaching reflection.

Students' learning objectives based on the need to understand the material and problems so that the learning outcomes overcome the barriers. Students demonstrate the ability to think critically, research, and reason. Students recognize and differentiate among diverse cultures through the learning. Students engage in activities directly benefitting the broader class.

Students demonstrate an understanding of the common body of knowledge in mathematics. Students demonstrate the ability to apply analytical and theoretical skills to model and solve mathematical problems. Students demonstrate the ability to analyze data and draw appropriate statistical conclusions. Students demonstrate the ability to effectively utilize a variety of teaching techniques and classroom strategies to positively influence student learning. These are understanding the learning goals leads to the researcher view point. That is effective when carrying out the learning although before the discussion completed [36].

#### 4) Change of student' learning

Changes in student learning developed into subtopics of the main subject. The researcher observes the motivation of the students when trying to learn something to improve their own learning

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experience. For example: "Analyzing concepts about the intersection of two graphs of linear functions." It turned out that the concept was inherited in a hierarchical or bottom-up manner, so that memory reduction or memorization gradually appeared.

The researcher also emerges the development of relationships with students and help them learn. Therefore, the researcher has high expectations, tightness, levels of achievement for the students, and accordingly. Students interviewed noted that more of them felt happy in the classroom and always tried more mathematical work. The efforts of the researcher to build relationships with students and change the way they carry out classroom learning have also changed the way students respond. The researcher notes that the students have more knowledge and skills than before the learning. For example, more students are taking Abstract Algebra and Real Analysis courses, where previously their learning outcomes were not satisfactory.

Discussion of the researcher with the educator in the real analysis material gave rise to share about: the presentation of the concepts, more examples of cases, representation visually, and the epsilon concept and the preferable delta.

It also found that the learning is towards a competitive curriculum, and the students become challenged. In the class, among others, there is raised about literacy, which is learning a concept that applied in the future. For example, when studying trigonometry, it turns out that in class discussions arises the importance of studying spherical trigonometry. And, it turns out, software needed that presents various graphs of trigonometric functions and their development. Thus, the efforts are to focus their attention on the achievement of the student learning become measurable from the improvement outcomes obtained. The students discussed a lot about mathematics and getting better or improving their achievements.

### F. Validity and reliabiliy

In the portion of the discussion, the researcher conveyed and explained the level of trust in the findings of the research actions in the learning. Observers stressed that 80% of self-confidence emerged and very confident. Observers also believe the validity because of not get the results expectd (33%). The confidential of their first experience with the researcher are very and enough" (33%).

The researcher gave the principle of the learning on the design was carried out through trials with colleagues. The colleagues are eager to raise new problems from their respective perspectives. Emerging from the discussiona are: starting the presentation of a concept from opposing definitions and diversifying it, posing problems from presenting practical mathematical knowledge, and extending all possible logic from a mathematical expression.

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Another proposal relates to the acquisition of experience in research. It proposed that the researcher needs statistics to help present and interpret the data collected to the reliabilityand validity. Another comment is that the learning provide a positive experience (44%). The value of learning is teaching, relating to real life, and forming a strong team.

#### G. Result

The researcher' perspective is exploring cultural identity in teaching and learning through action research. Findings from a critical perspective are about evaluating data and perspective of arguments of the class. The results presented in Table VIII.

No	Cultural Identity	Description	Characteristic
			work independently briefly;
			practice for one answer;
			emphasis on correct answers;
1	Adjustment	Students know from math classes through the learning levels.	learn concepts and skills, and find it;
	.j.		practical thinking in solving problems;
			emphasis on straightforward and correct answers beyond mathematical processes or strategies;
			most often or prominently is that mathematical competence interpreted as acquiring correct answers quickly and vice versa even though students have developed effective strategies to solve problems;
2	Imagination	Students tend not want to take advanced mathematics courses.	low learning outcomes
			work and math skills tend to be practical, not meaning
			formal mathematics not needed in a career
3	Algorithmic work	Students have advanced mathematics learning reasons.	no reason
		U U	choosing to be a graduate is the main one
4	Natural	Students adjust performance in groups.	self-study practice
			control aspects of the problem- solving have not yet emerged
			not independent

TABEL VIII.	RESEARCH	DESCRIPTION	OF IDENTITY
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The first identity is prominent, where students learn mathematics through involvement in mathematical class activities. The results of the interview are that learning liked a creativity and make whatever someone want. But in mathematics there is only a kind of procedure that ought to complete. So, the students stated that afterthe learning, mathematics becomes less like, they don't like the process so much through many questions, and following each step.

Students who are asked to follow the procedures in exercise test is without giving the meaning. The students directly take place in the classroom, so the assignments and the learning structures contributing to their mathematical identity significantly. The

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students are not like working through procedures where they do not get the meaning. For example, in math class, students cannot practice creativity, so they do not understand themselves as mathematical learners.

On the other hand, when students able to develop strategies and interpret mathematical problems with the ability to engage in the learning, they learn to see themselves as members of the community. If students' ideas and explanations accepted in class discussions, others also recognize them as community members. In other words, students who do not have the opportunity to deal with mathematics at the personal level, or not recognized as contributors to mathematics classes, may fail to see themselves as capable of learning mathematics.

The second identity of a mathematics learning culture related to the students' imagination. The imagery in learning concepts match their activities and how fits the daily experiences. The students see mathematics in a broader context turns out to contribute positively or negatively to their identity.

During discussions about advanced mathematics lectures, student responses varied. For example, students need math in their daily lives, and they haven't found it or felt it. Some students stated that advanced mathematics courses were in preparing themselves for further study. And, there are also those who claim that they want a career in the future. However, on the contrary, some students see no need to learn advanced mathematics because not used in daily life.

Regarding the imagination, the learning emphasizes reasoning ability and critical thinking. This action supported by several teaching colleagues, who stated that: "reasoning must always appear in content knowledge discussions." The researcher related mathematical concepts to logical constructs, both axiomatic and non-axiomatic. Indeed, at the initial meeting, the class had not reacted so much, but after walking, the student response increased. Through learning forms of action research, logic and reasoning are part of solving problems that arise.

The concept results from various ways of getting done, while procedural work tends to only a way of answering. Understanding the concept of fractions is better than the procedure of solving fractions or operations on fractions. For example, during the learning, obtained that a theorem did not always need before solving the problem. That is the high value.

Learning emphasized is formal mathematics, namely the construction of content knowledge where axiomatic systems raised through actions. The researcher doesn't let the widening of practical mathematics emerge, because the important is considering when failing to teach formal mathematics, graduates will not be able to recognize complex mathematical thoughts that are needed by the workforce, including in classs. For example,

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until now there are still opinions and comments that mathematics is difficult. These difficulties are mainly related to mathematical thinking skills that have not grown, not only to students but also from educators themselves. For example, [37] notes the mathematical knowledge used by car production workers is not known to workers but still needed in the work assignment. If students cannot associate mathematics that they learn and feel useful in life, then construction of identity does not contain the need for advanced mathematics courses.

Some students come from tree felling areas. The researcher is learning more the mathematical knowledge than most people need. Related to this, the learning is to bring up real problems in the community that is known to students. Through the learning, the researcher showed formal mathematics as an integrated part of a field of work. One result that researcher discovered and recognized was that indeed a career that requires advanced mathematics is not part of the imagination of the majority of students, both for themselves and the future.

The findings were followed up by the researcher using a teaching approach to literacy which combined into various activities. For example, the researcher and students read mathematical texts together, mark important words meanings (including terminology), write key words, to propose analogies and illustrations for difficult concepts, use multiple representations, and use tools or media.

The method used by the researcher directed to help learned mathematical concepts, from simple to the advanced. The visual memory skills shown by many students can be used to support the recognition and from learning mathematics. That teaching mathematics is not solely on aspects of fluency in representations, but on literacy, which makes learning more acceptable to students. The presentation shows various representations in tasks, specifically visuals, and helping to learn. Simultaneously, special considerations stated for students' needs and adaptation of curriculum and pedagogy to accommodate those.

A third identity, algorithmic work, is revealed when students use their energy within the limits and requirements that apply. For example, students who see the need for advanced mathematics in their education or the opportunity to work more study the contents of that knowledge. Students feel a variety of requirements that continue to evolve therequirement to meet and can participate in the activities. Students have been satisfied to attend classes with minimum requirements, not seeing their potential and needs or being recognized by others as students of mathematics education graduate programs.

The challenge for the researcher is to implement needs-based learning from real problems faced by students. For example of content knowledge,the researcher feels difficulties. Therefore, the researcher prioritizes developing problems or

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complicating problems through follow-up questions. Advanced questions related to concepts are more difficult than adding problem variables. For example, learning directed not merely getting answers but adding new problems to existing problems. The researcher bias is to reduce the use of formulas or methods to a minimum in solving problems. The process that researchers do is to formulate the smallest problem from the stages of mathematical work, think of a problem-solving model, conduct a visualization of the problem, make a model and test models of various kinds of solution.

The three mathematical learning identities of these students are not mutually exclusive, but interact to shape and maintain that identity through algorithmic work. Participation in conducting research is carried out by students in the class, their activities emerge, and learning identity develops. In the same way, the researcher maintains student interest or desire in a particular problem. Thus, the mathematics raised is as a requirement of knowledge and career needs, as a candidate for mathematics educators in schools. Student mathematical identity maintained through imagination and algorithmic work both.

The fourth learning culture identity found by the researcher is the original nature without control. Specifically, gender. Mathematical classes dominated by female students compared to men. In reality, the characteristics of natural are not independent of relationships with other people and society. Learning theory [38] states that aspects of natural nurtured and strengthened through involvement with others.

In the context of the student's natural identity, the results of the work of female and male students shown. It turned out that they were different and copied each other so that the implementation of learning became effective. The researcher in a unique position listens to students and reports on work results where mathematics learning influenced by the existence of gender, which often does not guarantee the ability to learn mathematics.

About the natural of learning mathematics, it found that students stated that there was a connection between talent and difficulty. This finding is indeed difficult for researchers in the learning. Indeed, most students still fail, but scientific facts do not support the idea that learning mathematics is related to genetic factors. Therefore, the researcher constructs a way of teaching, based on students slow and still wrong performances. The balances practical and researcher formal mathematics in the learning so that the class as a whole participated.

The essence of the learning is that with action research each group in a variety of different needs conducts activities and the students understand their respective practices. The learning model used is to integrate the four learning identities so that at the same time there is an identity that seems prominent and less emphasized.

Each identity shows the implementation of the different learning to describe the behavior of the students in a variety of identities even though. The model is intended to keep the emerging ideas together as student actions in the context given. The four identities turned out to contribute to their formation, where nature provided a still vague explanation for participating in learning mathematics. Therefore, the researcher and students reduce that naturalistic and build three other identities.

The four identities are used by the researcher to understand how students learn the mathematics of experience in the classroom and through tailored it to a broader. The student experience does not need to reflect only one of the four identities. Thatis some experiences stretched over two or more mathematical learning identities. For example, learning advanced mathematics connotes student identity in two ways: (1) through imagination that mathematics is an importantfor further study and (2) algorithmic work needed to take other mathematics courses.

The stage of matching identities developed through the experience of students with mathematics and, for most mainly emerged in the class. The most significant potential affects student identity in the class. In this study, teaching is developing a matching identity through assignments and class structure where students are actively involved in creating. These activities are different from other forms of learning (not research) where is primarily a learning activity.

Through the development of those identities, the students feel that being in a math class like academic home-stay and their ideas valued. The researcher found that before the learning, the students worked freely in the practice of getting one answer and causing them to learn less enthusiastic mathematics and seemed not as subject matter that was useful to learn. Burton [39] states that the type of the learning is monotonous, insignificant, and isolated from studies of students and their mathematical experience. Therefore, mathematical tasks that invite students to work on mathematics, make meaning, and develop their own on complex mathematical problems are useful and support their learning identity. In the learning, the researcher used open-ended mathematical assignments of questions and project questions that had many responses or one response with many completed paths. Researchers also arrange classes to encourage discussion, share knowledge and experience, and collaboration. According to [40], the class encourages the researcher to draw knowledge out from students and make the construction of knowledge of the learning experiences.

Developingimagination of the students turns out to require long-term efforts on the part of crossdisciplinary educators. Their students' imagination

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and the development of mathematics outside the class, in the past, when learning took place or the future might conflict or change over time. The researcher consistently reinforces the interests. The researcher provides broad opportunities for students to learn mathematics beyond what done in class. The researcher' activity is to assess student performance and discuss the link between mathematical thinking and using the outside one.

Although the student mathematics class is out of control during thelearning, the researcher encourages matching identities. The researcher aimsat high expectations through challenging problems. Although students tend to naturalistic, it seems that is less useful and very detrimental to support learning mathematics. The researcher does this by returning to other identities such as the Learning Model, which is three instances other than naturalists support students through involvement in class, develop a positive imagee, establish high expectations and requirements, and regardless beliefs of the mathematical knowledge they already have.

The four identities contribute to an understanding of how students learn mathematics. Through the learning, the researcher develops and improves the student learning identity and eager to attend advanced mathematics courses. The researcher does not assume that all students will develop a positive identity when conflicting. The researcher conducts the learning, so the identity supports others in the developing.

#### CONCLUSION

Firstly, the researcher teachs following the referenced material. The researcher focuses on new methods or strategies that change the aspects of the mathematics. For example, the incorporation of technology, emphasis on basic topic, i.e., thereal number, uses a lot of representation, centers on communication, problem-solving, or inquiry. The other target is the assessment practices, problemsolving skills, and types of interactions between students and students. They also focus on curriculum issues, looking for the best ways to assess learning programs and the impact of the programs. Everything influences the level of such as learning. the student's conceptual understanding of functions, or the results of the broad influence of current practice in the class.

Many learning forms of research centered on the need for students to learn by striving hard. Mediation through these activities focuses on culture and curriculum suitability, expresses mathematics anxiety, uses strategies that consider learning styles, lots of intelligence, and support remediation. In general, educators learn something and reason to assess learning situations. Some are driven based on class needs, or study programs, others are intellectual awareness.

However, there is also something important for them on a topic. Almost in general, topics are

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personally appropriate to educators in their particular work context. Mostly, overall action research is not intended to transform their teaching practices or learning philosophies but rather provides additional improvements in practice.

This study also explores the validity standards used by educators in the provisions of education to ensure the quality and direction of education. Educators guarantee the accuracy in conducting action research based on similar findings, discuss with other educators and the researcher, discuss with experts in the same field, and examine their students. The standard of validity is to consult with other educators regarding questions, designs, and results of action research. In particular, the value is the interaction with educators from the same study program.

The benefits of research actions in teaching, become more reflective, and in gaining understanding and work tools on problems in the classroom. Students benefit, including those with high needs. The mediation of action research shows benefits in practice and class. The main benefit for educators is that research into their actions is more reflective in teaching practice, more aware of what happens in the classroom and is more aware of students and their learning.

Most of the educators interviewed stated that action research was more practical if they used an informal approach but still in the action research quality. While the stumbling encountered is very valuable, which seen as accuracy and challenge. Educators seem willing and can continue to carry out action research using a few formal methods. However, the formality of action research is increasing, as are embedded in the daily curriculum and supported by the student community.

This study investigates how (and if) educators continue to carry out action research as part of teaching assignments. In this study, educators did not continue after trying one or two times in learning. While it was declared valuable, some of them continued, stating that teaching positions were currently not possible because they were not encouraged. Some educators interviewed commented that they were overworked and could not find the right time. Even if done, it usually happens in a less formal situation. In many cases, the results are not written down.

Regarding the change in practice, educators say about being more reflective as a result of conducting action research. They become better observers in class. By conducting classroom action research, educators are more aware of their students and the consequences of teaching practices for their students. Relationships with students increase, and students respond increased the learning.

Other key results related to self-confidence increased in class. Action research raises the confidence of educators to try something new, ask questions, investigate, don't afraid, to talk, and to argue. Sometimes it is alienated from critical Volume 1 Nomor 2 Oktober 2020

educators who "just want to pay" and don't care like "being the best educator is for their students."

All educators interviewed showed benefits for students with high needs, especially those with low incomes. Action research sawed as a tool used to solve problems on campus or class when students with high needs are not superior. One shirt, due to the learning of the form of action research, students with high needs get a higher ranking before and at the same time obtain a higher level of mathematics.

Action research finds ways to reach out and help their students, often providing new information that is valuable to educators and does not seem to be available. Education undergraduate education programs need to serve those who make curricular decisions that will affect students with high needs. Other educators use online facilities to learn and try new techniques in class that can relate to students with high needs and have succeeded in changing academic performance. Students already their believe that they can learn mathematics, and they are more successful than before.

#### H. The teaching

The findings of this study are values in teaching and learning of mathematics related to the professionalism of educators or lecturers or the researcher and the development of the quality of the design. The researcher' experiences and efforts to continue action research are examples of putting theory into practice and need to continue it. For example, there is no general agreement on the definition of learning, how learning takes place and what constitutes reasonable evidence that learning has taken place.

It is observable changes in the researcher behavior, means acquiring new knowledge, and the creating of a disequilibrium. The researcher makes different philosophic assumptions about the learning process. The recommendation is performing drill and practice on procedures and facts to strengthen mental net, but there is no meaning of phenomena representation. For example, an *insight* of a concept represented symbolically towards equation and a visual not appear. In fact, s symbol  $\frac{1}{2}$  written as  $1 = \frac{1}{2} + \frac{1}{2}$  or 2=1+1, so when represented visually is like Figure 1 below.

1/2	1/2
1	1

### Figure 1. Visual Representation of Equation

The Figure shows that <sup>1</sup>/<sub>2</sub> is 1 from 2 or <sup>1</sup>/<sub>2</sub> from 1 as a whole. The researcher denied the theory of "mental bonds", with reinforced by desirable behavior in the form of bulding insight. Thatbrought to the educational programmed learningand new standardized techniques. In the study, the researcher searched for types of teaching that led to greater student achievement.

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The researcher assessed the freedom to identify a problem or mediate a class to achieve its goal was stronger than other type of the learning.For this reason, learning programs convince students to learn through action research. In almost every interview regarding usefulness is that the researcher chooses and develops topics in class including for the teaching, according to the specificity of the material.

The data collected shows a variety of additional proposals for improvement the learning programs. Thatis emphasizing the importance of service and learning from other presentations before beginning the action research. Therefore, the development of mathematics learning is the expectations and real needs of students. For example, when studying a concept of Trygonometry, the studentsexhibit extensive knowledge and skills appropriate to the Mathematics course, use sophisticated multi-step reasoning, integrate ideas of the concept with strong algebraic, modelling skills to successfully solve difficult problems, exhibit excellent problem solving skills, and communicate effectively using appropriate mathematical language, notation. diagrams and graphs.

The researcher assesses that different experiences and knowledge are sources of teaching. The inquiry conducted by the researcher ended that, although the implementation of the learning is a selected direction, the understanding and point of view of the researcher focused on exploring the subjects in mathematics.

#### I. Reflection

The learning as well as completing the interviews with educators or observers further established the full value of action research.One limitation of this study is that the researcher does not implement consistently, so there are differences in conducted the experience. The researcher refer to various sources regarding action research and discusses with collegues who also carry out the learning. So, the researcher identified themes are interpreted differently.

Another limitation is that this research is to do the learning by choice. But, that is practical with several strengths, including a hundred percent return rate for th survey of all educator or observers programs in one year, and is consistent between the survey and interview findings. The results are emphasizing the value of the learning and as a component of the mathematics education program.

This action research reveals useful and effective in investigating problems or testing new ideas in class, for the benefit of students with special needs and in general. The researcher shows a challenge approach to professional development, towards the issue related to learning mathematics problems. The observers stated that the researcher demonstrated the action research effectively, simple, and welldesigned problem-solving, and how to try out possibilities in teaching practice.

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Overall, this study reveals a useful action research strengthening problem-solving tools and and increased trust in teaching practice. By implementing the action research, the researcher expands teaching and learning methods and become more active in reflecting on the work done. With all accounts among the few observers, the action research has added value to the researcher's portfolio of teaching and learning experiences.

The portfolio is a teaching system compared to the researcher experience for increasing the students' learning of mathematics. This research suggests that such follow-up discussion is enriched significantly through the use of action research instruction, asimilar approach provided a more balanced experimental model. The traversal is for accelerated understanding of complex concepts relies in large part on conceptual assembly. The use of action rsearch based on atheoryincorporate into curriculum, i.e., in light of the fact that many of students today's university come of nonlinearcognitive performances. The difficulty is of providing the students training to produce qualified professionals who think flexibly and synthesize and apply advanced knowledgeacross many disparate problems, in exploring approaches to instruction based on the learning principles. Though focused on the domain of teacher education, the framework presented easily adapted to other domains wishing to explore the impact of the learning method.

#### J. The learning

Among the views of students, the learning obtained satisfying outcomes. Data show that the students have a high view of mathematics education. In a collective culture that emphasizes interdependence, the relationship between the researcher or mathematics educators in general and the students opposite in the sense of creating opportunities for to succeed, i.e., successin respecting the wider needs.

The learning is significant because of its position in the education system that emphasizes literacy skills. At the same time, there is other views of knowledge and learning. It is a reconstruction of experience adds to the meaning, and increases ability to the mathematics. The research maintaines the incidental learning and help counteract the practice of teaching mathematics. Theory of instruction in which making "sense" learned was the central issue in the learning it self. In the interview, the students pass through developmental stages and that the use of active methods which gives scope to spontaneous the research reconstruct what is to be learned.

Theperception contributes significantly to support learning mathematics. Regarding that view, the researcher builtsthat mathematics is a skill and trained and managed. That is the pragmatic approach that researchers use in the learning. The result is that learning forms action research into a form of discipline and teaching is a shared practice

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and can be accepted in the classroom. Students do not negative about mathematics, and tutorial meaning additional support or action.

The belief that mathematics is a skill improved through the practice of action research, and that with diligence and hard work, students become educated. In other words, for the most part, that belief influences the performance of teaching rather than learning, which turns out to contribute to mathematical performance. The performance of the students has attracted the attention of the researcher and regarding understanding of the content knowledge.

The implementation of the different from the background of professional teaching experience so far, especially of low student learning. That is, the idea of students' constructing their own mathematical knowledge rather than receiving it in finished form from the educators or a textbook.

The findings are about the students' constructive processes. They continually invent ways of dealing with the problem. In class, the students rely many times on invented strategies to solve a variety of problems. That is, successful work in learning programs are encouraged to invent the students' own procedures for solving a problem, even though limited capacity to handle information. For amle, there is a combinatorial strategies, a series of sophisticated solution identified.

A significant number of the students independently adopted more procedures or their

thinking on on a task. For example, solution of  $\frac{1}{2}$  +  $\frac{1}{3}$  showed in Figure 2 below for 4 groups of solution.

Step 1.1: 
$$\frac{1}{2} + \frac{1}{2} = (\frac{1}{3} + x) + (\frac{1}{3} + y)$$
  
Step 1.2:  $\frac{2}{2} = \frac{2}{3} + (x + y) \rightarrow \frac{1}{3} = x + y \rightarrow \frac{1}{3} =$   
 $2x = 2y \rightarrow \frac{2}{6} = 2x = 2y \rightarrow x =$   
 $y = \frac{1}{6}$ .  
Step 1.3:  $\frac{1}{2} = \frac{1}{3} + x = \frac{2}{6} + \frac{1}{6} = \frac{3}{6}$ .  
Step 2.1:  $\frac{1}{2} + \frac{1}{3} = \frac{1}{3} + \frac{1}{3} + x$   
Step 2.2:  $\frac{1}{2} = \frac{1}{3} + \frac{3x}{3} = \frac{1+3x}{3}$   
Step 2.3:  $\frac{3}{6} = \frac{2(1+3x)}{6} \rightarrow 6x = 1 \rightarrow x = \frac{1}{6}$ 

Step 3.1: 
$$\frac{1}{2} + \frac{1}{3} = \frac{1}{3} + \frac{1}{3} + x$$
  
Step 3.2:  $\frac{1}{2} - \frac{1}{3} = x \rightarrow 1 - \frac{2}{3} = 2x \rightarrow \frac{1}{3} = 2x \rightarrow x$   
 $x = \frac{1}{6}$   
Step 3.3:  $\frac{1}{2} = \frac{1}{6} + \frac{1}{6} + \frac{1}{6} = 3 \times \frac{1}{6}$   
Step 3.4:  $\frac{1}{3} = \frac{1}{6} + \frac{1}{6} = 2 \times \frac{1}{6}$   
Step 3.5:  $\frac{1}{2} + \frac{1}{3} = (3 \times \frac{1}{6}) + (2 \times \frac{1}{6}) = (3 + 2) \times \frac{1}{6}$ 

Step 4.1: 
$$\frac{1}{2} = a \times \frac{1}{3} = \frac{3}{2} \times \frac{1}{3}$$
  
Step 4.2:  $\frac{1}{2} + \frac{1}{3} = \left(\frac{3}{2} \times \frac{1}{3}\right) + \frac{1}{3} = \left(\frac{3}{2} + \frac{2}{2}\right) \times \frac{1}{3} = \frac{5}{2} \times \frac{1}{3}$ 

#### **Figure 2. Four Groups of The Solution**

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That is a learning designed to provide diverse opportunities for exploring solutions based on meaning and to discover rules. So, planning for the learning promotes the development of thinking and reasoning about mathematics. The atmosphere is necessary and make sense in terms of experience. The imaging activity is of sense making and problem solving. And, the students' performance affected by dissociation from the solution of mathematics problems and providing accounts of the thinking and reasoning.

Declining student achievement should be an issue to assess attention to mathematics education, especially learning and teaching mathematics. For example, the researcher found that self-confidence in learning mathematics affect the achievement. The attitude towards mathematics stems from the development of early learning, which influences the views of students about mathematics to become more mature. Unfortunately, it appears in the learning that students are still 'imitating from educators, friends themselves, or other sources' in learning mathematics. As stated [41], most adults avoid math or don't even like it often can be traced from their learning experiences.

### AKNOWLEDGMENT

The researcher expressed his gratitude to the colleagues of the Mathematics Education Study Program who had submitted and filled out the instruments of this study. The researcher further acknowledges that teaching andlearning session devoted to immersion in the action research, and at least some follow-up class discussion built into the research model. The researcher compelled to address the acknowledges to be clear weaknesses in the custom designed the learning.First, in representing area of action fewer in number than the other original theorists behind the learning.The greater elaboration of the learning would align more closely with original design.

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