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Inquiry training of agriculture vocational education and direct instruction based field practical: a technique for measuring student's learning outcomes in marginal land management

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Marginal land in the form of rocky dry land is found in Indonesia, especially in Kupang. Learning methods to improve their learning outcomes about marginal land, especially through practical was considered weak. We studied students' practical learning outcomes improvement in managing marginal land by comparing Inquiry Training of agriculture vocational education (ITAVE) versus direct instruction (DI) based approach on palmyra fruit fibers compost use to remediate rocky dryland. The study was designed according to true experimental design. We divided students of Agricultural College (Politani) into two groups, namely whether they participated on ITAVE or DI base learning. The two groups have homogeneous academic presentation indexes. We conducted tests at the end of every practice. We found ITAVE group students had significantly ($p<0.05$) higher cognitive, affective and phsycomotoric out outcomes, compared to the DI group. The ITAVE group also had better agronomic skills. We conclude the ITAVE base practical for agriculture vocational students improves learning outcomes, better than the DI approach.

Keywords: Kupang-Indonesia, rocky dryland, palmyra fruit fibers

INTRODUCTION

Practicum of plant cultivation in Kupang State Politani uses a Direct Instruction / DI approach on practicum from nursery to post-harvest. Students carry out practical work with instructions from the lecturer or instructor to carry out an activity. Students apply DI by selectively observing, remembering and imitating instructions from the instructor. Teachers demonstrate certain knowledge or skills, then train these skills step by step to students. Therefore through DI certain knowledge or skills can be easily understood by students. The same thing was stated by Arens (2009, pp. 197) and Jauhar (2011, p. 45). Another advantage, DI can also maximize learning time (Joyce et al., 2010, p. 309). Carol, (2013), stated that based on the theory of how the human brain works, DI is suitable for the group Perceivers and is not suitable for the group Judgers.

DI has several limitations because it is teacher-centered. This is consistent with Arends's statement (2009, p. 297). High teacher control in learning activities can have a negative impact on the ability of students to solve problems, independence and curiosity (Jauhar, 2011, pp. 51-52). Jauhar also stated that most students often act passively and less encourage them to develop the ability to think and creativity to add information or knowledge beyond that given by the teacher because they believe the teacher will tell them this. In fact, this model according to Arends (2009, p.297) is not appropriate for learning social sciences, nor is it appropriate for learning agriculture.

Agriculture vocational Education Practicum cannot be separated from DI because education requires students to gain learning experience through learning resources that come from nature, including crop cultivation. This is also in accordance with the principle of learning vocational education namely "Learning by doing". The learning objectives of agricultural vocational education practice can be achieved by "doing" strategies, according to Kinsey's opinion (Carol, 2013). Direct learning is relevant in improving student learning outcomes, especially psychomotor aspects. Ratri and Joko (2013), have also proven practical learning using DI can improve student learning outcomes especially for psychomotor aspects. For this reason, it is necessary to find a learning solution that can improve the learning outcomes of students, especially cognitive and affective aspects.

Learning Inquiry Training (IT) is learning to use the concept of scientific research and research practice. The essence of learning is to involve students in truly original research problems by confronting them in the field of investigation, helping them to identify conceptual or methodological problems in the field and inviting them to design ways to solve problems (Joyce et al., 2009, p. 194). The learning approach puts learning responsibilities on students. This learning approach began in 1989 on teaching mathematics (Jahr and Wysocki, 2011).

InquiryTraining Agriculture Vocational Education (ITAVE)based Practicum "is a combination of IT-based and DI-based practicum. Combined DI and non DI learning has been recommended to be applied also in the mathematics curriculum in the United States (Merrill, 2000, p. 2). The use of a combination approach allows students to learn in the best way for success for themselves. This learning can be used in a lot of knowledge (Kistner et al., In Merrill, 2000, p. 3). The combination learning approach is very beneficial for minority students both because of their socio-economic background or low level of intelligence (Jahr and Wysocki, 2011).

The aim of the study was to study the improvement of student practical learning outcomes in managingland marginalby comparing Inquirytraining -base in agriculture vocational education (ITAVE) versus direct Instruction (DI) on the use of palmyra fruits fiber compost to improve rocky dry land.

MATERIALS AND METHODS

The study was conducted using the method True Experimental Design. The study population was Kupang State Politani students. Determination of population is based on the focus of practical learning research in vocational higher education in agriculture.

Selected research samples were Semester V students of the Department of Food Crops and Horticulture (TPH), Horticultural Industrial Technology Study Program (TIH Study Program). The selection is based on the type of agricultural courses most often given in the study program. The study sample consisted of two groups, namely the control group were students who used DI-based practicum (according to the curriculum applied to all study programs at Kupang State Politani), while the treatment group was students who used-based ITAVEpracticum. Group division is based on GPA values taken from the documents of students' academic abilities, so that both groups have the same academic abilities.

The sample characteristics were based on the GPA of the DI group with an average of 2.72, 2.16 (minimum) and 3.79 (maximum), while the ITAVE group had an average(GPA) of 2.90, 2.30 (minimum) and 3.64 (maximum). Both groups are homogeneous based on the calculation of the t-test compared to t table.

The type of research instrument uses a practicum test consisting of Cognitive, Affective, and Psychomotor domains. The test is given when practicum in the form of self-assessment, peer assessment and practicum test. Documents of student academic ability obtained from Horticulture Industry Technology Study Program.

Practical learning experiments consist of two learning methods namely DI and ITAVE. The implementation of learning is based on the Practicum Learning Implementation Plan (PLIP3) prepared by the researcher. Each PLIP3 group implements PLIP3 following the stages of corn cultivation. The experiment was carried out four times according to the schedule of Organic Agriculture courses prepared by TIH Study Program. This course weighs three Semester Credit Units (SCU) 3 (2-1). Based on the SCU weight, the practical learning is carried out twice a week, each for 120 minutes. The implementation of DI learning was conducted on the first day while day II was for theLearning group ITAVE. The statistical hypothesis tested is: Accept Ho if $\mu A = \mu B$ and Reject Ho if $\mu A > \mu B$

μA : Learning outcomes in domain (domain) Cognitive, Affective, or Psychomotor learning

outcomes (learning outcames) practicum about the utilization of local potential in students who take-based practical learning ITAVE μB : Learning outcomes domain (domain) Cognitive, Affective, or Psychomotor practicum learning outcomes about the utilization of local potential in students using DI-based practicum learning.

Hypothesis Test to test whether or not there is adifference realbetween partner data using the Wilcoxon Test (Siegel, 1997 p. 93-98; and Somantri& Muhidin, 2011 p.305-308).

RESULTS

Average test score of four psychomotor, affective and cognitive practicum in the DI group tended to be lower than the group ITAVE. The DI group test score is higher than ITAVE only in practice I (psychomotor) and practicum III (effective). Figure 1 shows the mean results of psychomotor, affective and cognitive practicum between DI andlearning ITAVE.

The highest psychomotor domain practicum test scores were found in practicum IV, while the lowest showed affective domain test scores were the highest compared to psychomotor and cognitive, the lowest average test scores were in the cognitive domain. The highest test score in practicum II is in the affective domain, while the lowest psychomotor domain score. Psychomotor domains in practicum III had the highest average test scores compared to other mean scores on all lab tests, while the lowest scores were in the cognitive domain. The mean value of the cognitive domain practicum test in practicum IV shows the highest value, while the lowest value is in the psychomotor domain. The mean psychomotor domain of practicum IV shows the lowest value compared to all the average test scores.

Hypothesis test results of practical activities for Cognitive and Affective domains show higher learning outcomes of-based practicum students ITAVE than DI. Psychomotor learning outcomes in-based practicum learning IT are higher than DI learning in practicum III and IV while learning outcomes in Practicum I and II are not significantly different. Learning outcomes in the Cognitive, Affective and Psychomotor domains are shown in Table 2.

The learning result is total learning outcomes from Cognitive, Affective and Psychomotor learning 4 times practicum between DI and based practicums ITAVE. The calculation results show that the practical learning outcomes of students who did four practical activities using based learning ITAVE differed significantly compared to students using DI. The test results are shown in Table 3.

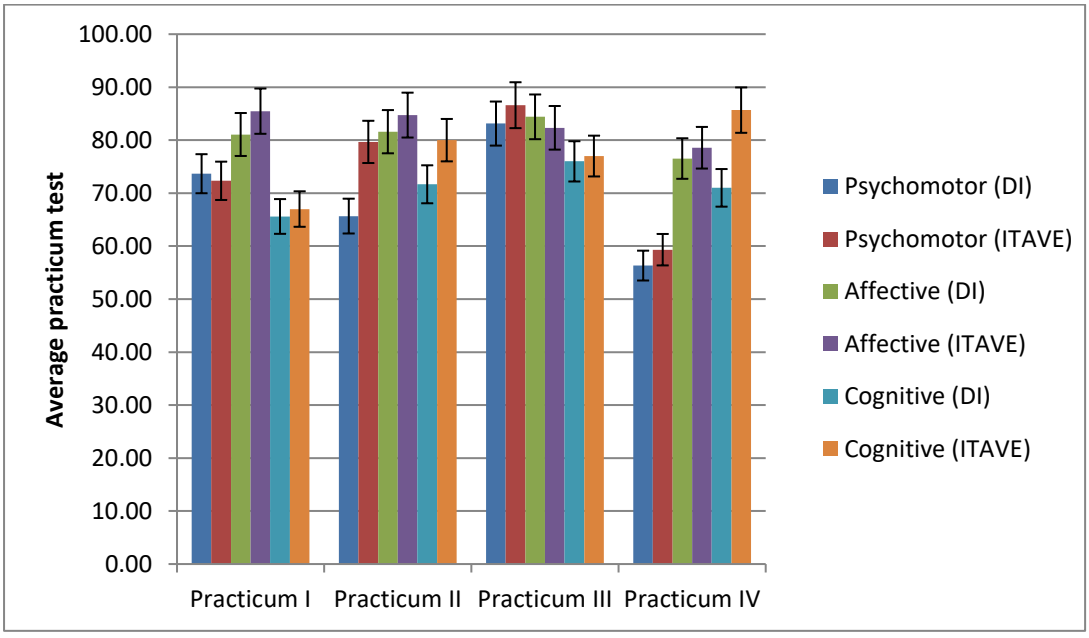

Figure 1. Average Practical Value of the Psychomotor, Affective and Cognitive Domains

Table 2. Descriptive Practical Learning Results Based on DI and ITAVE

Practicum of Practice	Domain		
	Cognitive	Affective	Psychomotor
I	Ho rejected	Ho rejected	Ho accepted
II	Ho rejected	Ho rejected	Ho accepted
III	Ho rejected	Ho rejected	Ho rejected
IV	Ho rejected	Ho rejected	Ho rejected

Table 3. Descriptive Analysis of DI-Based Practicum Learning Results and ITAVE

Practicum Learning	Number of Samples	Average	Standard Deviation	t Calculate	Table T ά 0.05	Decision
DI	15	73.96	5.23	1	n = 15 t = 30	Ho rejected
ITAVE	15	77.32	6, 11			

DISCUSSION

Learning Outcomes Practicum in the Cognitive Domain.

ITAVE base practical learning can improve the results of the Cognitive field compared to DI-based practicum if the substance of learning is new for students. All practicum activities show the average Cognitive learning outcomes using higher-based practical learning ITAVE than DI. The cognitive domain competency in practicum consists of: Identifying soil color and vegetation on rocky land then comparing with Munsell Soil book (Practicum I), Compiling raw materials for palmyra fruit fiber compost (Practicum II), Calculating compost doses for practicum field testing (practicum III), and Calculating corn production from field research (practicum IV). The new learning substance can encourage activities inquiry that is wanting to know then ask. Students are encouraged to fulfill curiosity by asking so that they have a new cognitive structure because of their own desires. Interest and curiosity can be a motivation to learn so it becomes a strong desire to learn about it. Ausubel quoted by Komalasari (2011, p. 121) states the same thing where emotional motivation and experience are very important in learning events, because without strong motivation and desires from the learner there will be no assimilation of new knowledge into the cognitive structure it has. ITAVE based practicum becomes the right learning compared to DI-based practicum because the substance of learning is new and utilizes resources known to students but has not been developed. Students are also aware of the benefits of learning materials that can be applied after they have finished their education. The practicum of compost application on corn cultivation is the substance of learning that is needed by students because as a family of farmers who grow corn they want to increase their family's corn production. The same opinion was conveyed by Jahr & Wysocki (2011) who suggested that "... If our education system truly wants students to succeed, the students need to be taught how to solve problems with their own thoughts, something that cannot be done solely through direct instruction ".

Learning Outcomes Practical Affective Territory.

Affective domain test results can be improved through ITAVE -based contextual learning compared to DI-based learning if the substance of learning is interesting. This can encourage student curiosity. The practical material is interesting for students because it is in the form of new information about the utilization of the abundant potential of palmyra palm tree waste and the implementation of research exercises on the material in the field for agriculture on rocky land. Practicum I with practicum material "Color and special features of the rocky soil" is an interesting practice because the rocky soil is a well-known factual condition and encounters students but has not been studied in plant cultivation practice activities. The profile of rocky

land as a research exercise area is the substance of learning that has NTT specific characteristics. Learning can increase the interest and learning outcomes of the affective domain of students because the learning material is contextual, reality and interesting. This is what enhances the ability to conduct activities inquiry well so that students in-based practical learning ITAVE obtain higher Affective domain learning outcomes than students in DI-based practicums. The affective domain of practicum learning outcomes is shown by the group ITAVE which has a positive and better attitude than students in DI-based practical learning in terms of: Attitudes towards rocky dryland conditions (Practicum I), Attitudes towards the use of local raw materials in composting (Practicum II), and attitudes toward practical learning according to factual conditions (practicum IV). Attitudes towards the benefits of calculating the dosage and its application on practicum (Practicum III),-based practicum learning group ITAVE were lower than DI-based groups. The Affective Sphere of-based practicum learning group ITAVE is higher because learning provides opportunities for students to learn more independently. This is in accordance with the opinion expressed by Hamalik (2010, p. 175) which states that: Large value activities for teaching because: 1) fostering harmonious cooperation among students, 2) students work according to their own interests and abilities, 3) nurturing class discipline naturally and the atmosphere of learning being democratic. Affective domain of learning-based learning group outcomes ITAVE in practicum III lower than the DI group. This is due to students doing learning by calculating corn production and the application of palmyra fruits fiber compost and their own observations, so that they need to be more careful and must work together. The DI-based learning group only listened to information about corn production in each trial of compost application. This has an impact on the learning outcomes of the group ITAVE lower than the DI-based learning group. The success of-based learning is ITAVE influenced by the collaboration of students in gaining knowledge through research practice activities that apply research problems. Good cooperation can be formed if a cooperative climate is created in scientific research learning activities that confront them in the field of data interpretation, data formation, trial control or conclusion making. Students are also required to have courage because they are included in the research community, so they can see how knowledge is created and built in the community of scientists. This is in accordance with the opinion of Joyce et al., (1992, p.136), which states that; "A cooperative, rigorous climate is desired. The student needs to hypothesize rigorously, challenge evidence, criticize designs, and so on". This does not occur in PL-based practical learning because students are given complete information about the substance of learning so students are not motivated to find out more. The high interest in learning in-based practical learning ITAVE is the basis for obtaining high affective learning outcomes.-based practical learning ITAVE can improve effective competence if the learning process can attract students to learn. Feelings of interest will encourage activities inquiry so they ask questions to explore knowledge. Student interest arises because they realize that the learning gained can be an exercise in solving their problems in farming using scientific steps.-based ITAVElearning trains them to improve their understanding of science and creative thinking so that they can make responsible decisions specifically related to science and technology. The same opinion was conveyed by Schlenker quoted by Joyce et al., (2009, p. 2202) which states that research training can improve: "... understanding of science, productivity in creative thinking, and skills for obtaining and analyzing information".

Learning Outcomes Practicum of the Psychomotor Domain.

Psychomotor domains can be achieved properly when supported by fine motor skills and the ability to manipulate objects. Motor skills include physical movements in practice and measurement. This is in accordance with the opinion of Simpson quoted by Clark (2013) which states that motor skills are shown in the form of speed, accuracy, and procedures and techniques. The ability to manipulate objects requires good analytical skills. This ability is owned by students who have good academic abilities. Based on academic ability (GPA),-based learning groups ITAVE had higher academic abilities than DI-based learning groups. Therefore they have the ability to manipulate objects better so that the ability to observe is also better.

Students with good analytical and observing skills can perform well-based ITAVE learning can improve the learning outcomes of Psychomotor domain practicum because learning can encourage activities inquiry student. This occurs in-based learning ITAVE in Practicum I and II because the learning strategy begins by fostering

students' interest through delivering preliminary information about the condition of the land in one of the student's origin areas and showing compost from palmyra fruits fiber. Practicum I students are asked to describe the condition of the practicum land and compare it to the land in their area of origin. Practicum II conducted by the group ITAVEwas conducted by involving students to explore more information about the compost shown to them. Psychomotor domain practicum learning outcomes using DI-based learning proved to be lower than-based learning ITAVE. The same situation is not automatically indicated by the test results for each lab. DI-based learning is more effective in procedural practice because students gain knowledge in the form of Psychomotor competence directly from the instructor step by step. On the other hand students, with-based learning ITAVE will have difficulty receiving knowledge that is procedural because of the limited ability to explore that knowledge. If in the end, they can have these competencies after being given a conclusion at the end of the practicum activity by the lecturer, that knowledge will be easily forgotten. A similar opinion was conveyed by Jauhar (2011, p. 45) which stated. procedural knowledge is easier to understand through DI-based learning. This is consistent with the statement of Joyce et al. (1992, p. 309) DI-based learning can: "... *is the* maximization of student learning time".

Practical Learning Outcomes of Marginal Land Management.

The learning outcomes of the marginal land management practicum are the accumulation of learning outcomes consisting of Cognitive, Affective and Psychomotor domains. The learning outcomes of marginal land management of students who obtain-based learning are ITAVE proven to be higher than students who obtain DI-based learning. ITAVE-based learning able to improve learning outcomes: 1) obtaining complete knowledge by working together to combine memories, 2) differentiating shapes, colors, and aromas of palmyra fruits fiber compost, 3) classifying agricultural waste and not agricultural waste, 4) classifying plants underutilized for food and feed needs, 5) considering mathematical formulas, 6) calculating fertilizer doses, 7) understanding codes or symbols and relating them to conditions in the field, 8) evaluating friend competencies, 9) recapitulating and interpreting data, 10) calculating, weigh and measure corn crop production, 11) determine the way of administration and compost doses that have the most significant effect on corn production, 12) Concern for the environment and 13) Positive attitudes towards: a) the importance of the ability to calculate fertilizer doses, b) how to administer compost, c) differences in doses of compost or artificial fertilizer in the field d) observing healthy plants, getting sick, and ready to harvest, e) conditions NTT land, f) methods of cultivation carried out by NTT farmers, and g) the role of practicum on NTT-specific land.

CONCLUSION

First, ITAVE based practical learning can improve the Cognitive realm of students compared to DI-based practicum. The increase was found in students' thinking abilities including knowledge, understanding, application, analysis, synthesis, and assessment of rocky land use and palmyra fruits fiber compost as NTT's local potential in marginal land management.

Second,-based practical learning ITAVE can improve Affective domain learning outcomes compared to DI-based practicum. The improvement includes attitudes, values, and interests in creating effective cooperation, the awareness that learning is an exercise in solving problems using scientific steps. learning ITAVE can develop students' positive attitudes towards science, provide opportunities for students to work together, increase courage as members in the research community to build knowledge.

Third, Psychomotor domain practicum learning outcomes in-based practicum ITAVE are higher than DI. Improvements are found in 1) motor skills in the form of physical movements, 2) the ability to manipulate objects, and 3) more precise and accurate measurements.

Fourth, the practical learning outcomes of marginal land management in students who carry out-based practicum ITAVE are higher than DI. Practical learning outcomes consist of 1) obtaining complete knowledge about the shape, color and aroma, method of grouping and interpreting data, 2) being positive towards the environment, and practicum activities, 3) ability to calculate, weigh and measure, recapitulate and conduct land management marginal.

Learning topics by utilizing resources known to students but not yet developed is interesting learning material to be learned through ITAVE-based practical learning Learning

Material in ITAVE practicum learning should be in the form of selected learning material which is used as an exercise in solving factual problems

through scientific steps. Practical learning material encourages and stimulates interest in analysis and observation of students if the original material is simple but the students feel the benefits.

The success of ITAVE-based practical learning is determined by information on student knowledge related to the practical material through activities to guide students to demonstrate their knowledge as learning outcomes.

ITAVE based practical learning are suitable for use in learning materials that are directed to obtain learning outcomes in cognitive and affective domains.

ITAVE based practical learning can be used to obtain psychomotor domains when directed to learning to achieve Basic Competence: able to process data, be able to interpret data and be able to perform observations by working together.

Practical learning uses the topic of learning natural resources that are already well known to students but have not been utilized for agriculture.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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AUTHOR CONTRIBUTIONS

Suryawati design and conduct research, data collection, data analysis, manuscript writing and submit manuscripts.

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