

Students' Attitudes Vis-À-Vis Performance Towards Chemistry

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ABSTRACT

The study aimed to determine the attitudes of education students towards Chemistry. The respondents were the BSED – Science of Cebu Technological University School Year 2016 – 2017. There were faculty members of Chemistry as respondents in order to demonstrate whether their teaching approaches affect the attitudes of education students toward the subject. The study revealed that education students had unsatisfactory performance and negative impressions toward Chemistry subjects. It also revealed that they had low performance towards Chemistry competencies such as classifying, comparing, analyzing, and creating. It also showed that Chemistry teachers used multiple representations/approaches in teaching the subject in order to motivate the interest of the students towards the subject. The finding of the study exhibited that there is no significant relationship between performance and attitude of students toward Chemistry. Chi Square was used to compute the relationship between the performance and the attitudes of students toward Chemistry.

Keywords: Attitudes, Performance, Teaching Chemistry, Descriptive Method, Cebu Technological University – Main Campus, Cebu

1. Introduction

Attitude towards Chemistry is essential. It denotes interests or feelings towards studying Chemistry. Attitude, motivation, and genuine interest are the most important student characteristics associated with successful studies (Daley et al., 2003), (Berg, 2005b). Attitude and academic achievement are important outcomes of science education in colleges/universities. Students' attitude and interest could play a substantial role in students' decision to study science (Abided, 2009). Students' attitudes towards learning chemistry fueled many study projects for a long time. In the late 1980s there was a significant decline in Chemistry education, and towards the turn of the century, the issue of attitudes towards Chemistry became an international concern.

Hackling and Pain research (2005) asserted that science learning is best assisted with multiple representations wherein the learners would share their learning, they would be able to collaborate on their experiments, and they would verify their knowledge through formulating images of what they have grasped. Educators' multiple representations in their instructions are likely to make abstruse science concepts more reachable for students/learners. Students who keep on performing their learning are most likely enthusiastic in engaging their acquired knowledge.

The researcher observed that the education students of Cebu Technological University often said that the chemistry subject is difficult. That is why this study will be used for addressing the areas of concern in order to improve the positive attitudes of education students at Cebu Technological University – Main Campus toward Chemistry.

1.1. Study Problem

The study determined students' attitudes vis-à-vis performance on Chemistry of BSED-Science major at Cebu Technological University – Main Campus Cebu City during academic year 2016 -2017 as the basis for enhanced course of action. It may specifically answered the following questions which are relevant to the

performance of the students towards Chemistry such as (1) related information of the students' respondents as to age and gender, and type of student; (2) teachers' respondents as to educational attainment, number of years in teaching Chemistry, appropriate seminars/trainings attended, and teaching approaches; (3) performance of education students in Chemistry as to: classifying, comparing, and analyzing and creating competencies; (4) attitudes of the student respondents on Chemistry; (4) relationship between performance and attitude of the students toward Chemistry; (5) course of action to be taken based on the findings.

2. Methodology

The study identified the attitudes of education students at Cebu Technological University – Main Campus toward Chemistry and their performance towards the course (Chemistry). In gathering the data, purposive sampling was used. The data to identify these attitudes and their performance were generated through a survey of education students from all second year to fourth year BSED-Science. The data gathered were analyzed, and interpreted using descriptive statistical treatment. An accepted recommendation would be developed to totally eliminate the negative perception of students towards Chemistry. A questionnaire was designed to assess the attitudes of students toward learning chemistry. The questionnaire was based on the questionnaire made by Gita Perkins at Arizona State University (December 2011) for the performance of students; for students' attitudes survey questionnaire was based on the questionnaire of Balance Motoko Ollie at Edith Cowan University Perth, Western Australia and for teachers' approaches survey questionnaire was based on the questionnaire made by Balance Motoko Ollie BSc. Ed (Chemistry); M. Ed (Science Education); PGDE and MSc. (Analytical/Environmental Chemistry) at Edith Cowan University Perth, Western Australia (May, 2012). The data gathering in the research was done through the use of the questionnaire technique. The questionnaire forms were administered to all second year to fourth year students of BSED – Science of Cebu Technological University – Main Campus and Chemistry teachers of the same institution as respondents after asking permission from the Campus Director. Data from the students survey questionnaires and teachers' survey questionnaires were analyzed using the descriptive statistical methods involving the percentage, mean, standard deviation. The survey questionnaires were subject to interpretation using Likert method. For students' survey questionnaires: 4 = strongly disagree, 3 = disagree, 2 = agree, and 1 = strongly agree. For teachers' survey questionnaires: 5 = used in every lesson, 4 = in most lessons, 3 = in some lessons, 2 = in few lessons, and 1 = never used in any lesson.

From the above given score, the mean of each item was computed. For students' survey questionnaires: the outcomes from the mean of the score from each item are interpreted as follows: 3.25 – 4.0 means strongly agree, 2.50 – 3.24 means agree, 1.75 – 2.49 means disagree, and 1.00 – 1.74 means strongly disagree. For teachers' survey questionnaires: the outcomes from the mean of the score from each item are interpreted as follows: 4.20 – 5.0 means always in every lesson, 3.39 – 4.19 means usually in most lessons, 2.58 – 3.38 means oftentimes in some lessons, 1.38 – 2.59 means seldom in few lessons, and 1.00 – 1.37 means never in any lesson.

For students' survey questionnaires, the item with high average means tells that the respondents strongly agree with the attitude and the low average means that the respondents strongly disagree. For teachers' survey questionnaires, the item with high average means shows that it is commonly used in teaching Chemistry and the low average means reveals that it is not used or seldom used in teaching Chemistry.

3. Findings

The attitudes of the students toward the subject (Chemistry) reveal how they internalized the effects of Chemistry in their life. Sometimes, they are not aware that the lives in this world revolve in Chemistry.

Students as to their Age and Gender. This provides the frequency and percentage of respondents as to their age and gender. It shows that age clustered into 16-18 had the highest frequency of 115 and had a percentage of 56%. Age clustered into 19-21 had a frequency of 78 and had the percentage of 38%. The age 22-above had the lowest frequency. This data imply that the said student respondents are expected to show some level of maturity. At least, they are expected to be responsible in coping with difficulties of the subject. For gender of the respondents, female respondents had a frequency of 105 while male respondents had a frequency of 99. Most of the respondents are female. Fewer male students are enrolling in this course. Perhaps, the major courses offered by the education department are not in-line with their interests. Evidently, a certain culture in the Philippines shows that men are more skilled enhancers compared to women. That is why they preferred courses wherein skills are prevailing like

engineering, nurses, and etc. Education, on the other hand, is more academic than technical.

Type of Student. Type of student tells us whether he/she is a working/student assistant/part-time or a full-time student. This may also give an idea whether it affects their performance towards the subject. The frequency and percentage of students as to their type. Majority of the student respondents were full-time students with a frequency of 187 and had a percentage of 92% and for the working students had a frequency of 17 and had a percentage of 8%. It is expected that the full-time students would excel in their performance because they have ample time to study compared to the working students who have to divide their time between study and work. Moreover, the result also shows that only few are working students which imply that students' parents/guardians have the capability to send their children to this institution. Despite being working students, their performance in subject competencies is not affected.

Teachers as to their educational attainment. The teachers are another set of respondents to the study. They are included in the study because their instructions might contribute to the performance of the students towards the subject. Educational attainment of the teachers influences the attitudes of the students toward the subject. In a way that encourages the latter to study well so that in the future they may be like their instructors/teachers. The result shows that there are two instructors who are full-fledged masters: one is a master in her field of specialization and the other is master in another field. The rest of respondents had units in master in their own field of specialization with 71% and had a frequency of 5. The continuing study of the instructors helps them to grow personally as educators and to become efficient instructors. It is hoped that not only teachers would develop or grow but the students as well.

Number of Years in Teaching Chemistry. Teaching experience of the teachers may help the students to appreciate the contribution of the subject (Chemistry) to the progress of the society because one way or another, the teachers with such length years of teaching experience may conduct experiments/activities which bring the students to realization that Chemistry plays an important role in the community. It shows that most of the chemistry teachers had 1-5 years of teaching experience with 86% and one teacher had 6-10 years of teaching experience with 14%. Though most of the teachers don't have such lengthy teaching experiences, they did their part to respond to the demand of the students. Length of teaching experiences would help the instructor determine what strategies he/she is going to use in the different levels or groups of students. In this way, he/she may find it easy to handle her/his students.

Appropriate Seminars/Training. Attended. The seminars attended by the teachers may help them to enhance their teaching strategies in delivering the subject matter to the learners. They need to attend seminars from time to time because the students in these millennial generations are more advanced. By this, they may accommodate or entertain whatever confusions that the latter are holding in their mind. the percentage of respondents who attended seminars/workshops. From the result, seminars attended by most respondents are syllabus making/Safety Laboratory/K12/OB International Research Congress/Operating AA's with 51%. Seminars/Workshops attended by teachers are one of the contributing factors for the teachers to become more effective in delivering the lessons to the students. For Sixth Pate Convention/31st Philippine Chemistry Congress, Basic Research/Test Construction/Teaching Strategies had the same frequency of 1 and a percentage of 14%. There is one teacher who did not attend any seminars within the span of three years. It had a percentage of 14%. Seminars/Workshops are important for the instructors because it is in this way that they can update their teaching strategies. Since, the students are now more knowledgeable about communication technology. Instructors should definitely go into the trends that can help the students grasp the lessons more easily and more quickly. They can use gadgets such as multimedia. Instructors should not be left behind by the new technology in presenting their lessons to the students. In this way, there is a smooth flow of learning.

Table 7. Teaching Approaches in Teaching Chemistry

Teaching Approaches		Mean	Verbal Description
• Student – centered approach.	St	4.14	Usually in most lessons
• Generic science approach.	Ge	3.51	Usually in most lessons
• Interdisciplinary approach.	Int	3.57	Usually in most lessons
• Case study approach.	Ca	2.28	Seldom in few lessons
• Concept mapping approach.	Co	3.14	Oftentimes in some lessons
• Induct-Observe-Explain approach.	Pr	3.85	Usually in most lessons
• Socratic approach.	Pr	3.85	Usually in most lessons
• Lecture approach.	Le	4.57	Always in every lessons
• Independent study approach	In	2.57	Seldom in few lessons
• Workshops and example classes approach.	W	3.28	Oftentimes in some lessons
• Integration of content areas approach.	Int	3.57	Usually in most lessons
• Generating and testing hypotheses approach.	Ge	3.57	Usually in most lessons
• Flexible/strategic grouping approach.	Fle	3.14	Oftentimes in some lessons
• Field experience, field trip, or field study approach.	Fie	1.14	Never in any lesson
• Cooperative learning approach.	Co	4.14	Usually in most lessons
• Teacher explains chemistry ideas to students.		4.8	Always in every lesson

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• Teacher writes notes on the board for students to copy	4.2 2 8	Always in every lesson
• Teacher uses small groups of students to discuss ideas.	3.2 2 8	Oftentimes in some lessons
• Teacher uses the whole class to discuss ideas.	3.8 8 5	Usually in most lessons
• Teacher lets students read chemistry textbooks.	2.8 8 5	Oftentimes in some lessons
• Teacher demonstrates a chemistry experiment.	4.2 2 8	Always in every lesson
• Teacher uses a diagram to explain ideas.	4.1 1 4	Usually in most lessons
• Teacher asks the students to develop their own diagram to show their own understanding of ideas.	3.7 7 1	Usually in most lessons
• Teacher uses 3D models to illustrate chemistry concepts.	2.0 0 0	Seldom in few lessons
• Teacher uses role-plays to engage students in acting out Chemical processes.	2.0 0 0	Seldom in few lessons
• Teacher draws graphs to show relationships and uses 3D models to illustrate chemistry between variables as an example of reaction rates, water pollution and solubility.	3.5 5 7	Usually in most lessons
• Teacher uses flow charts to illustrate processes.	3.4 4 2	Usually in most lessons
Average mean	3.43	Usually in most lessons

Legend:

4.20 – 5.0 = Always in every lesson

3.39 – 4.19 = Usually in most lesson

2.58 – 3.38 = Oftentimes in some lesson

1.38 – 2.59 = Seldom in few lesson

1.00 – 1.37 = Never in any lesson

Approaches of teachers in teaching the subject are important because students have different capacities for digesting the lessons. The latter must consider approaches which are applicable to most of the students. The common knowledge that students have a short-term capacity in their listening skills brings the teachers to become more resourceful. The results reveal that from the weighted average mean of the items which is 3.434 and best described as usually used in most lessons, it explicitly showed that Chemistry teachers used multiple representations or approaches in teaching the subject. This means that the Chemistry teachers are effective. The

statement “Teacher explained Chemistry ideas to students” had a mean of 4.857 which means that it is always used in every lesson, this entails that the subject is highly conceptual. Students need elaboration of the lessons/topics. “Lecture approach” with a mean of 4.571 shows that it is always used in every lesson. It reveals that the subject is again highly conceptual. Only a few students can grasp the lesson easily. “Teacher writes notes on the board” and “Teacher demonstrates Chemistry experiments” have a mean of 4.286. These reveal that they are always used in every lesson. Teacher writes notes on the board because no books are required for students. On the other hand, the teacher demonstrates Chemistry experiments because it is the first-hand ideas in which demonstration is the most applicable due to inadequacy of materials/apparatuses. Moreover, the statement “Field experience, field trip, or field study approach” got a lowest mean of 1.143 which means it is never used in any lesson. This strategy is never used by the instructors in any lesson because it is prohibited by the administration due to some bad incidents that happened in other universities conducting it. “Teacher uses 3D models to illustrate Chemistry concepts” and “Teacher uses role-plays to engage in acting out chemical processes” had the same mean of 2.000 which mean seldom used in a few lessons. “Teacher uses 3D models to illustrate chemistry concepts; these are the process of developing graphics and images that appear to have three dimensions. Though the demands of computer systems are increasing, survey results show that many of the science instructors seldom used this type of strategy. Role-plays are not applicable to all topics because the subject is highly conceptual and needs the expertise of the instructor. Besides, role-plays are time consuming.

Table 8. Performance of education students towards Chemistry competencies.

Competency	f	%
Classifying	102	50.00
Comparing	75	37.00
Analyzing and Creating	27	13.00
Total	204	100.00

The competencies measured in the performance of the students are classifying, comparing, and analyzing and creating. Classifying competency had a frequency of 102 with a percentage of 50%, comparing competency had a frequency of 75 with a percentage of 37%, and analyzing and creating competency had a frequency of 27 and a percentage of 13%. The results show that the students need to have more practice in solving problems. They need to develop more of their skills in classifying, comparing, analyzing, and creating. Thus, the results show that the students have poor performance in subject competencies.

Table 9. Attitude of the student respondents towards Chemistry.

Statements	Mean	Verbal Description
As a student...		
• I enjoy chemistry courses more than the others.	2.36	Disagree
• Chemical symbols are the same as Chinese to me.	2.73	Agree
• I would like to have chemistry lessons most of the time.	2.11	Disagree
• The development of chemistry is responsible for many environmental dilemmas.	1.80	Disagree
• Chemistry knowledge is helpful to interpret many aspects of our everyday life.	1.62	Strongly disagree
• The Chemistry course is associated with the other courses.	3.15	Agree
• I solve chemistry exercises very quickly.	2.96	Agree
• The Chemistry course assists the development of my conceptual skills.	1.95	Disagree
• During the chemistry lesson, I was excited.	2.76	Agree

● Chemistry knowledge will be favorable after my graduation.	3.12	Strongly disagree
● Chemistry knowledge is necessary for understanding other courses.	1.91	Disagree
● The advancement of chemistry uplifts the quality of our lives.	1.66	Strongly disagree
● Chemistry is our dream for solving many environmental problems.	1.89	Disagree
● My future career is not dependent on knowledge of Chemistry.	2.52	Agree
● The progress of chemistry contributes to the development of a country.	1.81	Disagree
● Chemistry is a guilt-free subject for our compulsory education.	2.15	Disagree
● I make many efforts to comprehend chemistry.	1.74	Strongly disagree
● I doubt if I can ever pass my chemistry subject in the yearly examination.	2.94	Disagree
● The profession of a chemist is one of the most alluring.	1.87	Disagree
● I believe every individual must have knowledge of chemistry.	2.96	Agree
● I like chemistry courses.	1.82	Disagree
● Chemistry knowledge is important for my future career.	2.56	Agree
● I would like to have less chemistry lessons.	2.80	Disagree
● I understand the chemistry concepts very fast.	1.98	Disagree
● I find chemistry courses very attractive.	2.42	Disagree
● When I solve chemistry exercises, my mind goes blank.	2.29	Disagree
● I think people are ungrateful to chemistry applications.	3.03	Agree
Average mean	2.33	Disagree

Legend: 3.25 – 4.0 means strongly agree 1.75 – 2.49 means disagree
2.50 – 3.24 means agree 1.00 – 1.74 means strongly disagree

The attitudes of the students toward the subject (Chemistry) reveal how they internalized the effects of Chemistry in their life. Sometimes, they are not aware that the lives in this world revolve in Chemistry. The average mean of the items regarding students' attitudes toward chemistry is 2.335 which fall under "disagree". This means that they have a poor/negative impression on the subject. The statement "Chemistry knowledge is helpful to interpret many aspects of our everyday life" had an average mean of 1.632 which is equivalent to "strongly disagree". This may imply that the students may take the subject for granted. The attitudes shown by the students to this statement contradict their choice of course since they are Science major. One of the respondents during the administration of the survey commented that: *"Dili koi Manahan as ado major, napugos lang koi kuha kay ang akong Manahan nga major wala man gi-offer as CTU. Dili man koi ka-afford skwela as laing skwelahan. Barato man as CTU.* (I don't like my major but I was forced to take science because CTU does not offer the major which I like most. I can't afford to enroll in another school. CTU is financially affordable.) "The advancement of Chemistry uplifts the quality of our lives" with a mean of 1.662, which falls under "strongly disagree". This means that the students do not appreciate the contributions of chemistry to the lives of the people. "I make many efforts to comprehend Chemistry" had an average mean of 1.745 which is equivalent to "strongly disagree" thus revealing that on the part of the students they are less motivated to learn.

Likewise, the statement "Chemistry course is not associated with another course" which had an average mean of 3.157, which falls under "agree", this shows that students cannot see any relation of Chemistry to other subjects. "Chemistry knowledge will be favorable after my graduation" with 3.127 as mean, which is equivalent to "strongly disagree". This may mean that students believe that Chemistry is useful after their graduation because whether they like it or not, they will most probably handle Chemistry when they will be teachers. The statement "I think people are ungrateful to Chemistry applications" has an average mean of 3.039 which falls under "agree". This shows that students observed that the respondents may appreciate the benefits brought by Chemistry. However, statements "I think every individual must have the knowledge of chemistry", and "Chemistry knowledge is necessary for my future career" which is equivalent to "agree". The statement "The progress of Chemistry is responsible for many environmental problems" which marked "disagree" With these remarks, the

students see the usefulness of Chemistry in their lives as well as in the society.

RELATIONSHIP BETWEEN PERFORMANCE AND ATTITUDE OF STUDENTS TOWARD CHEMISTRY

Table 9

Chi Square Test of the Relationship between Performance and Attitudes of Students towards Chemistry

Source	df	X ²	P - value	Interpretation
Performance vs Attitude	26	15.12	.9952	Not significant

Significance level $\alpha = 0.05$

This shows the relationship between the performance and attitudes of the students toward the subject (Chemistry). This expresses whether the attitudes of the students affect their performance on the subject. Chi Square test was used to identify the relationship between the performance and attitudes of students toward Chemistry.

The **computed p-value** between the performance and attitudes of students toward Chemistry subject is 0.9952 which is higher than the set significant level which is $\alpha = 0.05$. This confirms that the performance of the students towards the subject is not significantly related to their attitudes or vice versa. In other words, the attitudes of the students have nothing to do with their performance towards the Chemistry subject. This further implies that their negative or positive attitudes toward the subject does not affect their performance to the latter. Based on the survey, it is because when they are given tasks to perform, they do it without thinking about their attitudes towards the subject. Their goal is simply to pass the minimum requirements of the course. That is why; they tend to do their best only to accomplish what is required.

4. Summary of Findings. Based on the gathered data that are treated statistically, the study has the following findings. The performance of students towards the Chemistry competencies reveals that students should develop their skills in classifying, comparing and problem-solving. On the other hand, the attitudes of students toward Chemistry have an average mean of 2.335 which is equivalent to “disagree”. This means that the students have a negative impression towards the subject. Perhaps, they could not appreciate the importance of Chemistry to the economic aspect of the society as well as to the lives of every human being.

The teaching approaches in teaching Chemistry have an average mean of 3.434 which means that various approaches listed in table 7 are usually used in most lessons. This finding tells us that the teachers patiently and diligently used the approaches just to cater to the needs of the students despite the negative responses from the students.

Moreover with the use of Chi Square, it was found out that there is no significant relationship between performance and attitudes of the students toward Chemistry.

5. Conclusion. Based on the findings of the study, it is concluded that students are less motivated to study. It is also concluded that the poor attitudes shown by the students toward the subject exhibited that they did not appreciate the importance of Chemistry in their lives. On the other hand, despite the poor performance and negative impression of students toward Chemistry, the instructors diligently and laboriously used varied approaches just to grasp the needs of the students.

6. Recommendation. It is recommended that the proposed enhanced course plan of the researcher should be applied so that there will be a higher students' performance and positive attitudes toward the subject (Chemistry). The possible strategies which help to level up the performance of the students towards the subject (Chemistry) are consultation to the expert or having tutorials, practice problem solving, field trip to companies w/chemical laboratories, and production ex. Shemberg, Coca-Cola Group of Companies, and conduct seminars for career guidance.

Course Action of the Study									
Areas of Concern	Objectives	Strategies	Persons Involved	Budget	Source of Budget	Time Frame	Expected Outcome	Accomplishment	Remarks
Low performance of students toward subject competencies as to classifying, comparing, and analyzing and creating	To level up the performance of the students toward subject competencies	- Consultation to the expert or having tutorials -Practice problem solving	BSED-Science students Experts/Instructors	50ph/meeting	Allowance	Every time they find any difficulties	Students increase performance toward subject competencies.		
Negative attitudes of Students toward Chemistry	To have positive attitudes toward Chemistry	-Field trip to companies w/chemical laboratories, production ex. Shemberg, Coca-Cola Group of Companies -Seminars for career guidance	BSED-Science students Personnel of the company Instructors Facilitators	300ph/students	Allowance	One day during summer or any preferred days	Students appreciate the contributions of chemistry to economics, life-style of human being and to health. Students are enlightened and weighted their capacity in chemistry/science as their major.		

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