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Development and Testing of a Learning Package for College Botany using Local Geography

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Abstract

This study was an attempt to examine the potential of local geography to teach botany as a socioscience. This was done initially through the development of a geographic learning package (GLP) for plant taxonomy and ecology as the medium for socioscientific teaching and second, in the testing for the significant effect of a socioscientific approach of teaching botany using GLP (SATGLP) to second year college students' learning performance and attitudes. Printed and non-printed documents of Davao Oriental geography, instructor-assembled standardized test questions for student learning performance and attitude scale for student attitudes, and expert judgment, classroom try-out of student responses for the validity and reliability of the learning package were used as instruments in the study. The 42 students in both control and experimental classes were found comparable in age, existing knowledge and acquired attitudes in science. One biology instructor taught both classes in the third quarter of the second semester, November – March 1999. Mean judgment ratings on the validity of the development of GLP indicated that it was more than satisfactory. It was able to use three main geographic elements: the physical features, natural resources and the socio-cultural characteristics of Davao Oriental for motivating, problem situation, and in contextualizing exercises and examples. On the other hand, t-test means showed that SATGLP is significantly different from the control only in the mean gain scores of the learning performance of students. The attitudes were significantly different only in the pretest scores of students. The findings suggest that geography, a social science discipline is a potential field resource in developing a learning package that could be used in teaching botany as a socioscience and that a Socioscientific using the geography of a locality such as Davao Oriental could improve the learning performance of second year college students. This approach however, had no significant gain effect on student's attitudes towards science.

Keywords: socioscientific teaching of botany, geographic learning package, learning performance and attitudes

Introduction

Botany is the study that deals with the biology of plants and their economic uses (Stern, 1988). The thrust towards socioscientific teaching in the 21st century is found in the rising public interest on ethnobotany (Kendler et al, 1992) and the urgent need for social approach in the application of science concepts and interpretation of skills where students can be currently empowered in decision-making and predicting societal outcomes (Ogena, 1994).

Pedagogically, a socioscience aims for the scientific and technological literacy among students. This means developing the ability to use scientific knowledge creatively in everyday life such as to solve problems and make decisions. It recognizes also that education, including science education, must promote development at the intellectual, attitudinal, societal and interdisciplinary levels (Rannikmae, 1997). In the iast two decades, it examined its educational implications in the light of the achicvement of community development (Atchia,1982). It has continuously taken effect until today in the application of contextual learning principles in the educational process (RSTA, 1995).

In this background, the potential of geography in teaching botany as a socioscience was then tested. Geography is reported to contribute to an understanding of other fields of learning because it can provide the means of understanding a variety of physical, biotic and cultural patterns found in the earth surface. It can even relate to the natural sciences since it studies the distribution of land and animals which ties itself to botany and zoology (Bacon, 1975).

The 1990's imperative of the Department of Science and Technology (DOST)-Science Education Institute to teach school biology as socioscience was the impetus of this study, hence this study sought to find ways of socioscientific teaching in botany.

Objectives of the Study

The study involved two phases with the following aims:

For Phase 1,

1.) To explore the elements of geography of Davao Oriental which can be used to develop a learning package for plant taxonomy and ecology as a medium for socioscientific teaching of botany; and

For Phase 11,

2.) To test the significant differences in the learning performance and attitudes of botany students divided into the experimental group exposed to Socioscientific Approach in Teaching Geographical Learning Package (SATGLP) and the control group exposed to Conventional Approach in Teaching Conventional Learning Package (CATCLP) in terms of pretest scores, posttests scores and gain in scores.

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Review of Related Literature

Imperatives for Metamorphosis in Science Curriculum and Content

The "Science for All" movement embarked by Asian Education Conferences in the past two decades to reorient aims and content of biology towards individual and community needs imposed the school science program today to have the goal of scientific literacy. This means that it requires science programs to achieve a balanced curriculum. Consequently, content of biology for instance should reflect the national development goals embodied in the Education Act of every country; the society or community needs; the availability of resources from curricular materials and manpower; the output of survey on base level needs of students (e.g., what they already know and what they need to know in improving daily life and to use them as the criteria to select content) are ways of handling knowledge explosion more effectively in secondary biology teaching (Vohra 1991).

In the use of teaching materials, the glossary of biological terms in English and the dialect of the students should be included. The teaching materials improvised by teachers or students, and financial support for the procurement of teaching materials shall likewise be added. The non-traditional (community) sources for biology teaching and to the means that they can be harnessed for the teaching of biology may consist of the following tasks: exploring the school campus or neighborhood gardens or orchards, field trips to factories of various types, local newspapers for case studies, human resources or knowledgeable persons in the community who can demonstrate or give information to special groups (e.g., skilled workers, doctors, carpenters, etc), and apprenticeships in factories or other community projects (Vohra, 1991).

In support to this, Jain (1992) contend that although content of biology in India is changing from descriptive to experimental, there is an urgent need to relate these changes with social, cultural and even religious backgrounds. Further, it is easier to teach the content of biological sciences in training courses but the teaching methods based on sociological and psychological principles of learning are difficult. Thus, the effectiveness of the teaching-learning process can be increased with the help of teaching aids; innovative materials; visits to zoos,
parks, gardens, herbaria; and the like.

In the Philippines, the Department of Education, Culture and Sports (DECS) and DOST are seeking to bring about reforms and establish new programs to commit the three principles for a more humanistic science education in the Philippines in which one of the most relevant for this study is education in science for the would-be scientist to mean education in the various disciplines.

This type does not separate theory from practice or science from the human enterprise. The development of a scientist should balance with humanist orientation, thus emphasizing not only the pursuit of knowledge but social concerns as well (Papasin, 1993). Consequently, the Science, Technology and Society (STS) curriculum was offered in Philippine schools as a strategy adhering to the concept of humanized science education program.

Emergent Role of Science Teachers

In the past two decades, science teachers were required to reorient teaching towards meeting societal needs rather than completing the syllabi. They were also asked to learn to go beyond lectures as the major form of instruction and to use a variety of teaching strategies to develop relevance of science and technology in the lives of the students (Gregorio, 1976).

In consonance to the above, Ogena (1994) admonished science teachers that scientific concepts should not be taught for its own sake since these concepts can become useful knowledge only when these are applied. Since the skills of interpreting and applying these concepts for decision-making and predicting probable outcomes should be the main concern for biology programs, the biology teacher then must also be able to cope given the limited teaching resources. Her creativity should extend far beyond what she considers now as a resourceful way of teaching the subject.

Nature of Geography

Lewthwaite (1984) characterized geography as the study of unusual diversity of things, each of which forms a separate object of study in another field, such as geology, botany, and sociology. Characterized more by its point of view and purpose than by its specific content, geography, like history brings together, or synthesizes, a variety of unlike things.

Bacon (1975) also explained that geography contributes to an understanding of other fields of learning, in turn, these fields contribute to geography. More so, geography is related to the natural sciences. For example, it studies the distribution of plants and animals on earth. This ties geography to botany and zoology. It deals with distribution of landforms which ties it up to geology. It is concerned with the variety of climates found on earth, thus tying itself with meteorology.

Use of Local Geography

Veloso's (1982) findings that the geography of Bukidnon was a potential teaching resource in a teaching-learning unit method. This was also known as the Morrison Technique. Said study primed the concept of this research when it recommended that parallel studies in other areas be made to effect changes and improvement not only in social studies courses but also in all subject areas. Veloso (1982) concluded that the effectiveness of the teaching-learning process could only be attained if the teacher is resourceful, creative and skillful in using a varied range of learning materials. Further, teachers must not be totally dependent upon textbooks, workbooks, and other commercially produced materials.

In addition, Balsicas (1994) showed that a literature-based approach in teaching biology was found to improve the learning performance but not the attitudes of students. This study looked like a literature-based approach since the science

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concepts in botany was contextualized with the use of geographic literature when designing the learning package.

Methodology

Research Design

Phase 1 took the exploratory or formulative design of Fonollera (1994) since it explored useful insights and potential uses of geography in developing a socioscientific learning package by literature survey method. In this study, however, literature search in books is undertaken not only from the libraries of schools but also from the government agencies in Davao Oriental. Phase Il was quasi-experimental and used the pretest-posttest nonequivalent control group design of Wiersma (1995). The pretest and posttest were administered to the two groups of college botany students. Threats of internal validity for this design such as of the selection difference is ruled out by pretest in both class

Research Instruments for Gathering Data

The first type of data was obtained from documents requested from provincial and municipal government agencies as well as from libraries. These were the printed documents (e.g., Davao Oriental Profile, 1991, etc.), and the non-printed sources (lectures and field demonstration by DA and DENR personnel). The second type of data was taken from the evaluation sheets to validate content and construct of the learning package and from the Bermuth's Cloze Test (Romero and Romero, 1997) results of 15 first and second year college students to measure its readability. In GLP's construct and content validation, there were two parts: 1) Part 1, a brief inquiry of the professional background of the eight experts; and 2) Part 2, the adopted Pascual's (1994) set of six criteria and rating scale where a given rate of 5 for any criteria means excellent, 4-very good, 3-good, 2-fair and I-poor. The grand mean rating of all the six criteria for construct and content validity was interpreted based on this scale.

Sampling Techniques

There were 20 and 22 Bonafede DOSCST college students enrolled during the second semester, June to November 1998, that made up the experimental and control groups, respectively. The students were enrolled in Botany 1 (College Botany). They were classified as regular second year Education students (BEED and BSE) major in General Science and Integrated Science, respectively. The experimental and the control groups were randomly assigned in two different schedules in the morning session, the former at MWF 8-10 a. m. and the latter, TTh 7:30 - 10:30 a. m.

Statistical Treatments

This study made use of the mean, standard deviation, t- test for significant difference of means between independent samples, t-test for significant difference of means between dependent samples within groups and Spearman Brown Formula.

Results and Discussion

Phase 1. Development of the Geographic Learning Package (GLP)

The learning package using geography of Davao Oriental or the geographic learning package (GLP) specifically for the two topic units, plant taxonomy and plant ecology was mainly based on the unit learning objectives formulated in the syllabus and their specific breakdown. Consequently, these unit objectives followed Aquino's (1988) four dimensions of behavioral objectives in the cognitive domain for the modem science program. They were the following:

For Unit I — Plant Taxonomy

A. Compare the scientific systems of plant classification from that of other ordinary or pseudoscientific classification systems,

B. Survey specimens under kingdom Plantae and identify their classification level using the basic scheme, and

C. Recognize the pattern in giving the common names of plants in the community and apply their corresponding scientific names of plants.

For Unit II — Plant Ecology with Biodiversity and Conservation

A. State the concept of ecosystems and the reciprocal interrelationships between them and the plants,

B. Describe the behaviors of plants in interacting with the environment,

C. State the concept of biodiversity and conservation and explain the need for its adoption in the community

Based on the need to accomplish the objectives stated in the syllabus and on the potential to provide scientific facts that could enrich and motivate interest in learning botany, the useful elements in the geography of Davao Oriental found were considered diverse. These were also the same elements found by Veloso (1982) in the study on the geography of Bukidnon as a source of teaching materials for social studies. These could be classified mainly in the following areas:

- Physical features of Davao Oriental such as data on the location, climate, size and shape, pictures of land forms, and topographic maps
- Natural resources like tables of land classification, inventories of flora and fauna as well as mineral resources, data of soil types and agriculture
- Socio-cultural characteristics such as data on the population and density, sex and age structure, literacy, dialect, religion, customs and traditions

After geographic elements of Davao Oriental were carefully reviewed and evaluated for the development of GLP, these were deemed useful in the learning process in the following ways:

a.) On familiarizing taxonomic classifications, the ordinary or pseudoscientific classification scheme shown in the plant inventory of the geographic primer of Davao Oriental came out as lead example for the motivation.

b.) On imparting skills to identify plants, the local plant stocks in the plant inventory of Davao Oriental served as both examples and motivation.

c.) On establishing familiarity and direct awareness to students on the bases of rules of nomenclature, some of the common indigenous beliefs, customs,

stories and folklores indicative of how plants are named in the culture of Dabawenyo's provide helpful examples for learning the bases of scientific plant taxonomy and ecological concepts.

d.) On introducing the rationale or importance of plant ecology, the data about the physical resources as depicted in crop zone maps (Plate 1) turned out as the text for the background or problem setting.

e.) On drawing out the concept of ecosystem and its reciprocal interrelations with plants, pictures of some of the geographical resources taken from the three municipalities of Davao Oriental in Set I of Plate 2 served to clearly distinguish the nature and draw out visually its concept when compared.

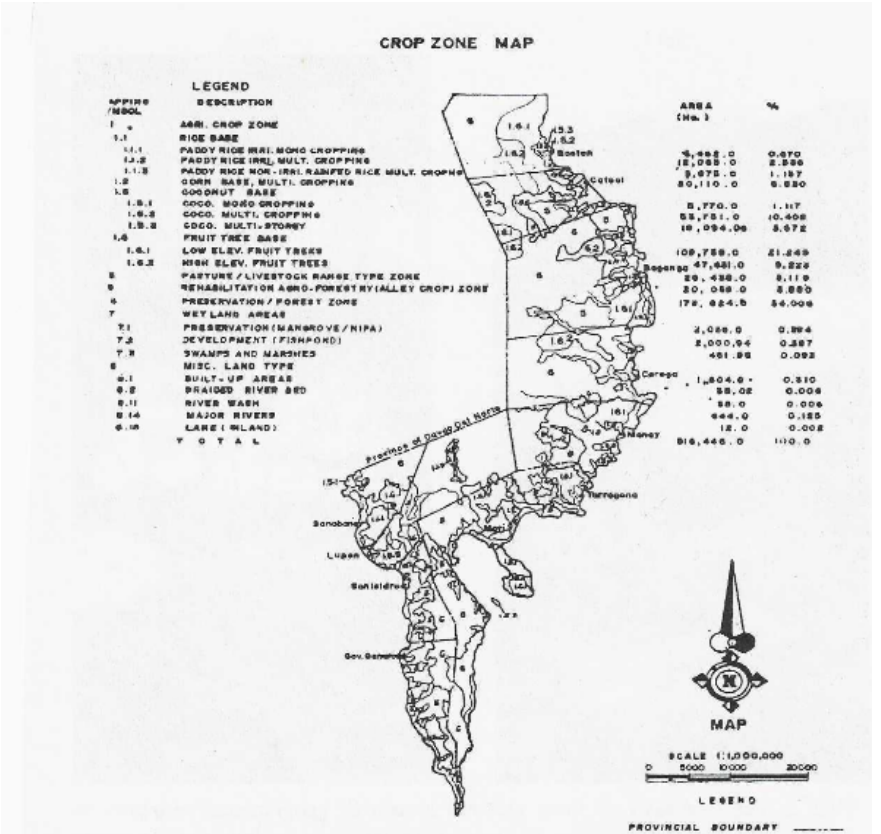

Plate 1. Crop zone map showing the geographical distribution of dominant vegetation and crops planted throughout the 11 municipalities of Davao Oriental

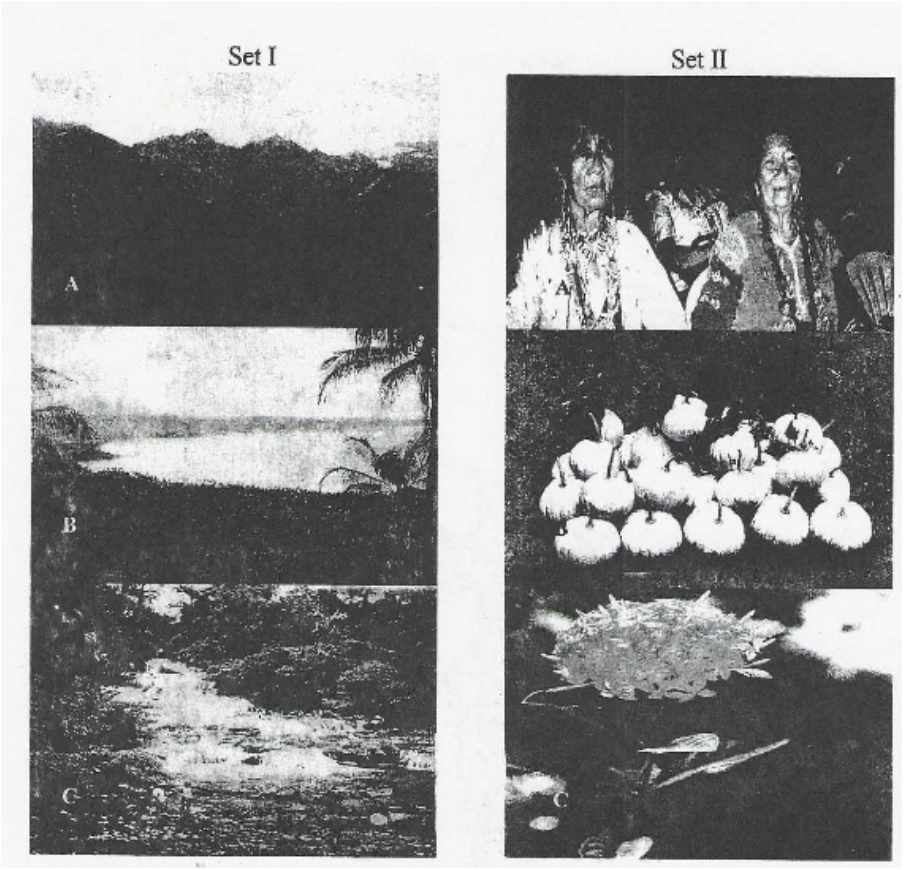

Plate 2. Set I consist of three pictorial scenes of geographical resources in various municipalities of Davao Oriental made to draw out the nature and concept of ecosystem by contrasting with Set Il that shows only pictures of subjects of ecosystem components. (Set I. A. An upland forest ecosystem of Gov. Generoso; B. Pujada Bay coastal ecosystem of Mati; C. Freshwater ecosystem of Aliwagwag Falls Set II. A. Two Mandayan women; B. Pile of mature squash, Cucurbita maxima.; C. Santan (Ixora sp.) inflorescence) with Set II of (Plate 2) which are pictures showing subjects that are not examples of ecosystem but only its components. In addition, ecological map of Davao Oriental had formed the major part of the exercise in characterizing various types of ecosystems.

f.) On taking up the interactions of plants with the ecosystems, the research report initiated by DENR-Ecosystem Research Digest (1993) on the status of seagrasses of Pujada Bay, Mati, Davao Oriental served as the content material for discussion of ecological concepts, principles and their applications.

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g.) On promoting advocacy for biodiversity and conservation, the JICA-DIDP (1998) reports concerning the status of the physical, natural resources and socio-cultural actions and the socioeconomic profile of Pujada Bay, Mati, Davao Oriental had contextualized their concepts.

These results showed that a learning package for college botany could be developed with the use of local geography such as that of Davao Oriental and the elements in geography could be useful particularly in applying motivation, contextualizing, or situation the introduction and the main texts of lessons. As to the construct and content validity of the development of GLP using geographic elements, the ratings and judgments of the experts are shown in Tables 1 and 2.

Table 1 shows GLP' s construct validity mean ratings of the eight experts on the six criteria. The GLP got the highest mean rating of 4.25 in suitability/ appropriateness and clearness/conciseness. This is followed by mean ratings of 4.12, 3.88, 3.62 and 3.38 in the organization of learning experience, scope or coverage, statement of objectives and in evaluation scheme as the lowest, respectively. These ratings imply that the construct of GLP excelled in terms of suitability and or appropriateness and clearness or conciseness, was very good in terms of the other said criteria and was only good in terms in terms of its evaluation scheme. Nevertheless, the GLP got a grand mean rating of 3.81 denoting that its construct validity was generally very good.

Table 2 reveals GLP's content validity means ratings of the experts on six criteria. GLP got the highest mean rating of 4.50 in coverage of learning experience and the lowest one of 3.62 in the evaluation scheme. It got mean ratings of 4.12, 4.00, 3.88 and 3.80 in the presentation, clarity, objectives, and time allotment, respectively. These indicate that GLP excelled both in the coverage of learning experience and presentation while it came out very good in the rest of the said criteria. Consequently, its content validity got a slightly higher grand mean rating of 4.0 relative to its construct validity value of 3.81. On this basis, the total mean ratings in both construct and content validity suggest that the development of GLP was valid for instructional use and testing.

Table 1. Construct validity mean ratings on the Geographic Learning Package for College Botany by 8 experts

Criteria	Scale					Mean
	5	4	3	2	1	
Statement of objectives		20	9			3.62
Organization of learning experience	10	20	3			4.12
Scope of coverage		28	3			3.88
Suitability/appropriateness	15	16	3			4.25
Clearness/conciscncss	5	20	10			3.62
Evaluation scheme	5	12	12			3.38
					Grand Mean =	3.81

Table 2. Content validity mean ratings on the Geographic Learning Package for College Botany by eight experts

Criteria	Scale					Mean
	5	4	3	2	1	
Objectives	10	12	9			3.88
Presentation	10	20	3			4.12
Coverage of learning experience	20	16				4.50
Clarity	5	24	3			4.00
Time allotment		24	6			3.80
Evaluation scheme	5	12	12			3.62
					Grand Mean =	4.00

Meanwhile, the actual quality of GLP as an instructional material for the socioscientific approach was determined by the classroom try-out, conducted. Prior to this, the readability test by Cloze (Romero and Romero, 1997) procedure was also undertaken to ensure the readability level of GLP to the target learners. Out of 15 respondents who were second year college students other than those under the test classes, the scores obtained were all found within the instructional level of 51% based on Bennuth Cloze Test Scores (1968). This means that GLP was readable within the level of college students.

After the try-out had been conducted, the construct and content validity of GLP was further confirmed when it disclosed that the learning behavioral objectives following Aquino's taxonomy for the modern science program in the two topic units were applicable in the classroom situation. These are represented by the table of specification (TOS). However, these objectives were apportioned almost equally around the four dimensions of science learning objectives could not however be achieved initially at the allotted time of one month. Consequently, the time allotment was extended to one and a half months for various topic units during the test proper.

The try-out had also enabled the study to assess the reliability of the pretest-posttests in the learning performance and attitudes. The original total number of items selected to make the questions in the pretest-posttest instruments for the learning performance was 300 from five types of tests. It got only a moderate reliability coefficient of 0.61 in the try-out. Consequently, it was revised and the number of items reduced to 130. The latter obtained a reliability coefficient of 0.93 in the test proper: Unlikely, the Rabago's attitude scale readily got a reliability coefficient of 0.96 in the try-out which denotes high reliability. Hence, revision was not anymore necessary. On this regard, the content of this attitude scale and the pretest-posttest instrument for the learning performance are considered reliable.

Based on all the qualifying parameters employed in phase 1 of the study, the appropriateness of the GLP for college botany and the reliability of the pretest-posttest instruments for the learning performance and attitudes were generally established. Hence, they could be used for testing in the second phase of the study.

Phase II. Testing of the Socioscientific Approach in Teaching College Botany using Geographic Learning Package (SATGLP)

Pretest Scores

At simple random assignment, a class of 22 students became the control group (CATCLP) and another 20 students as the experimental group (SATGLP). Table 3 shows the standard deviations in the ages and the pretest means on the two aspects namely: 1) scores of stock knowledge and 2) usual attitudes towards botany. Comparison of means using t-test showed no significant difference between the two groups in terms of age and pretest scores. This means that the two classes are relatively even. Standard deviation values also indicated that they were also homogeneous in

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terms of stock knowledge and attitudes towards botany at the start of testing.

Table 3. Standard deviations in the student age and the pretest mean scores in the learning performance and attitudes of students given two learning package treatments

Treatment	No.	Age		Learning Performance		Attitudes	
		SD	x	SD	x	SD	x
CATCLP	22	1.03	20.45	8.32	24.73	11.79	146.73
SATGLP	20	1.33	19.60	6.05	22	13.73	141.50
T_c at df = 40 T_t at ∝ .05 = 1.684			0.6933^{ns}		1.18^{ns}		0.9356^{ns}

Posttest Scores

Table 4 shows the pretest and posttest mean scores and the t-test values in the learning performance and attitudes within CATCLP and SATGLP. There is a higher increase of the mean posttest scores of 62.5 and 67.5 from the mean pretest scores of 24.73 and 22 respectively in the learning performance of both treatments than the scores in the attitudes. The t-test in the learning performance brought out t-computed values of 13.22 in CATCLP, and 116.24 in SATGLP that were respectively higher than the tabular t-values of 1.721 and 1.729 between the posttest and pretest means. Thus, there was a highly significant difference of the posttest mean scores from those of the pretest within both treatments.

Table 4. Pretest and posttest mean scores in the learning performance and attitudes of students given two learning package treatments

Score	Learning Performance		Attitudes	
	CATCLP	SATGLP	CATCLP	SATGLP
Pretest	24.73	22.00	146.73	141.5
Posttest	62.50	67.50	151.23	155.7
t_c at df = 21.19	13.22^{s}	16.24^{s}	1.45^{ns}	2.237^{s}
t_t at ∝ 0.05	1.721	1.729	1.721	1.729

Conversely, the increase shown by the posttest mean scores of 151.23 and 155.70 from the pretest mean scores of 146.73 and 141.50 of the attitudes in both treatments yielded different outcomes. The computed t-value in CATCLP was 1.452 which is lower than the tabular t-value of 1.721 while SATGLP's computed t-value was

2.237 which is clearly higher than its tabular t-value of 1.729. This means that there was a significant difference between the pretest and posttest means in the attitudes only in SATGLP. These suggest that both treatments differed in their level to cause effects in the learning performance and attitudes of the students. Students in SATGLP showed significant changes in both of their learning performance and attitudes while students in CATCLP had manifested the same but not in their attitudes.

On the other hand, Table 5 shows the posttest mean scores of CATCLP and SATGLP and the t-test values of their significant difference in between. It presents that the posttest means scores of 62.50 and 151.23 of CATCLP in the learning performance and attitudes were slightly lower than those of 67.50 and 155.7 of SATGLP, respectively. When their significant difference was t-tested at 0.05 level, there was no significant difference since the computed t-values of 1.307 and 1.00, respectively are less than the tabulated t-value of 1.684. This implies that both teaching approaches had generated the same effects in the learning performance and attitudes of the second-year college students. In other words, SATGLP could be as. good as the other. These findings parallel with those of Saramosing's (1994) study on the effects of resource management activities in the learning performance and attitudes of biology students and Capangpangan's (1984) self-learning approach in biology.

Table 5. Posttest mean scores in the learning performance and attitudes of students given two learning package treatments

Treatment	Posttest Mean Scores	
	Learning Performance	Attitudes
CATCLP	62.50	151.23
SATGLP	67.50	155.70
t_c at df = 40 t_t at $\propto$ 0.05 = 1.684	1.307^{ns}	1.000^{ns}

Gain Scores

Getting the gain scores in the two treatments is another way of testing the effectiveness of CATCLP and SATGLP in this study. This is the difference between the posttest and pretest scores of the subjects (Pajo, 1994). The mean gain- scores in the learning performance and attitudes and their t-test values of significant difference between the two treatments are shown in Table 6.

Table 6. Mean gain scores in the learning performance and attitudes of students given two Treatments

Treatment	Mean Gain Scores	
	Learning Performance	Attitudes
CATCLP	37.77	4.50
SATGLP	45.65	11.05
t_c at df = 40	1.965^s	1.147^{ns}
t_t at $\propto$ 0.05	1.684	1.684

It appears that SATGLP's mean gain scores of 45.65 and 11.05 in the learning performance and attitudes respectively were slightly higher than those of CATCLP which were 37.77 and 4.50. However, t-Test for significant difference between yielded inverse outcomes. The computed t-value in the learning performance between CATCLP and SATGLP was 1.965 which is higher than the tabulated t-value of 1.684 while the computed t-value in the attitude was 1.147 which is clearly not. This confirms that there was a significant difference between CATCLP and SATGLP only in the mean gain scores of the learning performance of college students. This finding coincides with those of Balsica's (1994) which obtained a significant difference in the gain scores of the learning performance but not also in the attitudes when a literature-based approach is used in teaching biological concepts.

The findings further mean that given the same learning attitude of students, SATGLP gave more significant effects in improving learning performance than CATCLP and that it could then improve only the learning performance of college students.

Conclusions

Based on the findings of the study, the following conclusions are drawn:

1.) There are diverse elements in the geography of Davao Oriental that were useful in developing a learning package for teaching Plant Taxonomy and Plant Ecology as a socioscience. These were classified as those pertaining to the physical features, the natural resources, and the socio-cultural characteristics of Davao Oriental. After the appropriateness of the learning package of college botany using geography of Davao Oriental was established, the geographic elements selected were applied mostly in the learning package for motivation, introduction or problem situation and for contextualizing exercises and examples.

2.) There was no significant difference in the learning performance and attitudes of college students in botany between the experimental group exposed to SATGLP and the control group exposed to CATCLP in terms of their pretest mean scores.

3.) There was a significant difference only in the learning performance of college students in botany between the posttest and pretest mean scores in both CATCLP and SATGLP. However, there was a significant difference in the pretest and posttest mean scores of the attitudes only in SATGLP.

4.) There was no significant difference in the learning performance and attitudes of college students in botany between CATCLP and SATGLP in terms of their posttest mean scores.

5.) There was a significant difference between CATCLP and SATGLP in the mean gain scores of the learning performance of college students and none for the attitudes.

Recommendations

In view of the findings and limitations of the study, the following recommendations are forwarded:

1) The geography of a locality should also be used or imparted as a supplementing resource for teaching socio scientifically the natural sciences particularly in the use of instructional materials.

2.) The potential of geography of a locality in teaching biology as a socioscience should be given research importance in science education so that its effectivity will be explored further in other biological sciences aside from botany.

3.) The potential uses of local geography in achieving a balanced curriculum in S and T should be given interest by Commission on Higher Education.

4.) More replications should be done to establish the potential uses and effects of local geography in the learning performance and attitudes of students in different colleges on the same subject.

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