KORESPODEN ARTIKEL

Understanding the Newton Motion Concept Through Qualitative and Quantitative Teaching

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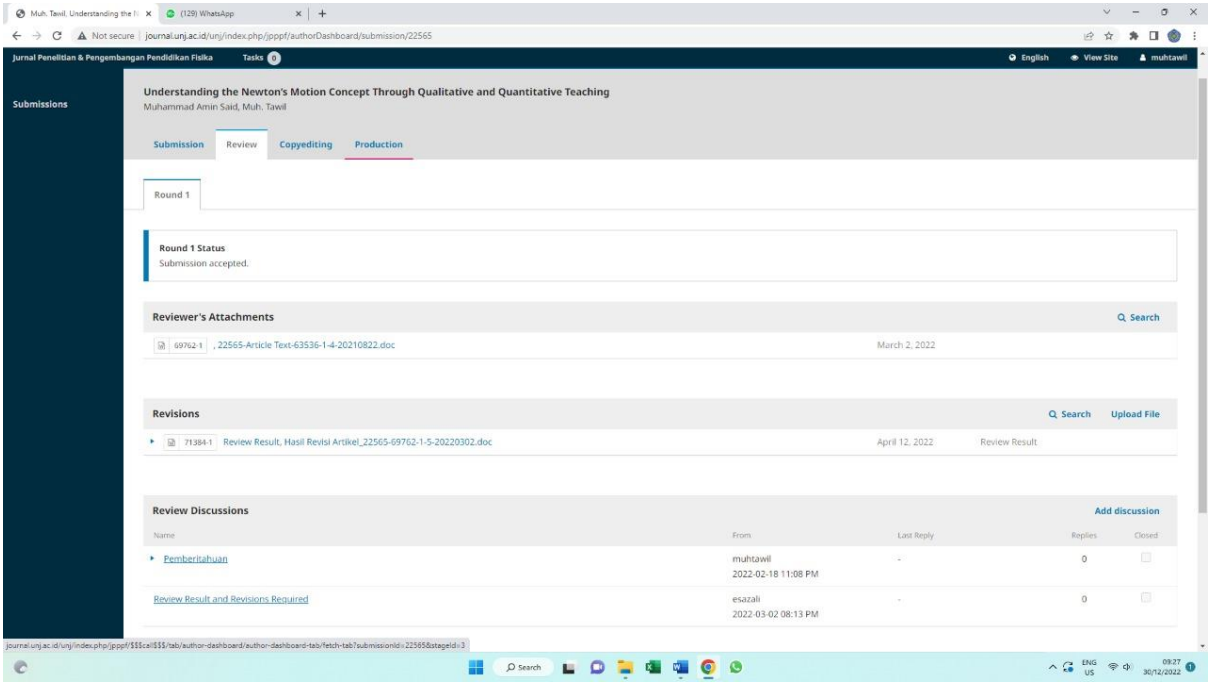

Understanding the Newton Motion Concept Through Qualitative and Quantitative Teaching

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Abstract

This research aims to analyze the influence of qualitative teaching and quantitative pursuit to understanding the concept of motion Newton Student of Science Education Study Program of FMIPA Universitas Negeri Makassar. The main objectives of this study were to obtain information: 1) the characteristics of pretest and posttest results of understanding of Newton's motion concepts of students following qualitative teaching, 2) characteristics of pretest and posttest results of understanding of Newton's motion concepts of students following quantitative teaching, 3) student activities, and 3) a significant difference understanding of Newton's motion concepts of students who follow qualitative teaching and who follow quantitative teaching. Designing mixed methods research, the embedded experimental model, the population of 100 students odd semester 2019/2020 divided into group A of 50 students, and group B as many as 50 students. Data collection techniques using interviews and tests, the data were analyzed qualitatively and quantitatively. The results of the study were found in group A: 1) initial understanding of Newton's concept based on Aristotelian's theory of 30 students (60 percent), Impetus 15 students (30 percent), and Newton's 5 students (10 percent). The posttest result of understanding Newton's concept of motion based on the theory of Aristotle 1 student (2 percent), Impetus theory 4 students (8 percent), and Newton's theory 45 students (90 percent). In group B: 2) early understanding of Newton motion concept based on Aristotelian theory 35 students (70 percent), Impetus theory 10 students (20 percent), and Newton's theory 5 students (10 percent). The posttest result of understanding Newton's concept of motion based on the theory of Aristotle 5 students (10 percent), Impetus theory 35 students (70 percent), and Newton's theory 10 students (20 percent); 3) student activity in following learning included in high category, and 4) There is a significant difference understanding of Newton motion concept of students who follow qualitative teaching and who follow quantitative teaching. The study found that strict mathematical formulations do not foster the ability to comprehend the physical concept qualitatively. Students are generally only interested in solving physics problems that are manipulation of numbers and equations. They are not passionate about the qualitative aspects of mathematical formulations.

Keywords: Qualitative Teaching, Quantitative Teaching, Understanding, Concept, Newton's, Motion.

INTRODUCTION

Effective teaching in a lecture is manifested by the mastery of the material as well as the teaching skills of the lecturer's. Of course the type of material taught will greatly color the way of delivering the material. This is often less realized by the lecturers, resulting in less interesting lectures, especially in the eyes of a quality that is considered difficult, such as physics. As a result students lack understanding of the concepts of physics.

Concepts in physics are generally formulated from the general impression of the observed natural phenomena of everyday life. Such common impression is usually firmly embedded so it is very difficult to be influenced or changed. Unfortunately, such general impression or intuition is not always consistent with the facts of physics (Druxes, 1983; Benjamin Crowell,2008). In the case of

motion, for example, if a student holds a ball while walking, then he releases the ball, there will be three possible trajectory that the ball takes when it falls to the ground. Our general impression will be that the ball is falling straight down or even moving backwards. Physically, the forward parabolic ball path due to the combination of student translational motion with the motion of the ball accelerated downward due to gravitational pull.

In today's physics, the concept of motion can be grouped in three major sections: Aristotelian's theory, Impetus theory, Newton's theory (Aristotle, 2014;Arcangelo Quintaneiro, 2015; Jasroslaw Olesiak, 2015). The first two theories, Aristotelian's theory and Impetus theory were abandoned by students. The accepted theory of motion today is based on Newton's theory, commonly called Newtonian (Benjamin Crowell, 2008).

If the student university student submitted a case as above or a similar set of cases, the answers given can be grouped according to the three concepts of motion above. This grouping is not influenced by whether the student has obtained a mechanics course or not. The results of McCloskey (1983) and Muh. Tawil (2016) suggests that the erroneous conception of motion is systematic and based on intuition contrary to Newtonian mechanics (Wheijen CHANG, Beverley BELL and Alister JONES, 2014; Géraldine Poutot, Bernard Blandin, 2015). He also found that even trained students had a false concept of motion.

The fact shows that quantitative teaching of science tends toward the ability of mathematical manipulation, leaving behind the ultimate goal of conceptual understanding (J.C.L. Cornis, 1995; Muh. Tawil, 2011). Understanding the true concept of motion is very important for students, not only to support their learning achievements but also their application in everyday life. For students of science education program, this becomes very important again because as a prospective teacher, they are expected to transfer the correct concept to the students when they served in school.

Based on the above description, the problem in this research is: 1) What are the characteristics of the pretest and posttest results of understanding the Newton motion concept of students following the qualitative teaching?, 2) How are the characteristics of the pretest and posttest results of the understanding of Newton's motion concept following quantitative teaching?, and 3) Are there significant differences in understanding Newton's motion concepts of students who follow qualitative teaching and who follow quantitative teaching?

METHOD

Population in this study all students of science education program semester odd year 2019/2020 which program subjects interaction between physical factor as much as 100 students'. The population is divided into two groups, namely group A students are 50 students and group B students are 50 students.

The research method used is mixed methods research design Embedded Experimental Model (Creswell, Creswell. J. W & Plano Clark,V.L. 2007; Rebecca K. Frels, Anthony J. Onwuegbuzie, Nancy L. Leech, and Kathleen M. T. Collins. 2014) as shown in Fig. 5.

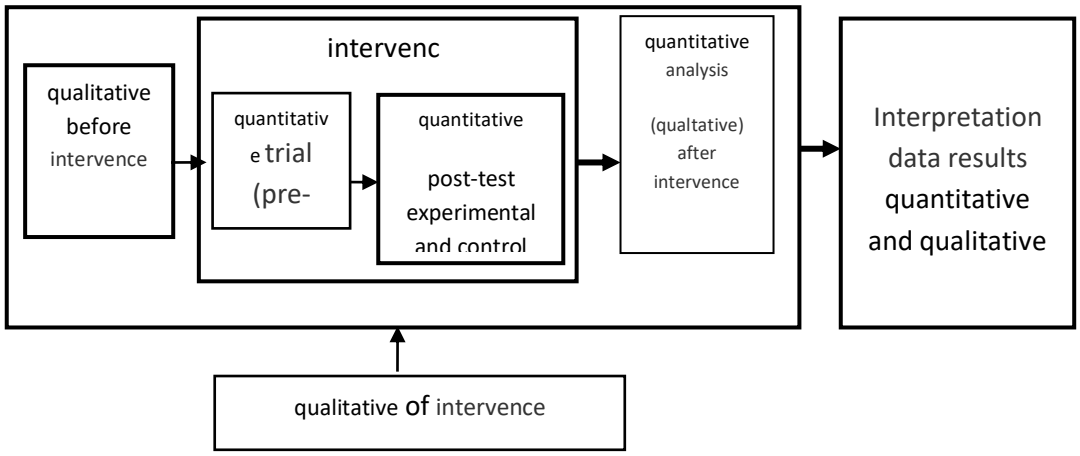


Figure 1. Embedded Experimental Model

The embedded experimental model (Fig. 5) may be the most commonly used variant of the embedded Design (Creswell, Creswell. J. W & Plano Clark,V.L. 2007;Tawil, M, 2017）. This model is defined by having qualitative data embedded within an experimental design (such as a true experiment or a quasi experimental). The priority of this model is established by the quantitative, experimental, methodology. This design can either be used as a two-phase, qualitative data can come before intervention, to shape the intervention, to develop an instrument, select participants, after the intervention (experimental and control group), to explain the results of the intervention or to follow up on the experiences of participants with certain types of outcomes. For the embedded experimental model: 1) the researches must decide at what point in the experimental study to collect the qualitative data (before, during, or after the intervention). This decision should be made based on the intent for the including the qualitative data (e.g., to shape the intervention, to explain the process of participants during treatment, or to follow up on results of the experimental trial), 2) for before-intervention approaches, the researcher needs to decide which qualitative results will be used in the quantitative phase and to consider how to plan the quantitative phase before the qualitative phase has been conducted. Again, the qualitative data collection should be carefully designed to match the intent for including qualitative data, such as to develop an instrument or shape the intervention, 3) for during-intervention approaches, the qualitative data collection may introduce potential treatment bias the affects the outcomes of the experimental, 4) for after-intervention approaches, decisions must be made

about which aspect of the trial will be further explored, and the researcher must specify the criteria used to select the participants for the follow-up data collection.

Stage Before Intervention

Analyze the course syllabus of interaction between physical factors

1. Course syllabus interaction between physical factors. Analysis of the syllabus of recovery interaction between physical factor in science education program Faculty of Mathematics and Natural Sciences Makassar State University. This syllabus has encompassed two stages, namely material analysis of recovery and task analysis.

   The analysis of the recovery materials is intended to select and establish, detail and systematically compile relevant lecture materials to be taught based on competency standards, basic competencies and indicators to be achieved in the recovery of interaction between physics factors.

   The task analysis is aimed at identifying the key indicators needed in the interaction between physics factors and analyzing them in a frame of motion concept that will be developed in the learning device.
2. Analyze student needs. Analysis of student needs that support qualitative and quantitative teaching. Information at this stage is obtained through analysis of the results of preliminary survey on the implementation of teaching interaction between physical factor in science education program Faculty of Mathematics and Natural Sciences Makassar State University.
3. Analysis of learning resources and facilities available in science education program Faculty of Mathematics and Natural Sciences Makassar State University of South Sulawesi. Information at this stage is obtained through analysis of the results of the initial survey on the facilities / infrastructure available to support the implementation of interaction between physical factor lectures, learning media. Based on the analysis of learning resources and facilities, an applied teaching assessment was conducted.

Stage of Competence Formulation

The formulation of competence is intended to convert the competence of the material analysis, and task analysis into sub-competencies (basic competencies), indicators to be achieved, including the indicators of concept comprehension.

Development Stage of subject matter

Activities undertaken at this stage are to develop 1) qualitative and quantitative teaching (syntax, social systems, support systems, and instructional and nurturant effects) taking into account the characteristics of conceptual understanding; 2) learning tools, consisting of lesson plans, student activity sheets; and 3) research instruments (Newton's concept of motion comprehension test, open-ended interviews manual) and qualitative analysis (teaching characteristics applied) using observation sheets.

Research Instrument Development Stage

At this stage two research instruments were developed namely concept comprehension test (ie, Aristotelian theory, Impetus theory, and Newtonian theory), open-ended sheet interviews, and observation sheet. The development of this instrument is based on the indicators of Newton's understanding of concepts. Furthermore, the concept of understanding test in validation by a mechanical expert to know the level of validity and reliability.

The Pretest Stages and Interviews are open-ended

At this stage, pretest and open-ended student interviews are performed in group A, as well as in group B. The test used in the pretest is the comprehension test of Newton's motion concept. Meanwhile, the implementation of open-ended interviews is equipped with a tape recorder. The interview was conducted in 10 stages, each stage of 10 students attending the interview.

Implementation Phase

At this stage activities are carried out:

1. Implement qualitative learning in group A with phases: 1) Presentation of Data and Identification of Concept, 2) Testing Attainment of the Concept, and 3) Analysis of Thinking Strategies. In group B, quantitative study is applied with phases: 1) conveying learning objectives and preparing students, 2) demonstrating knowledge and skills, 3) guiding training, 4) checking understanding and providing feedback, and 5) providing practice and application of concepts. Implement posttest

and student interviews both in group A, as well as in group B. The test used in posttest is a test of understanding the concept of Newton's motion. Meanwhile, the implementation of interviews open-ended interviews are equipped with a tape recorder.

2. Collect and analyze qualitative data and quantitative data (Huey T. Chen. 2006; Daniel R. Johnson. 2011).

Stage of Interpretation

At this phase, all of the data from the quantitative and qualitative and interpretation interpretations are drawn to draw conclusions and report the study results. The subject of this study are all students in academic year 2019/2020 in science education program at one of the State University of Makassar of which during the experiment they took lectures of interaction between physics factors. The instruments in this study were interviews open-ended sheet, and understanding the concept of motion Newton test.

Data analysis is done by referring to research problem. Based on the research problem, data analysis is done in two ways, quantitative and qualitative. To answer the test results of understanding Newton's concept of motion, it used descriptive statistical analysis and inferential analysis using a two-sided "t" test. In addition, to clarify the interpretation of the results of the analysis, data acquisition is also described in the form of diagrams. For the research implementation, the dominant syllabus analysis of interaction between physical factor and student activity is qualitative and has been implied in all series of activities undertaken at each stage of application of qualitative and quantitative teaching. This analysis is performed on all components of the teaching application performed by Bruce Joyce, Marsha Weil, and Showers (syntax, social systems, reaction principles, support systems, and instructional and nurturant effects). While, the quantitative data of the program will be analyzed using inferential statistics (Peter Liebscher. 1988; Frankel, and Wallen, 2009)

RESULTS AND DISCUSSION

Qualitative Before Intervention

1. Characteristics of Interaction Physics Interaction Lecture Materials

   The course syllabus of interaction between physics factor consists of the topic of kinematics and dynamics. Material kinematics, consists of several topics, namely: 1) motion with constant velocity, and 2) motion with changing velocity. While the material dynamics, namely: 1) Newton's first law, 2) Newton's second law, and 3) Newton's third law. Basic competencies, students can understand concepts and analyze: 1) motion, position, distance, and displacement, 2) speed and acceleration, 3) straight motion, 4) vertical motion, parabolic motion, 5) circular motion, 6) Newton's first law , 7) Newton's secon law, and 8) Newton's third law. The indicators, namely the students can find the different concepts of motion: Aristotelian theory, Impetus theory, and Newton. In this study only focused on the topic of kinematics, because on this topic many students cannot understand the concept of motion (Tawil, M, 2015).

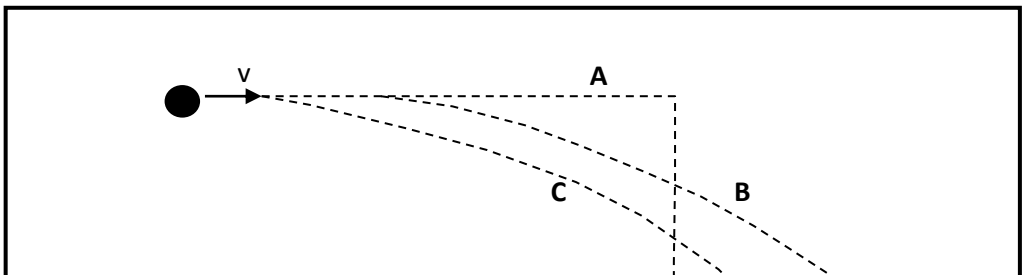
2. Development of Research Instruments

   Based on the indicators of the achievement of teaching objectives, then developed a test of understanding the concept of Newton motion accompanied by an interview sheet, and the observation sheet. Number of question items that meet the validity of 5 items from 10 items of matter with reliability 0.98. While the item of interview sheet that is open-ended adjusted with the number of items a valid question. Observation sheets are adapted to the qualitative and quantitative teaching syntax. The observation sheet comes with an observer filling instruction.

   Items about understanding Newton's concept of motion as following:

Problem-1.

Students are asked to check the path of a projectile fired horizontally from the of a tower. The path formed by the projectile is given as in Fig. 1.Which path is following a projectile?



Interview: Clarify the theory underlying your answer choice?

Problem-2.
Student are required to predict the trajectory of moving objects circular inside a pipe, but after the object leaves the other end pipe as Fig.2. Which path is following a objects?

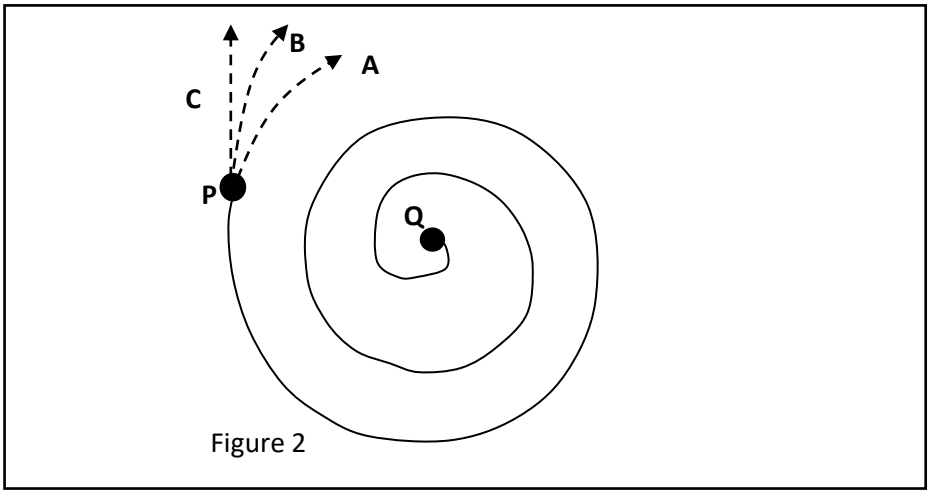


Figure 2

Interview: Clarify the theory underlying your answer choice?
Problem-3
Figure 3, shows an empty round pipe located on a horizontal table without friction. You look from above. A ball is fired into the pipe at point A and the ball leaves the pipe at point B at a high rate. Which track will the ball follow on the table, after leaving the pipe?.

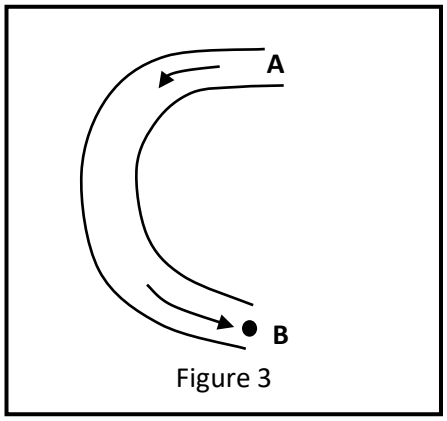
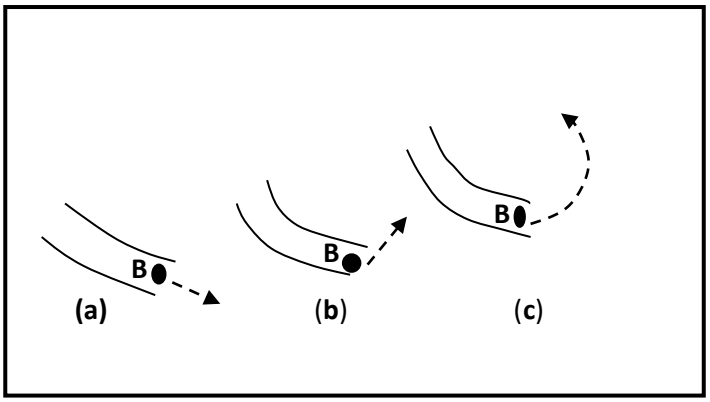


Figure 3



Interview: Clarify the theory underlying your answer choice?

Problem-4

Figure 4, shows a moving X ball. The ball slips down on the AB field, then on the BC tract which is horizontal and without friction. At point C, the ball leaves the track. Ignore air resistance. Which trajectory is following after the ball off from point C?.

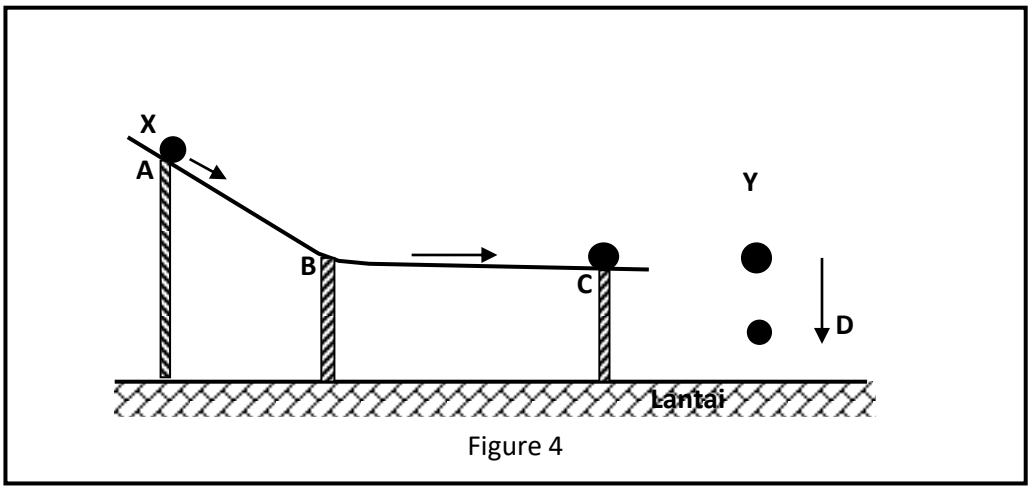
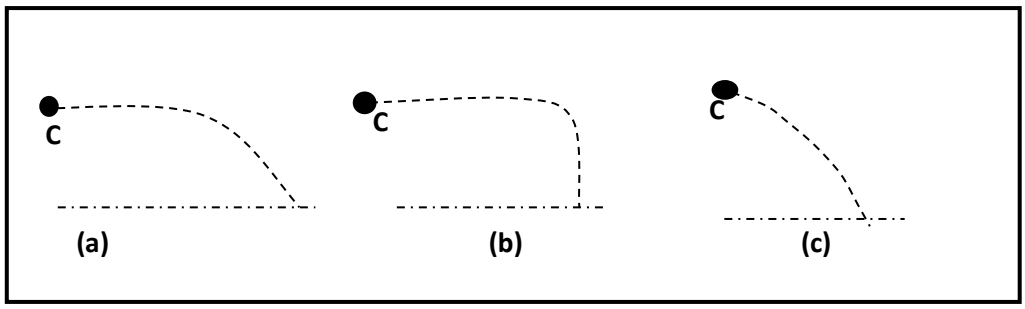


Figure 4



Interview: Clarify the theory underlying your answer choice?

Problem-5

The moon circles the earth continuously in its circular motion. In Figure 5a. Choose one of three answers that fulfill the motion of the month.

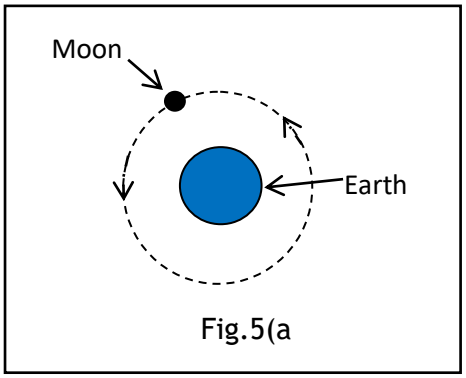
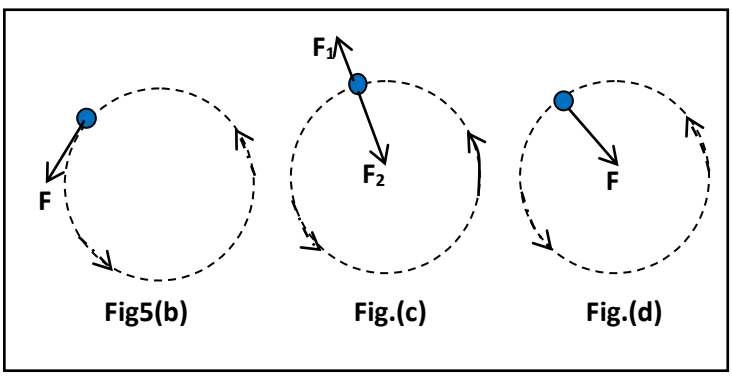


Fig.5(a



Interview: Clarify the theory underlying your answer choice?

3. Characteristics of Qualitative and Quantitative Teaching

Qualitative and quantitative teaching equipped with learning tools and instruments are based on the development of instruction according to Bruce Joyce & Showers, 1992 and James W Drisko, 2016, 1) Syntax: a) orientation, b) student training, c) consolidation, d) evaluation, 2) Social system: cooperation between students and students and lecturers seriously carry out activities in teaching, 3) Management principles: in this teaching, the lecturer acts as facilitator or facilitator. In the overall process of recovery, teachers are tasked with and responsible for maintaining an atmosphere of learning by showing a supportive attitude, 4) support systems: media means to support teaching implementation (computers and teaching devices); 5) instructional and nurturant effects: instructional impacts: understanding the concept of motion, and the nurturant effects is the ability to develop creativity.

Apply qualitative and quantitative teaching by following the teaching syntaxes that have been made. Implementation of this teaching is expected to improve understanding of Newton student's motion concept.

4. **Respondent Characteristics**

The cognitive abilities of respondents who follow qualitative and quantitative teaching are assumed to be homogeneous. The average cumulative grade point average of respondents was 3.20 in the odd semester of 2019/2020, and their social skills were very good, it was shown to communicate, cooperate in problem solving, responsible, and discipline following the recovery, the average percentage of their attendance fulfilled the policy and regulation academic of Universitas Negeri Makassar in chapter 5, related lectures, study period, and academic leave article 21 paragraph (4) stating that every student can take the final exam of a semester after taking 80% of lecture.

The average high-level thinking skills, especially the skills of the science process and the creative thinking skills of the students who follow the lectures are high category (Tawil,M, 2013a Tawil,M, 2013b).

Quantitative Premeasure Results

Group A Pretest results

Table 1. Aristotelian Theory Results

Problem	Answer	Number of respondents	Percentage
1.	A	10	20
2.	A	5	10
3.	A	5	10
4.	B	5	10
5.	B	5	10

	Amount	30	60

Interview Results

After the respondents completed the question of pretest, then interviewed, in table 3 found that there are 30 students or 60 percent who still use the theory of Aristotle.

Problem-1, there are 10 students or 20 percent of students choose answer A on the ground that the rifle gives a large thrust force to the bullet that overcomes its gravity. As a result projectil straighter. But the force of the thrust is slowly shrinking and its gravity pulls the bullet down into the ground in a straight line. In such an opinion, the meaning of the natural projektile motion that is always falling to earth to its proper place.

Problem-2, there are 5 students or 10 percent of students choose answer A on the grounds that this motion is like project motion, they argue that there is a force that keeps the object moving circularly when it escapes from the mouth of the pipe at point P, and follows A slowly discharged and causing a stationary object.

Problem-3, there are 5 students or 10 percent of students choose answer A on the grounds that there is a force that keeps the object moving away leaving the path from point B slowly discharged and causing the stationary object.

Problem-4, there are 5 students or 10 percent of students choose answer B on the grounds that there is a large thrust to the object that is gliding and the force overcomes the gravity, consequently the object moves straight. However, the thrust is slowly shrinking and its gravity pulls it down to the ground in a straight line.

Problem-5, there are 5 students or 10 percent of students choose answer B on the grounds that the Centripetal force and the large centrifugal force are each equal and keep the moon in a circular motion. As a result of such a concept, the resultant force is zero, then the moon will move straight uniformly (straight with fixed velocity).

Table 2. Impetus Theory Results

Problem	Answer	Number of respondents	Percentage
1.	B	3	6
2.	B	2	4
3.	A	3	6
4.	A	2	4
5.	B	5	10
	Amount	15	30

Interview Results

After the respondents completed the question of pretest, then interviewed, in table 4 found that there are 15 students or 30 percent who still use impetus theory.

Problem-1, there are 3 students or 6 percent of students choose answer B on the grounds that the project will move straight for a moment then form a parabola due to earth's gravity.

Problem-2, there are 2 students or 4 percent of students choose answer B on the grounds that after loose at point P, the object loses a circular force so it moves straight. But because the object tends to maintain its motion, so that the object is in a circular motion. This opinion seems to be based on Newton's first law but with a misconception.

Problem-3, there are 3 students or 6 percent of students choose answer A on the grounds that there is a force that pushes things to move straight leaving the path from point B which is slowly exhausted and causes a stationary object.
Problem-4, there are 2 students or 4 percent of students choose answer A on the grounds that there is a large thrust to the object moving straight for a moment then forming a parabola due to earth's gravity.
Problem-5, there are 5 students or 10 percent of students choose answer B on the grounds that there is a force towards the motion so that the moon moves in a circle.

Table 3. Newton's Theory Results

Problem	Answer	Number of respondents	Percentage
1.	C	1	2
2.	C	1	2
3.	B	1	2
4.	C	1	2
5.	D	1	2
	Amount	5	10

Interview Results

After the respondents completed the question of pretest, then interviewed, on table 5 found that there are 5 students or 10 percent who use Newton's theory.
Problem-1, only 1 student or 2 percent of students chose C, they argue that project motion is affected by two velocity vectors Vx and Vy, the resultant $= \sqrt{v_x^2 + v_y^2 + 2v_x v_y cos\alpha}$, so the path taken by the projektil is the path C.
Problem-2, only 1 student or 2 percent of students choose answer C on the grounds that the velocity of the object is always tangential and perpendicular to the radius of the circle.
Problem-3, only 1 student or 2 percent of students choose answer B on the grounds that there are forces acting on the object causing changes in the direction of velocity and resulting in acceleration. The acceleration is always directed to the center of the circle, while the velocity velocity likes the offensive path or the tangential direction.
Problem-4, only 1 student or 2 percent of students choose answer C on the grounds that project motion is influenced by two velocity vectors Vx and Vy, the resultant is $V = \sqrt{v_x^2 + v_y^2 + 2v_x v_y cos\alpha}$, so the path which is pursued by a parabolic-shaped projectile.
Problem-5, only 1 student or 2 percent of students choose answer D on the grounds that there is only a perpendicular Centripetal force in the direction of speed so that this force only deflects the Moon and does not accelerate or slow down its motion rate.

Group B Pretest results

Table 4. Aristotelian Theory Results

Problem	Answer	Number of respondents	Percentage
1.	A	5	10
2.	A	5	10

3.	A	10	20
4.	B	5	10
5.	B	10	20
	Amount	35	70

Interview Results

After the respondents solve the pretest problem, then interviewed, in table 6 found that there are 35 students or 70 percent who still use the theory of Aristotele's.

Problem-1, there are 5 students or 10 percent of students choose answer A on the grounds that the shotgun gives a large thrust force to the bullet that overcomes its gravity. As a result projectil straighter. But the thrust is slowly shrinking and its gravity pulls the bullet down into the ground in a straight line.

Problem-2, there are 5 students or 10 percent of students choose answer A, they argue that there is a force that keeps the object moving circularly when it escapes from the mouth of the pipe at point P, and follows the A path slowly discharged and finally the stationary object .

Problem-3, there are 10 students or 20 percent of students choose answer A on the grounds that there is a force that keeps the object moving away leaving the path from point B slowly discharged and finally the stationary object.

Problem-4, there are 5 students or 10 percent of students choose answer B on the grounds that there is a large thrust to the moving object and the force overcomes the gravity, consequently the object moves straight. However, the thrust is slowly shrinking and its gravity pulls it down to the ground in a straight line.

Problem-5, there are 10 students or 20 percent of students choose answer B on the grounds that the Centripetal force and the large centrifugal force are each the same and keep the moon moving circularly.

Table 5. Impetus Theory Results

Problem	Answer	Number of respondents	Percentage
1.	B	2	4
2.	B	2	4
3.	A	2	4
4.	A	2	4
5.	B	2	4
	Amount	10	20

Interview Results

After the respondents solve the pretest problem, then interviewed, in table 7 found that there are 10 students or 20 percent who still use impetus theory.

Problem-1, there are 3 students or 6 percent of students choose answer B on the grounds that the project will move straight for a moment then form a parabola due to earth's gravity.

Problem-2, there are 2 students or 4 percent of students choose answer B on the grounds that after loose at point P, the object loses a circular force so it moves straight. But because the object tends to

maintain its motion, so that the object is in a circular motion. This opinion seems to be based on Newton's first law but with a misconception.
Problem-3, there are 3 students or 6 percent of students choose answer A on the grounds that there is a force that pushes things to move straight leaving the path from point B which is slowly exhausted and causes a stationary object.
Problem-4, there are 2 students or 4 percent of students choose answer A on the grounds that there is a large thrust to the object moving straight for a moment then forming a parabola due to earth's gravity.
Problem-5, there are 5 students or 10 percent of students choose answer B on the grounds that there is a force towards the motion so that the moon moves in a circle.

Table 6. Newton's Theory Results

Problem	Answer	Number of respondents	Percentage
1.	C	1	2
2.	C	1	2
3.	B	1	2
4.	C	1	2
5.	D	1	2
	Amount	5	10

Interview Results
After the respondent completed the pretest problem, then interviewed, on table 8 found that there are 5 students or 10 percent who use Newton's theory.
Problem-1, only 1 student or 2 percent of students chose C, they argue that project motion is affected by two velocity vectors Vx and Vy, the resultant $= \sqrt{v_x^2 + v_y^2 + 2v_x v_y cos\alpha}$, so the path taken by the projektil is the path C.
Problem-2, only 1 student or 2 percent of students choose answer C on the grounds that the velocity of the object is always tangential and perpendicular to the radius of the circle.
Problem-3, only 1 student or 2 percent of students choose answer B on the grounds that there are forces acting on the object causing changes in the direction of velocity and resulting in acceleration. The acceleration is always directed to the center of the circle, while the velocity velocity likes the offensive path or the tangential direction.
Problem-4, only 1 student or 2 percent of students choose answer C on the grounds that project motion is influenced by two velocity vectors Vx and Vy, the resultant is $V = \sqrt{v_x^2 + v_y^2 + 2v_x v_y cos\alpha}$, so the path which is pursued by a parabolic-shaped projectile.
Problem-5, only 1 student or 2 percent of students choose answer D on the grounds that there is only a perpendicular Centripetal force in the direction of speed so that this force only deflects the Moon and does not accelerate or slow down its motion rate.
Furthermore, resume analysis of understanding the concept of motion before the intervention as in Table 7.

Table 7. Resume Understanding Motion Concepts

Group	Percentage of Understanding Movement Concept	Amount

	Aristotelean	Impetus	Newton's	
A	60	30	10	100
B	70	20	10	100

Qualitative During Intervention

Observation Result of Lecturer Activity

The implementation of Semester Course Plan (SCP) during qualitative and quantitative teaching activities is observed by 3 (three) observers. Observations made by the observer are written in the observation sheet of the implementation of SCP. The results of observation indicate that the level of implementation of the RPS of each meeting consisting of the preliminary stage, the core stage of teaching, the stabilization stage and the closing stage is very good. Lecturers do not experience difficulties in implementing teaching either in group A or group B.

Observation Result of Student Activity

The results of observation indicate that the level of student activity during the teaching which consists of the introduction stage, the core stage of teaching, the stabilization stage and the closing stage is very good.

Student activity in group A in comprehending every topic of motion material, studied qualitatively the theories underlying the concepts studied. This is done both individually and in groups. Interaction between groups with other groups is very dynamic. Meanwhile, in group B, students in understanding every topic of motion, studied by applying formulas in solving the problems studied. This is done both individually and in groups. Interaction between groups with other groups is very dynamic (Özlem ATEŞ and Ali ERYILMAZ. 2011; Daniel Kilburn, Melanie Nind & Rose Wiles. 2014).

Quantitative Postmeasure

Group A Posttest Results

Table 8. Aristotelian Theory Results

Problem	Answer	Number of respondents	Percentage
4.	B	1	2
	Jumlah Total	1	2

Interview Results

After the respondent solve the posttest problem, then interviewed, in table 10 found that only 1 student or 2 percent who still use Aristotelian theory.

Problem-4, only 1 student or 2 percent of students choose answer B with the reason remains the same before given treatment, it is assumed the student has not been able to improve the concept that has been understood.

Table 9. Impetus Theory Results

Problem	Answer	Number of respondents	Percentage

1.	B	1	2
2.	B	1	2
3.	A	2	4
	Amount	4	8

Interview Results

After the respondent solve the posttest problem, then interviewed, on table 11 found that there are 4 students or 8 percent who still use impetus theory.

Problem-1, only 1 student or 2 percent of students chose answer B on the grounds that the projectil will move straight for a moment then form a parabola due to earth's gravity.

Problem-2, only 1 student or 2 percent of students choose answer B on the ground that after loose at point P, the object loses a circular force so it moves straight. But because the object tends to maintain its motion, so that the object is in a circular motion. This opinion seems to be based on Newton's first law but with a misconception.

Problem-3, there are 2 students or 4 percent of students choose answer A on the grounds that there is a force that pushes things to move straight leaving the path from point B that gradually runs out and causes a stationary object.

Table 10. Newton's Theory Results

Problem	Answer	Number of respondents	Percentage
1.	C	10	20
2.	C	20	40
3.	B	10	20
5.	D	5	10
	Amount	45	90

Interview Results

After the respondent completed the posttest problem, then interviewed, in table 12 found that there are 45 students or 90 percent who use Newton's theory.

Problem-1, there are 10 students or 20 percent of students choose C's answer, they argue that project motion is affected by two velocity vectors Vx and Vy, the resultant $V = \sqrt{v_x^2 + v_y^2 + 2v_x v_y cos\alpha}$, the path taken by the projectile is the path C.

Problem-2, there are 20 students or 40 percent of students choose answer C on the grounds that the velocity of the object is always tangential and perpendicular to the radius of the circle.
Problem-3, there are 10 students or 20 percent of students choose answer B on the grounds that there are forces acting on the object causing changes in the direction of velocity and resulting in acceleration. The acceleration is always directed to the center of the circle, while the velocity velocity likes the offensive path or the tangential direction.
Problem-5, there are 5 students or 10 percent of students choose answer D on the grounds that there is only a Centripetal force that is always upright in the direction of speed so that this force only deflects the Moon and does not accelerate or slow down the rate of its motion.

Group B Posttest Results

Table 11. Aristotelian Theory Results

Problem	Answer	Number of respondents	Percentage
1.	A	1	2
2.	A	1	2
3.	A	1	2
4.	B	1	2
5.	B	1	2
	Jumlah	5	10

Interview Results
After the respondent completed the posttest problem, then interviewed, on table 13 found that there are 5 student's or 10 percent who still use Aristotelian theory.
Problem-1, there is 1 student or 2 percent of students choose answer A on the ground that the rifle gives a large thrust force to the bullet that overcomes the gravity. As a result projectile straighter. But the thrust is slowly shrinking and its gravity pulls the bullet down into the ground in a straight line.
Problem-2, there is 1 student or 2 percent of students choose answer A, they argue that there is a force that keeps the object moving circularly when it escapes from the mouth of the pipe at point P, and follows the A path slowly exhausted and finally the stationary object .
Problem-3, there is 1 student or 2 percent of students choose answer A on the grounds that there is a force that keeps the object moving away leaving the path of point B which is slowly exhausted and finally the stationary object.
Problem-4, there is 1 student or 2 percent of students choose answer B on the grounds that there is a large thrust to the moving object and the force overcomes the gravity, consequently the object moves straight. However, the thrust is slowly shrinking and its gravity pulls it down to the ground in a straight line.
Problem-5, there are 1 student or 2 percent of students choose answer B on the grounds that the centriptive force and the large centrifugal force are each equal and keep the moon moving circularly.

Table 12. Impetus Theory Results

Problem	Answer	Number of respondents	Percentage

1.	B	5	10
2.	B	5	10
3.	A	10	20
4.	A	10	20
5.	B	5	10
	Amount	35	70

Interview Results

After the respondent completed the posttest problem, then interviewed, on table 14 found that there are 35 students or 70 percent who still use impetus theory.

Problem-1, there are 5 students or 10 percent of students choose answer B on the grounds that the project will move straight for a moment then form a parabola due to earth's gravity.

Problem-2, there are 5 students or 10 percent of students choose answer B on the grounds that after loose at point P, the object loses a circular force so it moves straight. But because the object tends to maintain its motion, so that the object is in a circular motion. This opinion seems to be based on Newton's first law but with a misconception.

Problem-3, there are 10 students or 20 percent of students choose answer A on the grounds that there is a force that pushes things to move straight leaving the path from point B which gradually runs out and causes a stationary object.

Problem-4, there are 10 students or 20 percent of students choose answer A on the grounds that the existence of a large thrust force to the object moves straight a few moments then form a parabola due to earth's gravity.

Problem-5, there are 5 students or 10 percent of students choose answer B on the grounds that there is a force towards the motion so that the moon moves in a circle.

Table 13. Newton's Theory Results

Problem	Answer	Number of respondents	Percentage
1.	C	2	4
2.	C	3	6
3.	B	2	4
4.	C	1	2
5.	D	2	4
	Amount	10	20

Interview Results

After the respondent completed the posttest problem, then interviewed, in table 15 found that there are 10 students or 20 percent who use Newton's theory.

Problem-1, there are 2 students or 4 percent of students choose answer, they argue that project motion is affected by two velocity vectors Vx and Vy, the resultant $V = \sqrt{v_x^2 + v_y^2 + 2v_x v_y cos\alpha}$, so the path taken by the projectile is the path C.
Problem-2, there are 3 students or 6 percent of students choose answer C on the grounds that the velocity of the object is always tangential and perpendicular to the radius of the circle.
Problem-3, only 2 students or 4 percent of students chose answer B on the grounds that there is a force acting on the object causing a change in the direction of velocity and resulting in acceleration. The acceleration is always directed to the center of the circle, while the velocity velocity likes the offensive path or the tangential direction.

Problem-4, only 1 student or 2 percent of students choose answer C on the grounds that project motion is influenced by two velocity vectors Vx and Vy, the resultant is $V = \sqrt{v_x^2 + v_y^2 + 2v_x v_y cos\alpha}$,, so the path which is pursued by a parabolic-shaped projectile.

Problem-5, there are 2 students or 4 percent of students choose answer D on the grounds that there is only a perpendicular senripital force in the direction of speed so that this force only deflects the Moon and does not accelerate or slow down the rate of its motion.

Furthermore, resume analysis results understanding of the concept of motion after the intervention as in Table 14.

Table 14. Resume Understanding Motion Concepts

Group	Percentage of Motion Concept Understanding			Amount
	Aristotelean	Impetus	Newton's	
A	2	8	90	100
B	10	70	20	100

Inferential Quantitative Analysis Result
Testing Data Normality Understanding Group Motion Concept A Group

1. The test results show that $\chi^2_{hitung} = 4.78 < \chi^2_{(0.95)(3)} = 7.81$ which means that the understanding data of student movement concept of group A comes from normal distributed population with the level of trust α = 0.05.
2. Testing Data Normality Understanding Student Movement Concept Group B
   The test results show that $\chi^2_{hitung} = 6.61 < \chi^2_{(0.95)(3)} = 7.81$ which means that the students' group motion concept understanding data comes from normal distributed popups with the level of trust α = 0.05
3. Homogeneity Testing of Variance
   The result of testing of motion concept comprehension data for student of group A and student group B shows F=1.51<$F_{0.01(49,49)} = 1.96$. This means Ho is accepted, and thus the concept of motion understanding data has a homogeneous variance.
4. Hypothesis testing
   Test results show that $t_h = 7.01 > t_{(0.975)(98)} = 2.01$. This means Ho is rejected and thus on average the ability to understand the concept of motion based on Newton's theory differs between student group A and student group B.

Qualitative After Intervention
Interpretation Based on Qualitative and Quantitative Results

Based on the analysis of the understanding of the concept of motion of students of science education program Faculty of Mathematics and Natural Sciences of Makassar State University found that the pretest result of understanding the concept of motion according to Aristotle's theory in Table 7 group A compared to group B only differ 10 percent, so also aspect of understanding of motion according to Impetus theory, and Newton's theory of motion understanding is the same. This shows that student's in group A and group B ability understanding of the concept of motion is homogeneous.

The results of the analysis in Table 7 also provide information that many students use Aristotelean theory concepts and Impetus theory (90 percent) in explaining the concept of motion compared with using Newton's theory (10 percent). It is assumed that the students acquire the knowledge at the time of studying physics in high school or at the time of the students attending basic physics in semester three. The implementation of this pretest is done in the fifth semester, it means that the ritual of understanding the concept can last 2-3 years.

Interview result found that the explanation expressed by students both group A and group B on every aspect of Aristotelean, Impetus, and Newton's theory is generally not much different. These findings indicate that the mindset of the students is not much different in giving an explanation on any phenomenon of motion either parabolic motion and circular motion. Student explanation by using Aristotelean theory to parabolic motion phenomenon and circular motion more accelerate approach (acceleration) can be obtained by enlarging the force. The weight gain of the object will make it closer to its proper place and when no force works, the object will immediately be silent. Every moving object always gets a force boost from the outside, this force force will be passed on to the object. The moving object has a centripetal force and centrifugal force in keeping the object moving circularly. Students in explaining the phenomenon of parabolic motion and circular motion, more explain by using impetus theory by involving the effects of gravity in pulling the object down and the impetus pushing the object so that it moves horizontally and this motion has air resistance causing the object to move slowly and eventually impetus exhausted, so it falls naturally. Circular motion of the object gets a motion-shifting style.

Student explanation by using Newton's theory of parabolic motion phenomenon and circular motion is more to do a combination approach between scale motion and motion constant with accelerated motion toward the center of the earth, so that the path taken is always parabolic-shaped symmetrical. Movement of the object at such a constant speed along the path causes acceleration. Acceleration is always directed to the center of the circle, while vector speed always offensive trajectory or tangential direction.

Based on the posttest result after the intervention as in table 16, it was found that the average score of the students' motion concept understanding that followed the qualitative teaching (group A) was better than the students who followed the quantitative teaching (group B). The test item analysis of the concept of motion shows that about 90 percent of students from group A are in the Newtonian category and only 20 percent of students from group B are in the same category.

Similarly, the category of student impetus from group A is only 8 percent lower than group B of about 70 percent. In the Aristotelean category, students in group A are only 2 percent much smaller than in group B in the same category. This finding is interesting to note that the Aristotelean concept has been largely abandoned by students who follow qualitative teaching and a belief system of sedimentary motion phenomena in impetus theory.

Students who follow quantitative pursuits can generally bring Newton's laws well in quantitative terms. However, many of them fail to apply it in different situations and tend to correspond with the concept of impetus in expressing phenomena such as force, momentum, gravity, and free particles. Even in understanding the projectile and circular motions they are caught in the understanding of the concept of impetus.

Presentation of courses by applying qualitative and quantitative teaching among others is expected to give birth to the correct concept of motion and erode the system of Aristotle's understanding and impetus. This hope is not fully fulfilled. Michel MeCloskey (1983) points out that although Newton's laws are well-known, the results show that 30 percent of college students who have received a mechanics course are still inclined to hold the theory born 3 centuries before Newton. More than 50 percent of college students who have not attended college of mechanics believe that the behavior of moving objects is contrary to Newton's laws. Similar research was conducted by Ibrahim Abou Halloun and David Hestenes (1985). They found that 18 percent of respondents were Aristotelean

dominated, 65 percent impetus, and the remaining 17 percent were dominated by Newtonians. However, they also found that almost every student used a mixture of such concepts, and appeared disobedient in applying the same concept to different situations. Similarly, the results of Subaer's (1997); Cristina S. Papachristou, (2014) study found that students who had studied physics about 10 percent were Aristotelean dominated, 86 percent impetus systems, and 4 percent of Newtonian systems.

The findings of impetus theory in explaining circular motion, many teachers or lecturers, and students, as well as textbooks say that there are two forces acting on a circular object in sequence, the centripetal and centrifugal forces in which the two forces are equal but opposite. This explanation is wrong! Suppose that is true: the two forces will abolish each other, then the resultant force (in the horizontal plane) is zero, then the object will move straight irregularly instead of circular motion (Newton's Law I).

Newton's forces are always the influence of one thing on another. For example, the Earth's influence on the object (the force of gravity), or the wheel on the road (compressive force), or the road on the wheel (friction). So the origin of the style always lies in other objects. But where does the centrifugal force come from? We cannot show objects that do centrifugal force, then centrifugal force does not exist. The emergence of the idea of centrifugal force in circular motion is thought to be derived from a misunderstanding of Newton's Law III which can be formulated as follows: any object subjected to force F will give an interaction of force F equal to F, but in opposite directions and both styles are different.

For circular moving objects, clearly the Fc centric force, students automatically look for a style opposite to Fc. However, the two styles meant in Newton's law do not work on the same, but on different things.

This centrifugal force may also be derived from the experience of everyday students. For example, when students ride a car or bus that is turning a corner, students feel pushed out. Student’s, said that there is an outward force (centrifugal force) that works on us. But, not so, according to Newton I law, all things tend to move in a straight path.

In teaching the concept of a circle, it must be emphasized that the force generated acting on a circular object is a force observed by a silent observer and outside the system, not a force "perceived" by a self-circling object. If the word centripetal always creates a "centrifugal force", we can say other words like "central force". For "centripetal acceleration" we can use "central acceleration".

All the questions about student parabola motion tend to explain the direction of the motion of the direction of motion even though there is only a downward force of gravity. Students use the impetus style that sold well in the days before Newton (Benjamin Crowell, 2008). The impetus theory says that moving objects require force in the direction of motion(Daniel Gile, 1995). Objects moving at a steady pace also require a force in the direction of motion (contrary to Newton I law). The impetus idea fits better with everyday experience than Newton's law I. In our experience all things always need a force to maintain its speed. If there is no style, all things in this world will stop. Newton solved it with friction, but that was a fairly abstract solution. Because Newton explicitly takes into account the frictional force, he also succeeds in painting the movements of celestial bodies with the assumption that in space friction can be ignored.

Based on the answers of students who have been found both in the review before and after following the teaching of qualitative and quantitative it is possible to categorize the concept of motion that settles in their understanding. The large number of students who still embrace impetus theory shows that the teaching of mechanical material still needs to be studied more deeply by involving the deepening of the concept qualitatively, compared with the quantitative teaching. Although the concept of physics in general can be understood through various parameters that are strung together in some equations, but students tend to have difficulty translating mathematical symbols qualitatively (Chams-eddine Khiari, 2011).

CONCLUSION

Quantitative analysis results, it was found that students who follow the teaching of qualitative understanding of motion concept differ significantly with students who follow quantitative teaching. This means that qualitative teaching is one of the types of teaching that can be applied in the recovery to overcome the problem of student concept understanding. Students who follow quantitative teaching more focused to make problems by applying formulas without realizing that conceptual understanding is also very important in solving different kinds of problems.

The improvement of the phenomena found in this study should be done in a total and systematic manner. Total in terms of material and presentation of lectures harmonize the qualitative and quantitative. Systematic in the sense of students should be given certain exercises to change the perception of motion that they believe. Such exercises can include observation activities, simple experiments, and simulations of physical phenomena. Teaching is focused on conceptual knowledge rather than calculation because the concept must be mastered before its use in calculation (Erdat Cataloglu and Salih Ates. 2013). Thus the mastery of basic concepts becomes the main objective of the physics curriculum, both in high school and at the University.

REFERENSI

Aristotle. Metaphysics**.** Translated by R. P. Hardie and R. K. Gaye.

Benjamin, C., 2008, *Newtonoian Physics.* California: Fulletron.

Brown, M., 2009, A Comparative Study of Aristotle and Edmund Husserl's Analyses of Time**.** UW-*L Journal of Undergraduate Research XII (2009)*

Cataloglu, E., & Ates, S., 2013, The Effects Of Cognitive Styles On Naïve Impetus Theory Application Degrees Of Pre-Service Science Teachers. *International Journal of Science and Mathematics Education*. National Science Council, Taiwan 2013.

Chang, W., Bell, B., & Jones, A., 2014, Historical development of Newton's laws of motion and suggestions for teaching content**.** *Asia-Pacific Forum on Science Learning and Teaching*, Volume 15, Issue 1, Article 4, p.1 (Jun., 2014).

Chen, H. T., 2006, A Theory-Driven Evaluation Perspective on Mixed Methods Research *Research In The Schools* 2006, Vol. 13, No. 1, 75-83. Mid-South Educational Research Association.

Cornish, J. C. L., 1985, *Handout of Introduction to Physics.* Murdoch University. Australia.

Daniel, E., 2016, The Usefulness of Qualitative and Quantitative Approaches and Methods in Researching Problem-Solving Ability in Science Education Curriculum. *Journal of Education and Practice*. www.iiste.org ISSN 2222-1735 (Paper) ISSN 2222-288X (Online) Vol.7, No.15, 2016.

Drisko, J. W., 2016, Teaching Qualitative Research: Key content, course structures, and recommendations. *QWS. SAGE. Qualitative Social Work* 2016, Vol. 15(3) 307–321.

Druxes, H., Born, G., & Siemsen, F., 1983, *Kompendium Didaktik Fisika* (terjemahan). CV. Remaja Karya. Bandung.

Espinoza, F., 2005, An analysis of the historical development of ideas about motion and its implications for teaching. *IOP* Publishing Ltd Physics Education 40(2). www.iop.org/joumals/physed.

Frels, R. K., Onwuegbuzie, A, J., Leech, N. L., & Collins, K. M. T., 2014, Pedagogical Strategies Used by Selected Leading Mixed Methodologists in Mixed Research Courses.*The Journal of Effective Teaching an online Journal Devoted to Teaching Excellence*. Vol. 14, No. 1, 2014.

Graney, C. M., 2013, Mass, Speed, Direction: John Buridan's 14th century concept of momentum. *The Physics Teacher* for published version.

Gile. D., 1995, Interpretation Research: A New Impetus**?** *Hermes, Journal of Linguistics* No. 14.

Gorard, S., 2012, Mixed Methods Research in Education: *Report from the March Seminar 2012. Programme Norwegian Educational Research* towards 2020 - UTDANNING2020

Halloun, I. A., & Hestenes, D., 1985. Common Sense Concepts About Motion. *America Journal of Physics,* 53, 115,pp.1058-1065.

Halloun, I. A., & Hestenes, D., 1985, The Initial Knowledge State of College Physics Student's. *America Journal of Physics,* 53,pp.1043.

Johnson, D. R., 2011, *A Quantitative Study of Teacher Perceptions of Professional Learning Communities' Context, Process, and Content*. Seton Hall University Dissertations and Theses.

Kilburn, D., Nind, M., & Wiles, R., 2014, Learning as Researchers and Teachers: The Development of a Pedagogical Culture for Social Science Research Methods?. *British Journal of Educational Studies*.Vol. 62, No. 2, June 2014, pp. 191–207. University of Southampton Published online: 26 Jun 2014.

Khiari, C. E., 2011, Newton's Laws Of Motion Revisited: Some Epistemological And Didactic Problems. Edvcatio Physicorvm. PACS: 01. 40. Fk, 45.20.dc. ISSN 1870-9095

Kyris, G., 2012, The European Union and the Cyprus problem: a story of limited impetus. *Eastern Journal Of European Studies* Volume 3, Issue 1, June 2012.

Liebscher, P., 1998, Quantity with Quality? Teaching Quantitative and Qualitative Methods in an LIS Master's Program. Peter Liebscher, Palmer School of Library and Information Science, Long Island Univer- sity, 720 Northern Boulevard, Brookville, NY 11548 LIBRARY TRENDS, Vol. 46, No. 4, Spring 1998, **pp.** 668-680 *0*1998 The Board of Trustees, University of Illinois.

Machtmes, K., Johnson, E., Fox, J., Burke, M. S., Harper, J., 2009, Teaching Qualitative Research Methods through Service-Learning. *The Qualitative Report*. Volume 14 | Number 1.

McCloskey, M., Washburn, A., & Felch, L., 1983, *Intuitive Physics.* Scientific American, 248,pp. 114-130.

Ohanian, H. C., 1985, *Physics.* W.W. Norton Company & Inc. New York.

Olesiak, J., 2015, Nature and Necessity in Aristotele's Physics. *Studia Phylosophie* Cristianae*. UKSW*. 51(2015)1.

Papachristou, C. J., 2016, *Foundations of Newtonian Dynamics: An Axiomatic Approach for the Thinking Student*. Department of Physical Sciences, Hellenic Naval Academy, Piraeus 18539, Greece.

Papachristou, C. S., 2014, Aristotle's Theory of 'Sleep and Dreams' in the light of Modern and Contemporary Experimental Research. *Electronic Journal For Philosophy*.ISSN 1211-0442. University of Economics Prague.

Poutot, G., & Blandin, B., 2015, Exploration of Students' Misconceptions in Mechanics using the FCI *American Journal of Educational Research, 2015, Vol. 3, No. 2, 116-120*

Quintaneiro, A, 2015*,* Against the Aristotelian Method Concerning Scientific Knowledge Athene Noctua*, Undergraduate Philosophy Journal* Issue No. 3 (Spring 2015).

Sadler, G., 2007, Aristotle's Psychology, Emotion's Rationality, and Cognition of Being: A Critical Note on Ogren's Position. ISSN 1393-614X *Minerva - An Internet Journal of Philosophy 11* (2007*)*: 30-53.

Simard, S., & Karsenti, T., 2016, A Quantitative and Qualitative Inquiry into Future Teachers' Use of Information and Communications Technology to Develop Students' Information Literacy Skills. *Canadian Journal of Learning and Teaching*. Volume 42(5) – Special Issue.

Tawil, M, 2017b, Developing Students' Creativity through Computer Simulation Based Learning in Quantum Physics Learning. *International Journal Of Environmental & Science Education*, Oktober 2017, VOL. 12, NO. 8, 1829-1845.

Tawil, M. 2015, Penerapan Pembelajaran Guided Inquery Terhadap Hasil Belajar Calon Guru IPA Pada Mata Kuliah Interaksi Antara Faktor-faktor Fisik. *Jurnal Sains dan Pendidikan Fisika*. Jilid 11. No. 2, Agustus **2015**, ISSN: 1858-33X.

Tawil, M, 2013a, Portfolio-based Physics Learning Model To Improve Critical Thinking Skills. *International Journal of Education and Research*. Vol.1,No.9, September **2013**, ISSN: 2201-6333(Print),ISSN:2201-6740(Online).

Tawil, M, 2013b, Pembelajaran Berbasis Simulasi Komputer Untuk Meningkatkan Keterampilan Berpikir Kreatif. *Jurnal Ilmu Pendidikan (JIP)* Jilid 17, Nomor 3 Oktober **2013**, ISSN 0215-9643.

Thomas Nelson Winter, T. N., 2007, The*Mechanical Problems* in the Corpus of Aristotle.University of Nebraska – Lincoln. University of Nebraska-Lincols. Faculty Publications, Classics and Religions Studies Department.

Tipler, P. A., 1982, *Physics.* Second Edition. Vol.1. Worth Pbulisher Inc.

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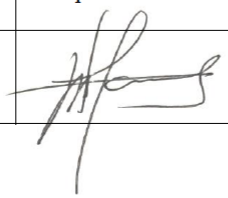
Corresponding Author sign:	

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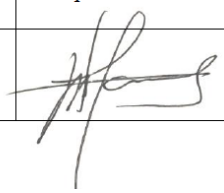
Corresponding Author sign:	

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April 19, 2022

LETTER OF ACCEPTANCE
Code Number: 11/JPPPF/2022

to
Muh. Tawil
Universitas Negeri Makassar

Dear Author,
It is our pleasure to inform that, after the review process and approved title, the paper,

Understanding the Newton Motion Concept Through Qualitative and Quantitative Teaching
All Authors: Muh. Tawil, Muhammad Amin Said

has been **ACCEPTED** for publication at the **JPPPF (Jurnal Penelitian dan Pengembangan Pendidikan Fisika)** to be published in Volume 8 Issue 1, June 2022.

Editor-in-Chief,
JPPPF
Fauzi Bakri, S.Pd., M.Si.