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Developing Hands on Practicals on Weed Control Using Plant Extracts for Undergraduates

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Abstract: This research aimed to develop and investigate the effectiveness of three hands-on practical on weed control using plant extracts for undergraduates, compare gains of students science process skills between before and after learning with the practical and investigate students preferences towards learning with the practical. The subjects, sampled by using the purposive method were 30 undergraduates from the Department of Biology, Srinakharinwirot University. The research tools consisted of three hands on practicals of the use plant extracts to control the weeds for undergraduates, a 40 multiple choice questions of science process skills with 4 options and a thirty items of 5-rating Likert preferences towards learning with the practicals. The data were analyzed by the descriptive statistics and t-test for independent samples. The findings indicated students science process skills after learning with the practical had significantly higher than those before learning with the practical ($p>0.05$). Students preferences towards learning with the hands on practical were at the high level of 4.21 ± 0.34. Therefore, this hands on practicals can assist students to understand the plant sciences, particularly the plant extract use for weed control.

Key words: Developing, hands on practical, undergraduates, science process, skills, plant extract

INTRODUCTION

Education reform has played an important role in all educational levels now a days. The learner-centered approach has been performed instead of conventional teaching methods and is strongly supported based on student's ability to assist their self-development to gain their highest potentiality. The practical research is a part of learning that can help student to attain student's competency (Laloknam *et al*., 2010; Phornphisutthimas *et al*., 2007a, b). This is because students have learnt by their experience using science process skills and scientific methods (Danmole, 2012). To get the higher achievement after learning in biology, the method using to learn biology is to add up the laboratory practicals in the classroom and give the idea to solve the problem that they occur during doing the experiments.

Undergraduate life science will be successful if students think like scientists and learning by doing the practical activities (Handelsman *et al*., 2007). To distinguish students' skills in science experiments, the questions of science process skills are tools for assessment in many laboratory courses, e.g., General Biology (Brickman *et al*., 2009; Dirks and Cunningham, 2006), Cell Biology (DebBurman, 2002; Shi *et al*., 2011), Introductory Agriscience (Myers and Dyer, 2006) and other sciences (Feyzioglu, 2009). The science process skills are important in all learning levels and students can develop the skills by themselves and their social assistance from basic to advanced skills.

After learning with science process skills, students can integrates their prior knowledge into meaningful scientific concepts (Brickman *et al*., 2009). Various skills that students can receive after learning with the practical activities are data interpretation, scientific writing, problem solving, experimental design and so on (Airey and Linder, 2008). The earlier reports of science process skills convince researchers to use the handa-on practicals for undergraduate biology to gain their new knowledge and stimulate them to be interested the science concepts in classrooms (Coil *et al*., 2010).

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The research's purposes:

- To develop a hands on practicals using plant extracts to control weeds for undergraduates at the Department of Biology, Faculty of Science, Srinakharinwirot University
- To compare the undergraduates science process skills before and after using the hands on practical in the class
- To assess the undergraduates preference towards learning with the hands on practicals

MATERIALS AND METHODS

Participants: The population of this research was 600 undergraduates who registered in the elective courses of plant sciences in the Department of Biology, Faculty of Science, Srinakharinwirot University in the academic year, 2011. Thirty undergraduates sampled purposively from the population were used as subjects of the study.

Research tools: The research tools used in this study were three hands on practicals in topic of the use of plant extracts for weed control included information sheet, laboratory manual and report as well as a 40 multiple questions with 4 options used as pretest-retest based on Temiz *et al*. (2006) as well as a 5 point Likert preference test with 30 items comprised 3 parts: understandings from this practicals, the sufficiency of activities in this practicals and application of this practicals. To develop students science process skills, the hands on practicals was developed from the scientific research (Chatiyanon *et al*., 2012) and adjusted to be appropriate to undergraduate level.

Procedure: Three units of a hands on practical was developed, nvestigated the content validity by five experts as well as reliability by using the students who have learned in plant science earlier. Before learning with the practicals, students did the pretest of science process skills. Students were given the basic knowledge before starting the practicals. The learning period was 3 h a week for 6 weeks. After the completion of the study, the participants took the science process skill posttest and evaluated their preferences towards learning using the practicals. The developments of each science process skill were analyzed using gain percentage <g> which is calculated according to the equation (Hake, 1998). The 0.3-0.7 gain percentage means the improving of basic science process skills in the middle level. The gain percentage scores of <0.3 and ≥0.7 are the low and high development level of the basic skills, respectively. The data were analyzed using the descriptive statistics, t-test for dependent and independent samples, as well as Completely Randomized Design (CRD) at the significance level of 0.05 (Table 1 and Fig. 1):

Table 1: Investigation of gender bias from students science process skill pretest

Gender	Number	$\bar{X}\pm S$	df	t-value	p-value
Male	11 (36.7%)	22.73±3.409	28	0.651	0.651
Female	19 (63.3%)	23.26±2.903	-	-	-

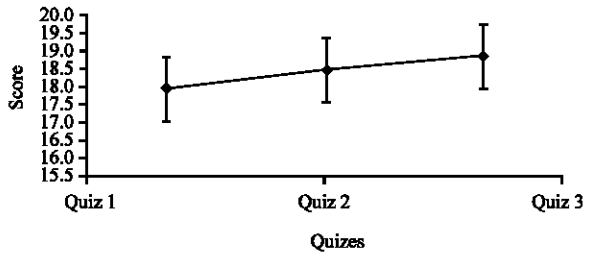

Fig. 1: Students' formative assessment after learning each activity in these practicals

$$<g> = \frac{\text{Posttest (\%)} - \text{Pretest (\%)}}{100 - \text{Pretest (\%)}}$$

RESULTS AND DISCUSSION

The demographics of a participant group were 11 male and 19 female undergraduates, aged 20-22. In general, the male number is more than that in all levels of the university. To investigate the achievement after using the hands-on practicals, the plant extracts for weed controls, in laboratory scale, the pretest and posttest were done before and after learning with this practicals, respectively. Gender was a factor that should be concerned since, the gender bias might occur as other topics in biology (Prokop *et al*., 2007). The pretest scores of science process skills were compared between male and female groups and data were analyzed using t-test for independent samples at $p = 0.05$. The findings showed that the gender bias was not found in this study (Table 2).

When all activities were completed, students' science process skills were assessed. The results in Table 3 showed that the students after learning with the hands on practicals had overall basic science process skills higher than those before with it ($p<0.05$). When comparing each item of basic skills, students posttest scores were higher than those pretest scores ($p<0.05$). Normally, Thai students do not enjoy learning botany since they think no more practicals to motivate them to engage in understandings about plants. Therefore, the activities of this practicals can assist students to use their science process skills to understand the concepts of biological control using plant extracts for weed controls. Besides the knowledge that students

Table 2: ANOVA results of quiz scores for science process skills using the CRD design (n = 30)

Sources	$\bar{X}\pm S$	<g>	MS	F	p-value
Quiz 1	17.93±1.015	0.879	6.10	8.115	0.001
Quiz 2	18.43±0.817	0.908	-	-	-
Quiz 3	18.83±0.747	0.931	-	-	-

*Significant difference at $p<0.05$

Table 3: Comparison of students' science process skills between before and after using the hands-on practicals (n = 30)

Science process skills	Pre-test $\bar{X}\pm S$	Post-test $\bar{X}\pm S$	t-value	p-value
Observing	1.97±0.81	3.43±0.63	-8.930	0.000*
Measuring	2.80±0.76	4.37±0.72	-9.175	0.000*
Classifying	3.13±0.86	3.57±0.73	-2.091	0.000*
Organizing data and communicating	2.40±0.67	3.37±0.85	-4.690	0.000*
Formulating hypothesis	1.40±0.77	2.83±0.65	-4.690	0.000*
Identifying and controlling variables	2.67±0.92	3.40±0.81	-4.690	0.000*
Experimenting	3.07±0.64	3.80±0.92	-8.930	0.000*
Interpreting data and making conclusion	2.80±1.10	3.78±0.94	-3.898	0.000*
Overall basic process skills	20.23±2.75	28.5±1.76	-3.898	0.000*

*Significant difference at $p<0.05$

Table 4: Undergraduates' preferences towards learning using the hands-on practicals in topic of using the plant extracts to control weeds

Description	Preference $\bar{X}\pm S$
This practical can help you to understand the weed controls using plant extracts	4.32±0.50
The activities in this practical are enough for students to learn the weed controls using plant extracts	4.14±0.27
After learning with this practical, students can use the knowledge to apply to other weed controls using plant extracts	4.15±0.35
Overall preference	4.21±0.34

gained from the practicals, students expressed their good preferences to this practicals with overall preference of 4.21±0.34 (Table 4).

CONCLUSION

The hands on practicals developed for undergraduate students can assist them to understand biological control using the weed control as model laboratory. After learning with the practicals, students have a better understanding of the concept of biological control using plant extracts, a developed basic science process skills and gain percentage by no effect of gender. Therefore, these practicals can be used to be replacement or supplement in various courses including the biological controls, plant ecology, etc.

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