

# Attitude and Practice of Students and Teachers in the Private and Public Senior High School toward Green Chemistry

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## Abstract

The study was conducted to determine the attitude and practice of the student and teachers in the senior high school among private and public schools in Mountain Province Philippines with regards to membership in environmental organization and Participation to environmental activity.

The salient findings of the study revealed that the attitude of senior high school students among the private and public schools to Green Chemistry is HIGH as reflected in the overall mean of 3.53. For the practice of senior high school students among the Private and Public Schools toward green chemistry the study shows SATISFACTORY. HIGH attitude in the study means that both teachers and students have neither favorable to green chemistry, and therefore, advocacy should be strengthened while SATISFACTORY practice means Green Chemistry is moderately practiced in both public and private school. However, it was surprisingly shows that the students in public high school demonstrated a higher attitude and practice compared to the students in the private. As to the attitude and practice among private and public schools teachers towards green chemistry, the study revealed that teachers in the public school have higher attitude and practice than teachers in private school. The findings of the study further revealed that there was a high relationship between attitude and practice toward green chemistry of teachers and students in public and private schools. Moreover, as to participation of environmental activity and membership to organization, the study shows that there was significant difference in the attitude and practice of students and teachers in public and private school toward green chemistry.

**Keyword:** Students, Teachers, Green chemistry, attitude, practice

## Introduction

Anastas and Warner (1998) In their publication “Green Chemistry, Theory and Practice” introduced their 12 green chemistry principles. An outlines of framework for making a greener chemical, process, or product as means of conserving environment.

Under the Act to Promote Environmental Awareness through Environmental Education and for Other Purposes otherwise known as “Republic Act 9512”, the following Green chemistry activities to be conducted in the school are: a) Use recyclable materials b) school canteens shall use reusable food containers and avoid selling processes food wrapped in non-recyclable packaging. c) Different recyclables, such as bottles, cans and plastic containers, which will be collected by a designated junkshop partner; and d) have temporary storage area for school’s

residuals waste which include non-recyclable and non-biodegradable discards. With the abovementioned activities, this study also verified the compliance of the students and teachers to green chemistry. Green Chemistry according to Anastas (1991) the uncovering innovative solutions to big question that affect our environment— like how to make chemicals, processes, or products greener, thereby reducing environmental or human health risks and increasing energy efficiency.

One of the basic policies of solid Waste Management and to promote Environmental Awareness through Environmental Education is the integration of Green chemistry awareness such as management of waste and recovery material into the academic curricula of formal and non-formal education such as management and recovery of solid waste material.

Pursuant to Ecological Solid Waste Management Act of 2000, Zero Waste Management promotes pro-environment products to eliminate health risk generated from solid waste and prohibit the indiscriminately disposal and burning. The goal of “zero waste management is related to the practice of green chemistry that is ethical, economical, efficient to guide people in changing their lifestyle where all disposable materials are recycled, re-use and reduce.

In support of Green Chemistry, the Department of Education (DepEd) issued guidelines to be undertaken in the implementation of National Greening Program (NGP) in the school. The NGP is a mandated program in all public elementary and secondary schools nationwide to establish their vegetable garden in the school known as *Gulayan sa Paaralan* (school in a garden) by using solid waste materials as vegetable pots especially in the urban cities. One purpose of the *Gulayan sa Paaralan* is to produce organic and nutritious food for the school children that can be add in the menu under supplementary feeding program. Likewise, the reduction, recycling, re-use and composting solid waste materials are anchored to Green chemistry.

### **Statement of Problem**

The study looked into the attitudes and practices of Students and teachers in the Private and Public Senior High School toward Green Chemistry.

Specifically, this study sought the answer of the following questions:

1. What are the attitude and practice of Students in the Private and Public Senior High School toward Green Chemistry as to:
  - a. Membership to environmental organization/club, and
  - b. Participation in environmental advocacy activities
2. What are the attitudes and practices of teachers in the Private and Public Senior High School towards Green Chemistry as to:
  - a. Membership to environmental organization/club
  - b. Participation in environmental advocacy activity
3. Is there a significant relationship of attitude and practice among students and teachers in private and public senior high school toward Green Chemistry?

## **METHODOLOGY**

### **Research Design**

This study used the descriptive method of investigation in gathering data of the attitude and practice toward green chemistry of students and teachers in the private and public schools.

### **Local and scope of the study**

This study covered the attitude and practice of students and teachers in private and public senior high school toward Green Chemistry. The study was confined to two national high schools and two private high schools in Mountain Province, Philippines. The subjects on the said investigation were 60 Grade 12 students and 20 senior high school teachers regardless of status whether they are permanent, casuals, or Job Order.

### **Data Gathering Tools**

The questionnaire checklist is the main instrument in gathering data for the study. The said tool consists of questions geared on attitudes and practices of Students and Teachers in the Senior High School among Private and Public Schools on Green Chemistry. The questionnaire has three parts as follows: profile of the respondents; attitude; and practice toward green chemistry. The instrument that

was used in the study adopted the 12 green chemistry principle developed by Anastas, Paul T. and John C. Warner (1991) therefore; validity test of the questionnaire was not necessary.

### Data Gathering Procedure

Letter of request for approval was addressed to the school principal in the conduct of the study. When permit was approved, the questionnaires were distributed to the target respondents through the respective school heads and the accomplished questionnaire was personally retrieved by the researcher. In the course of data interpretation, follow-up interviews were made to ascertain the validity of the findings.

### Analysis of Data

To determine the attitude and practice of students and teachers in the senior high school among private and public schools toward green chemistry, frequency count with 5-point scale was made to the items of the questionnaire. The following reference scale shown in table 1 was used to determine the attitude and practice.

**Table 1. Reference Scale on the Attitude and Practice**

Arbitrary Value	Numerical Equivalent	Descriptive Equivalent	Interpretation	
			Attitude	Practice
1	1.0-1.80	Poor	The attitude of the students and teachers are extremely unfavorable	Never Practiced
2	1.81-2.5	Fair	The attitude of the students and teachers are unfavorable	Rarely Practiced
3	2.6-3.3	Satisfactory	The attitude of the students and teachers are favorable	Green Chemistry is moderately practiced among the students enhance
4	3.4-4.2	High	The attitude of the students and teachers	Often practice

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are neutral

5	4.3-5.0	Outstanding	The attitude of the students and teachers most favorable	Always Practice
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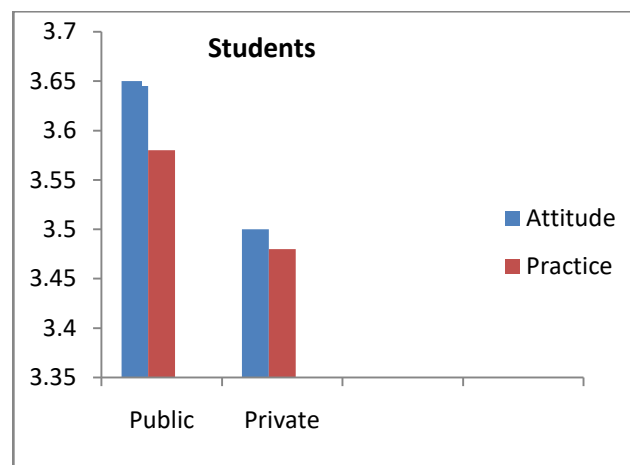
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To determine if there was a relationship of attitude and practice of students and teachers in public and private senior high school toward green chemistry, Pearson was used in the analysis.

## RESULT AND DISCUSSION

### Attitude and practice of senior high school students among private and public schools toward green chemistry

Figure 1 shows the comparison of attitude and practice of students in the private and public senior high schools toward green chemistry. It was revealed in figure 1 that the students in public high school have high **attitude and practice** toward green chemistry than in the private schools.



*Figure 1: Comparison of Attitude and practice of senior high school students among private and public schools*

The findings is contrary to the study of Bernardo E. C (2016) who said that the students in private school in the division of Pangasinan shows a significant difference in practice on environmental awareness activities. Accordingly, the students in the private school demonstrated high practice particularly on solid waste segregation compared to student in public schools which shows moderate. Moreover, the notion that students in public schools have high attitude and practice towards green chemistry according to Bagwan (interview, 2018) is that the students in public school were more exposed to extra-curricular activities was anchored to environmental protection. The YES-O is a mandated organization required by the Department of education (DepEd) to maximized students' potential development and demonstrated their skills in dealing with environmental issues. Findings of the study were also collaborated the study of Doquey (2014) who revealed that the public school students of Sabangan District of Mountain Province, Philippines have a high awareness of environmental issues and problems as compared to students in the private school due to their involvement of students in YES-O.

As shown in table 2 with an overall weighted mean of 3.65, the study revealed that the attitude towards Green Chemistry of the students among the private and public schools is “HIGH” which means that both public and private students were have favorable attitude to green chemistry.

**Table 2: Attitude and Practice of Senior High School Students among Private and Public Schools towards Green Chemistry (Public=30, Private =30)**

	<i>Public</i>	<i>Private</i>	<i>WM</i>	<i>DE</i>
Attitude	3.65	3.50	3.58	H
Practice	3.48	3.32	3.34	S

**Legend:**

1.0-1.80	- Poor	4.20-5.0	- Outstanding
1.81-2.50	- Fair	3.4-4.19	- High
2.6-3.30	- Satisfactory		

However, the findings show that *raw material or feedstock should be renewable and It is better to prevent waste than to clean up waste after it has been created* were rated outstanding which means that this was the most favorable attitude among the respondents as reflected in a mean of 4.47 and 4.23 respectively. While *synthetic methods should be designed to maximize the incorporation of all materials used in product processes* and *catalytic reagents (as selective as possible) is not superior to stoichiometric reagents* were rated FAIR.

This implies that because of the 3R’s mandated program of the DepEd that influenced students’ attitude, the students were already aware on some environmental issues related to green chemistry. Bumidang (2001) revealed that the prevention of waste than cleaning up waste after it has been created became the strength of students of junior high school of Sabangan National High School. Likewise, the same findings of Danglosi (2008) to the junior high school students of San Alfonso High School.

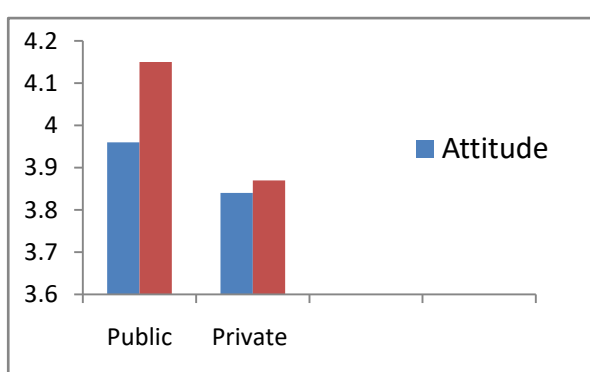
As to the practice of the student on Green Chemistry of senior high school students among private and public schools, the findings is SATISFACTORY. Satisfactory in the study means that practice on Green Chemistry is moderate among the students in both public and private school. Therefore, advocacy on green chemistry should be enhanced like take a school based earth day, make use of natural cleaning methods/agents in classroom, school wide composting project, etc. The findings further shows that most observe practice among the students in both private and public schools was *practice classroom recycling efforts and Utilize a variety of renewable resources*. This maybe dueto environmental friendly school program. As a government entity responsible for molding the young generation in the country shall be also the pioneer for waste recycling education. Likewise, as government agencies, the institution should monitor waste segregation in their areas of jurisdiction and implement such a program. It was also a common practice of the indigenous people to recycle or reuse their waste regardless of kind. These were supported by the NCIP (2001) in their study about the indigenous people's practices on natural resources conservation. Therefore, because the study was conducted in the locality of indigenous people, their green chemistry practices is attributed to their culture and reinforced by the National Greening program and several environmental laws of the government.

However, although the DepEd has a program on *gulayan sa paaralan* (School in a garden), the study revealed that *starting/maintaining school garden and advocates of healthier school lunches* are the least practice. This was possibly due to limited spaces in the school compound. Likewise, work education subjects today were not emphasize to gardening or agricultural education. Unlike in the earliest education wherein the students were given an opportunity to engage in gardening in the

available school lot in time of Technology and Livelihood Education (TLE). It was part of the agricultural training to prepare young generation to be self-reliance in their future.

Attitude and practice of senior high school teacher among private and public schools in Mt. Province toward green chemistry

With regard to attitude and practice of teachers, Figure 2 further shows the comparison of attitude and practice of teachers in private and public senior high schools toward green chemistry. It was revealed in figure 2 that teachers in public senior high school have a high attitude and practice towards green chemistry compared to teachers in the private high school. The high attitude and practice of public school teachers toward green chemistry is either connected to their role in the implementation of the National greening program. The Deped as one of the key leading gov't entity in the implementation of National Greening Program (NPG) has also environmental program like *Gulayan sa Paaralan* (School in a Garden), environmentally-friendly school, and the conduct of competition for best school which directly involved teachers.



**Figure 2: Comparison of Attitude and Practice of Senior High School Teachers among Private and Public Schools**

In *Gulayan sa paaralan* or School in a Garden, the teachers were instrumental in the program, likewise they can be also appointed as ex-officio member of the natural Resources and Management Council (NRMC) in their own locality. This council is a mandatory to Local Government Units under the direction of the Department of Interior and Local Government (DILG) as a respond to the growing environmental problem nationwide.

With the involvement of the public school teachers in local government especially in the clean and green activities, they are expected to have high regard attitude and practice on green chemistry. Such finding is confirmed by Lampac (2012) the executive secretary of the mayor Donato Danglosi that public school in their teacher's municipality are their direct partners in the implementation of the clean and green program in the barangay level.

In addition to Lampac (2012), the study of Lucas (2004) on the extent of implementation of RA 9003 in the different schools in the province said that the teachers in the public school have high extent of implementation compared to moderately implement in the private school. They have no option to implement in their school because it was their mandate and they were required to submit accomplishment reports.

### **Attitude and practice of senior high students among private and public schools in Mt. Province toward green chemistry as to participation to environmental activity and membership to environmental Organization**

The findings of the study in table 3 revealed NOT SIGNIFICANT about the difference in attitude on Green Chemistry of senior high students among private and public schools as to active participation in environmental activity.

This means that the findings support the hypothesis that there is no significant difference between the attitude and practice on Green Chemistry of senior high school students. However, there is a significant difference in the attitude of public school student toward green chemistry as to participation in environmental activity. Because students in public high school are required to participate in the national greening program/activity regularly, the perception of the students toward green chemistry is expectedly high. This implies that the more environmental related activity that the student will join, the more attitudes they will have toward green chemistry.

**Table 3: Attitude of Students among Private and Public Schools toward green chemistry as to active Participation in Environmental activity**

	Attitude		Practice	
	Public	Private	Public	Private
With Participation on Environmental Activity	3.35	4.06	3.47	4.05
Without participation on Environmental Activity	0	3.42	0	3.39
p-value	.775		0.03	

0 (zero) – means that the respondents were 100% have participation in environmental activity

In a survey conducted by Green Chemistry & Commerce Council (2014) to gain a better understanding of their green chemistry practices, the drivers who participated in environmental awareness activity have a high attitude and practice perception than those who have no participation at all. This collaborated the findings in the study that the attitude of the student in the public senior high school toward green chemistry is significantly different when having their participation in environmental activity.

Ravichandran S. (2019) in his book “*Implementation of Green Chemistry Principles into practice*” also described that public high school students in India are more aware of green chemistry than those in the private. One possible reason for this is that the public high schools as a government entity are directly connected in the implementation of the national greening program at the school level and they are required to submit such accomplishment reports to the government.

With regards to the attitude of students in the public and private senior high school toward green chemistry, Caruana (2015) said that despite information dissemination of green chemistry to students, there is no guarantee that the attitude and practice of millennials toward green chemistry are improving or enhanced. Since the millennials today are influenced by computer games there is also a sudden change in their behavior particularly on how they deal with their environment. The introduction of different social lifestyles such as the use of disposable wear and social networking to the millennials is another factor that the students today don’t have the concern to nature.

According to Paredes (2007) despite existing rules and policies that the students will follow in school to maintain their cleanliness, most of the time the student doesn’t follow. The student would prefer to pay their penalty rather than doing it. The statement of Paredes collaborated Baldo (2010) who said that the students’ behavior toward the clean and green activity of the school has a low turnout if teachers are not with them, the students are busy on their social networking like Facebook and they

only act when the teachers are present. This implies that technology has a negative impact on the behavior of students and so with their attitude and practice toward green chemistry.

With regards to practice of senior high school students among private and public schools toward Green Chemistry as to participation in an environmental activity, SIGNIFICANT is revealed in the study as reflected in table 4. This means that the findings of the study dis-agree with the hypothesis but this finding of the study supported the survey conducted by Green Chemistry & Commerce Council (2014) that the drivers who participated in environmental awareness activity have high in practice than those who never participated.

Since the participation of students on environmental activity is partly mandate of the DepEd especially in the public school, the students were have grounded knowledge on some green chemistry principle and perhaps because some of it they were practiced them in their home. Some green chemistry principles were also integrated into their curriculum. In public school, young environmentalist student organization (YES-O) was mandated organization in public school under the direction of the DepEd. Its fundamental activity is involving students to initiate programs regarding conservation of natural resources and solid waste management not only in their school but also in their locality. These activity includes clean and green activity, *gulayan sa paaralan*, waste recycling and among others. To maximize students involvement on environmental concern like green chemistry, regular competition for best YES-O organization in the whole DepEd Division and Best *gulayan sa paaralan* was conducted. Award were based on the organization initiated programs and their accomplishment which the private school have a minimal participation.

With all these involvement of students in environmental activity, the practice of green chemistry is founded. Therefore, the more environmental activity to be participated by the students like workshop, orientation, camping, etc, the more they have outstanding practices on green chemistry principles.

The findings of the study also collaborated on the study of Santos (2014) that to improve the quality of green chemistry education, the students are encouraged to participate in the environmental activity rather than by giving lectures on principles of green chemistry in the classroom. The advantage of the participation of students in environmental activity is to perform what they are learning with their associate right away. Knowledge, skills, and attitude are easily transferred because it is a collaborative, integrated, and having enabling learning environment.

As to membership in Environmental students Organization, table 4 below shows the comparison of the attitude toward Green Chemistry of among Private and Public Schools Senior High School Students. The membership of students to environmental organization improves their attitude perception on green chemistry. Because in an organization according to Constable(2016) that involvement in an organization will develop desirable values from others which can transform them into an environmentalist. Therefore, joining an organization may generate positive attitude not only toward green chemistry but including their environment.

**Table 4: Attitude of Students among Private and Public Schools toward green chemistry as to**

	Attitude		Practice	
	Public	Private	Public	Private
With membership on Environmental Organization	3.85	4.13	3.52	4.13



n			
Without membership on Environmental organization	3.60	3.46	3.59
			3.42
p-value	.707		.069

However, NOT SIGNIFICANT was revealed in the study as reflected on P value of .707 which is greater than the 0.05 level of significance. Therefore, null hypothesis is accepted. It means that there is no significant difference in the attitude of Senior High School Students among Private and Public Schools towards green chemistry as to membership in Environmental student organizations. Despite of being a member of an environmental organization, it has no bearing to their attitude. Such finding is similar to that of Zapanta (1999) who found out that attitude of students in public high school toward solid waste management is not significant in their attitude even they attended seminars and have membership in a different club in school.

The possible reasons brought out by Constable (2016) why membership to an environmental organization has nothing to do with their attitude towards green chemistry is that their perception of joining the organization is for social purposes, their purpose is to associate themselves with their friends rather than the learning and involvement to the objectives of the organization. The organization was also active at the beginning of the school year but becomes weak in the middle term of school year.

Accordingly, a student's organization president brought out his dismay during his interview; he explained that in his organization, their primary activity was focused on income-generating project rather than to the realization of their objectives. So during the middle term, their advocacy failed. This statement collaborated Bumidang (2001) that membership to students' organization does not guarantee the members to improve their attitude because some are just taking for granted. Another problem in the organization is how the goals and objectives of organization are instilling to the ideals of the members.

This implies that in order for the organization to develop high attitude toward green chemistry, the primary aim of the organization is on their advocacy program rather than the income generating project (IGP).

As to practice on Green Chemistry of Senior High School Students among Private and Public Schools, *Table 6*, statistical analysis using SPSS reveals NOT SIGNIFICANT with a p-value of .069 which is greater than 0.05 level of significance. The null hypothesis is, therefore, accepted which means that there is no significant difference in the Perception on Green Chemistry of Senior High School Students among Private and Public Schools as to membership in Environmental student organizations. Such finding is similar to that of Zapanta (1999) who found out that the attitude and practice of students in public high school toward solid waste management are not significant even they attended seminars and members to a different club in school.

Bumidang (2001) said that membership to students' organization does not guarantee the members to develop positive thinking because not all purpose of joining is their avenue for learning but for only social involvement. Another problem is the systematic activities to attain the goals and objectives of the organization are not well-defined so that they are motivated to participate of such activities. In other word, they cannot foresee a good in the organization. According to Santos (2014), to improve the behavior of students toward green chemistry the students are encouraged to participate in

environmental activity because the advantage of the participation according to Bowmen (2012), is to be rational in all way that are affecting our society.

### **Relationship of attitude and practices of students and teachers of Private and Public Schools toward Green Chemistry**

Table 5 present the relationship between attitude and practice of students and teachers in public and private schools. The study reveals that attitude and practice on green chemistry among the public and private school is positively correlated at .528 for public and .539 at Private. This implies that the attitude of students on green chemistry is attributed to the practice. This means that if attitude will increase, the practice will increase also. This supports the findings of Doquey (2016) in her study about the environmental awareness of students in Sabangan District. Beltran (2013) likewise stated in his study on the SWM practice of students at ISSPC that attitude and practice are correlated.

**Table 5: Relationship of attitude and practices of students in the Senior High School among Private and Public Schools in Mt, Province on Green Chemistry**

STUDENTS				TEACHERS			
PUBLIC		PRIVATE		PUBLIC		PRIVATE	
Attitude	Practice	Attitude	Practice	Attitude	Practice	Attitude	Practice
1	.528**	1	.528**	1	.528**	1	.528**
.528**	1	.528**	1	.528**	1	.528**	1

\*\* . Correlation is significant at the 0.01 level (2-tailed).

As regard to attitude and practice of Teachers on green chemistry, the study reveals that attitude ad practice of private school are correlated at .936\*\* while in public is correlated at .734\*\* therefore, the attitude and practice are correlated, The findings support Paredes (2007) study about teachers perception on teaching math that if the attitude towards math is difficult the practice in dealing in math subject is also poor.

## **CONCLUSION RECCOMENDATION**

### **Conclusions**

1. The ATTITUDE towards green chemistry of the student for both private and public senior high school is SATISFACTORY. Better to prevent waste than to treat or clean up waste after has been created got the highest mean, while the PRACTICE towards green chemistry is SATISFACTORY which means often practice with practice recycling effort is the most rated.
2. The ATTITUDE towards the green chemistry of teachers in the public and private senior high school is SATISFACTORY. Energy requirements of chemical processes should be recognized for their environmental and economic impacts should be minimized was the most rated. In PRACTICE towards green chemistry, the overall result is SATISFACTORY however, the Start/Maintain a school garden is the most rated in public senior high schools practice while in private school, Practice classroom recycling efforts were the most rated.
3. There is a correlation between attitude and practice among teachers and students in a public and private school toward Green chemistry

### **RECOMMENDATION**

1. School heads, teachers and students should be enhanced with skills in dealing environmental issues by inviting speakers or facilitators in school functions such as in organic farming, solid waste recycling, eco-friendly product processing.

2. Continuing green chemistry education for students and teachers should be supported by the school heads. As such, the program contained in the School Program Plan should be fully implemented.
3. Integration of Green chemistry in the curriculum in the K-12 Program

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