

Chemxcelerate: A Teaching Techniques in Enhancing Students' Performance and Competency

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Abstract

This study investigated the effect of ChemXcelerate Teaching Techniques on the Students' Performance and Competencies in chemistry among the Grade 12 STEM students in Cavinti Integrated National High School. Specifically, it aimed to determine the level of ChemXcelerate teaching techniques; the students' learning competency; and the students' performance. The study also aimed to determine the significant difference on students' performance; and the significant effect of using ChemXcelerate teaching technique on students' learning competency.

The study used a descriptive design and a survey questionnaire- checklist and 50-items test. Moreover, the researcher utilized weighted mean, standard deviation, t-test, and regression analysis. Fifty (50) STEM students from Cavinti Integrated National High School was assessed and used as respondents of this research.

The findings showed that the level of ChemXcelerate Teaching Techniques were perceived as very great extent. Similarly, students' learning competencies were also perceived as very great extent. The students' performance in summative test is high, furthermore, their performance in diagnostic test is evidently low. It only implies that they performed higher after the utilization of ChemXcelerate teaching techniques. A significant difference between the performance was observed after the utilization of ChemXcelerate teaching techniques. Additionally a significant effect was found between ChemXcelerate teaching techniques and students' learning competency.

Based on the findings, the following were conclusions derived from the data and results of the study presented, analyzed, and interpreted: ChemXcelerate Teaching Techniques has significant difference on the diagnostic and summative of the students; and ChemXcelerate Teaching Techniques has significant effect on students' learning competencies. Therefore, hypotheses were rejected. Hence, the utilization of ChemXcelerate teaching techniques in chemistry was effective.

Based on the conclusions formulated from the findings, it is recommended that teachers may engage students to an interactive activities when utilizing traditional method of teaching or lecture that is tailored to individual preferences; and teachers may take the opportunity to improve their teaching techniques particularly in science education. Future researchers are advised to further study different teaching techniques and its effect on students performance.

Keywords: ChemXcelerate; Teaching Techniques; Students' Performance

1. Introduction

Science and Technology is one of the most challenging subjects. This kind of field required more effort to impart the content effectively and efficiently. There are learners found this subject complicated when they need to remember unfamiliar words and to understand profoundly, such line of topic especially in Chemistry is precisely puzzling and analytical.

It is correlated that learning science is absolutely difficult, for both successful and unsuccessful students. Science is more difficult than the other subjects, and especially compared with ones.

Furthermore, Dacumos (2016) observed that despite the significance of science education, students exhibit negative responses because they never thought of it as an enjoyable way for them to grasp significant concepts; thus resulting in low academic achievement. Through a research article the Ely (2019), it was concluded that through the Chemistry Achievement Test (CAT), the level of mastery in Chemistry competencies is generally average mastery.

Learning can be considered as a change that is permanent in nature, so that it is significant for the for the teachers to enhance and produce a child- friendly ways to uplift the interest of their learners so that it will provide more interesting approach in teaching and learning certain lesson that may result to academic improvement and practical principles in their future.

As cited in Philippine Education Assessment, every Filipino has access to complete quality education by providing the necessary basic education input, provide affirmative action to learners with special need and engage the private sector in broadening opportunities for basic education, provide relevant instructional materials and improve quality of instruction and professional development of teachers (EFA, 2015).

The vision of this teaching techniques in enhancing students' performance and competencies focuses on how to create depth and systematic learning in this field. Teaching can execute using different teaching techniques.

The impact of teaching techniques on students' learning competencies will be correlated. It tried to adjust different teaching techniques that brings different level of changes in the students performance. To see the most important aspect of student engagement caused by the teacher's use of various teaching techniques. Results revealed that when classroom discussion technique was used, the students in the class were found to be significantly more motivated than in the class where no technique was used, (Nath, 2015).

To address this issue, ChemXccelerate, as a teaching technique aims to enhance students' performance and competencies. Applying this teaching techniques may begin to contribute ways to uplift the academic achievement and developed teaching and learning process. Research has shown that teaching methods like can lead an improved understanding on chemistry concepts.

1.1 Statement of the Problem

Specifically, this sought answers to the following questions:

1. What is the level of utilizing ChemXccelerate teaching technique in terms of:
 - 1.1 Lecture;
 - 1.2 Concept Mapping;
 - 1.3 Laboratory Workshop;
 - 1.4 Peer Tutoring; and
 - 1.5 Role Play?
2. What is the level of students' learning competency in terms of:
 - 2.1 Communication skills;
 - 2.2 Collaboration;
 - 2.3 Creativity;
 - 2.4 Critical thinking; and
 - 2.5 Managing of information?

3. What is the level of student performance in terms of:
 - 3.1 Diagnostic test; and
 - 3.2 Summative test?
4. Is there a significant difference on student performance in diagnostic and summative test?
5. Is there a significant effect in utilizing ChemXccelerate teaching techniques and student learning competency?

2. Methodology

The research used descriptive design to determine the effectiveness of ChemXccelerate teaching technique in chemistry. According to Calmorin (2009), descriptive method of research is concerned with gathering, classification, and presentation of data and the collection of summarizing values to describe group characteristics. The independent variable: that consists of the ChemXccelerate teaching technique in terms of lecture, concept mapping, laboratory workshops, peer tutoring, and role playing and the dependent variable consist students' competency in terms of communication, collaboration, and creativity; and students' performance in terms of diagnostic and summative test. This method refers to the collection of data from members of the population in which direct contact is made employing the survey questionnaires and exam both in hardcopy.

3. Results and Discussion

This chapter enumerates the different results and discusses the results that were yielded from the treatment of the data that was gathered in this study. The following tabular presentations and discussions will further characterize the effect of ChemXccelerate teaching technique in enhancing students' competency and performance in Chemistry.

Level of ChemXccelerate Teaching Techniques in Chemistry

Table 1 to 5 presents the level of effectiveness of ChemXccelerate teaching techniques in Chemistry in terms of lecture, concept mapping, laboratory workshops, peer tutoring, and role playing.

The level of ChemXccelerate teaching techniques in terms of Lecture illustrates that students strongly agreed that lecture can help them record important information, examples, and explanations provided by the teacher for later review and study of chemistry concept ($M=34.62$, $SD=0.49$). Furthermore, they believe that this technique somewhat engage them in activities such as asking questions, participating in discussions presented during the lecture ($M=3.30$, $SD=0.91$), which can enhance their understanding and retention of the material provided by the teacher. Additionally, this interactive element of the lecture method can foster a more dynamic learning environment, encouraging students to actively process and apply the information being taught.

The level of ChemXccelerate teaching technique in terms of lecture attained a weighted mean score of 3.98 and a standard deviation of 0.37 and was great extent among the respondents.

Table 1 Level of ChemXccelerate Teaching Technique in terms of Lecture

STATEMENTS	MEAN	SD	REMARKS
1. I can record important information, examples, and explanations provided by the teacher for later review and study.	4.62	0.49	Strongly Agree
2. I actively participate during class discussions,	3.76	0.82	Agree

and I feel comfortable sharing ideas, asking questions, and engaged in a meaningful dialogue			
3. It ensures that lectures incorporate diverse viewpoints and perspectives.	3.84	0.55	Agree
4. I can easily receive clarification and explanation on complex topics directly from the teacher.	4.38	0.49	Strongly Agree
5. I am engaged through activities such as asking questions, participating in discussions presented during the lecture.	3.30	0.91	Moderately Agree
Weighted Mean		3.98	
SD		0.37	
Verbal Interpretation		Great Extent	

The result indicates that lecture is perceived positively by students. While lectures are often seen as traditional teaching methods, their integration within the ChemXccelerate teaching technique seems to enhance student understanding and engagement.

Table 2 Level of ChemXccelerate teaching techniques in terms of Concept Mapping

STATEMENTS	MEAN	SD	REMARKS
1. It is a useful tool which helps the students to learn in meaningful way by visualizing the scientific concepts.	4.42	0.57	Strongly Agree
2. It promotes lively interaction among teacher-student as it requires active participation of students.	4.16	0.58	Agree
3. The structure of concept maps aids in the recall and processing of information	4.50	0.65	Strongly Agree
4. It offers a flexible approach that can be tailored to individual preferences.	3.92	0.63	Agree
5. It is not restricted to a specific subject or grade level.	4.64	0.48	Strongly Agree
Weighted Mean		4.33	
SD		0.33	
Verbal Interpretation		Very Great Extent	

Table 2 exemplifies the level of ChemXccelerate teaching techniques in terms of Concept Mapping.

The level of ChemXccelerate teaching techniques in terms of Concept Mapping exemplifies that students strongly agreed that it is not restricted to a specific subject or grade level ($M=4.64$, $SD=0.48$). Moreover, they think that this technique offers a flexible approach that can be tailored to individual preferences ($M=3.92$, $SD=0.63$).

With a weighted mean score of 4.33 and a standard deviation of 0.33, the students' level of ChemXccelerate teaching technique in terms of concept mapping was to a Very Great Extent.

This means that Concept Mapping technique is not only well-received but also highly regarded for its ability to enhance comprehension and knowledge retention in the subject. It promotes learning in a meaningful way by visualizing chemistry concepts by encouraging active participation.

Table 3 Level of ChemXccelerate teaching techniques in terms of Laboratory Workshop

STATEMENTS	MEAN	SD	REMARKS
1. It help me to draw conclusions based on my findings in the laboratory work.	4.26	0.53	Strongly Agree
2. I improve my critical thinking and problem solving skills through active engagement on chemical processes	4.42	0.50	Strongly Agree
3. It provide an interactive hands-on learning environment.	4.76	0.43	Strongly Agree
4. I acquire essential scientific skills such as observation, measurement, and data analysis.	4.18	0.44	Agree
5. I am able to explore, question, and seek evidenced-based answers.	4.46	0.50	Strongly Agree
Weighted Mean		4.42	
SD		0.25	
Verbal Interpretation		Very Great Extent	

Table 3 demonstrates that students strongly agreed that laboratory workshop provides an interactive hands-on learning environment for them ($M=4.76$, $SD=0.43$). Also it aids in acquiring essential scientific skills such as observation, measurement and data analysis ($M=4.18$, $SD=0.44$) was agreed by the students. The weighted mean score of 4.42, along with a standard deviation of 0.25, indicates that the students found laboratory workshop teaching technique to be very effective in chemistry as it can be interpreted as to Very Great Extent.

This only shows that when students are exposed to laboratory workshops, they can easily recall science concepts. It also enhance their enthusiasm for interactive learning and their ability to make observations, encourage them to participate and exploring unfamiliar topics. Moreover, it enhances their skills in drawing better findings and conclusions, analyzing and interpreting data, and problem-solving, ultimately leading to the generation of accurate and precise results.

Table 4 Level of ChemXccelerate teaching technique in terms of Peer tutoring

STATEMENTS	MEAN	SD	REMARKS
1. I contribute meaningfully in class discussion by answering questions or asking relevant questions.	4.06	0.59	Agree
2. I share my ideas in class and show respect for the opinion of others.	4.14	0.64	Agree
3. Peer tutoring improves my self confidence in class.	4.08	0.44	Agree
4. I show cooperative and supportive attitude during class discussion and activities.	4.14	0.50	Agree
5. I show no disturbing behavior in class.	4.15	0.53	Agree
Weighted Mean		4.11	
SD		0.33	
Verbal Interpretation		Great Extent	

Table 4 shows the level of ChemXccelerate teaching technique in terms of Peer tutoring.

Based on the table, students agreed that in this technique, they show no disturbing behavior in class ($M=4.15$, $SD=0.33$). Moreover, they also agreed that they can share ideas in class and respect the opinion of others ($M=4.14$, $SD=0.64$) as well as it contributes to a cooperative and supportive learning environment ($M=4.14$, $SD= 0.50$).

The weighted mean score of 4.11, accompanied by a 0.33 standard deviation, implies that the participants highly valued peer tutoring in the field of chemistry.

This only demonstrates how Peer Tutoring is highly accepted as a beneficial tool for improving self confidence and promoting collaborative learning and knowledge acquisition in the field of chemistry within their peers.

Table 5 Level of ChemXccelerate teaching technique in terms of Role Playing

STATEMENTS	MEAN	SD	REMARKS
1. It is interesting.	4.64	0.53	Strongly Agree
2. It gives a scope to show innovation and creativity.	4.50	0.51	Strongly Agree
3. It improves academic learning in chemistry.	4.22	0.51	Strongly Agree
4. It raise student motivation and interest.	4.60	0.49	Strongly Agree
5. It help learners understand how to effectively design a role play activity.	4.18	0.63	Agree
Weighted Mean		4.43	
SD		0.29	
Verbal Interpretation		Very Great Extent	

The level of ChemXccelerate teaching technique in terms of Role Playing proves that students strongly agreed that role playing provides an interesting learning experience ($M=4.64$, $SD=0.53$). Moreover, they think that this technique help them design an effective role play activity ($M=4.18$, $SD=0.63$).

With a weighted mean score of 4.43 and a standard deviation of 0.29, the level of ChemXccelerate teaching technique in terms of role playing was to Very Great Extent.

Level of Students' Competency in Chemistry

Table 6 to 10 presents the level of students competency in terms of collaboration, communication, creativity, critical thinking, and managing information.

Table 6 Level of Student Learning Competency in terms of Collaboration

STATEMENTS	MEAN	SD	REMARKS
1. I can communicate effectively with my team members.	4.54	0.50	Strongly Agree
2. I listen actively to others' ideas and perspectives.	4.20	0.63	Agree
3. I contribute ideas and insights during group discussions.	4.34	0.71	Strongly Agree
4. I works collaboratively to solve problems	4.54	0.49	Strongly Agree
5. I respect the opinions and contributions of others.	4.96	0.19	Strongly Agree
Weighted Mean		4.51	
SD		0.25	
Verbal Interpretation		Very Great Extent	

Table 6 presents the level of students' learning competency in terms of Collaboration.

It can be seen from the table that students strongly agreed that ChemXccelerate engaged them in respecting the opinions and contributions of others ($M=4.96$, $SD=0.19$). On the other hand, they agreed that it contributes in actively listening to others' ideas and perspectives ($M=4.20$, $SD=0.63$).

The level of students' learning competency in terms of collaboration attained a weighted mean of 4.51 and a standard deviation of 0.25 and was very great extent among the respondents.

It only means that learners demonstrate a reasonable level of engagement in communication skills. It also encourages them to communicate collaboratively with others to solve problems as well as contributing ideas and insights during group discussions.

Table 7 Level of students' learning competency in terms of communication

STATEMENTS	MEAN	SD	REMARKS
1. I can express ideas clearly and effectively.	4.08	0.71	Strongly Agree
2. I convey complex chemistry concepts in an understandable manner.	3.98	0.76	Agree
3. I demonstrate confidence and clarity in presentations and discussions.	4.22	0.75	Strongly Agree
4. I provide constructive feedback to my peers.	4.42	0.60	Strongly Agree
5. I adapt communication style to different situations	4.56	0.49	Strongly Agree
Weighted Mean		4.25	
SD		0.21	
Verbal Interpretation		Very Great Extent	

The level of students' learning competency in terms of Communication Skills shows that the students strongly agreed that they can adapt communication style from different situations effectively ($M=4.56$, $SD=0.49$). Furthermore, it enables them to convey complex concepts in an understandable manner ($M=3.98$, $SD=0.76$), showing an agree response. With a weighted mean score of 4.25 and a standard deviation of 0.21, the students' level of learning competency in terms of communication skills was to a Very Great Extent.

It only suggests that the students showed a high level of learning competency in terms of communication skills, as reported by the respondents. Students who can adapt communication style to different situations able to convey complex topics in an understandable manner. It also enables them to express ideas clearly and effectively. As a result, students become better at communicating ideas and are adept at identifying key challenges in the field.

Table 8 Level of students' learning competency in terms of Creativity

STATEMENTS	MEAN	SD	REMARKS
1. I can generate a variety of ideas quickly and easily.	4.26	0.56	Strongly Agree
2. I can make connections between concepts and ideas	4.16	0.61	Agree
3. I can integrate knowledge and ideas from different disciplines	4.42	0.67	Strongly Agree
4. I can creatively apply chemistry principles to real-world scenarios.	4.50	0.50	Strongly Agree
5. I can easily find alternative approaches when conducting experiments.	4.50	0.60	Strongly Agree
Weighted Mean		4.36	
SD		0.15	
Verbal Interpretation		Very Great Extent	

Table 8 presents the level of learning competencies in terms of Creativity.

Based on the table below, the respondents strongly agreed that through ChemXccelerate, they can

creatively apply chemistry principles to real world scenarios ($M=4.50$, $SD=0.50$) and finding alternative approaches when conducting experiments is easy ($M=4.50$, $SD=0.60$). Nonetheless, they agreed that engaging them in practical applications helps in making connections between concepts and ideas ($M=4.16$, $SD=0.61$).

The weighted mean score of 4.36, accompanied by a 0.15 standard deviation, suggested that the students have improved creativity through ChemXccelerate teaching techniques in the field of chemistry as it can be interpreted as to a Very Great Extent.

This suggests that students are highly engaged and actively participate in fostering creativity within the learning environment. This allows them to apply academic knowledge effectively to real-life situations. It also enables them to integrate their knowledge with insights from other areas, prompting more creative and innovative thinking.

Table 9 Level of students' learning competency in terms of Critical Thinking

STATEMENTS	MEAN	SD	REMARKS
1. I consistently considers various options.	4.58	0.49	Strongly Agree
2. I can combine scientific ideas to form a new one.	4.60	0.49	Strongly Agree
3. I can identify and recall information.	4.70	0.46	Strongly Agree
4. I can interpret data accurately to draw meaningful conclusions.	4.70	0.45	Strongly Agree
5. I present a specific personal position to a clearly formulated problem	4.64	0.48	Strongly Agree
Weighted Mean		4.64	
SD		0.04	
Verbal Interpretation		Very Great Extent	

From the level of students learning competency in terms of critical thinking, it can be seen that the respondents strongly agreed that they can identify and recall information promptly in chemistry ($M=4.70$, $SD=0.46$) and as well as interpreting data accurately in drawing a meaningful conclusion ($M=4.70$, $SD=0.45$). Nonetheless, they strongly agreed that engaging in various techniques helps them consider various option in chemistry ($M=4.58$, $SD=0.49$).

The weighted mean score of 4.64, accompanied by a 0.04 standard deviation, suggested that the participants have improved critical thinking skills as interpreted to a Very Great Extent.

This demonstrated how critical thinking skills in various teaching techniques in learning chemistry is evident. This forms a strong foundation for further explorations. It also encourages a mindset for continuous learning. Combining scientific ideas and presenting specific position in formulating problem enables students to use their knowledge gain from various teaching techniques which is vital for future success.

Table 10 presents the level of learning competencies in terms of Managing information.

Table 10 Level of students' learning competency in terms of Managing Information

STATEMENTS	MEAN	SD	REMARKS
1. It enhance my ability to synthesize information from multiple sources.	4.62	0.48	Strongly Agree
2. I effectively locate relevant information to meet my academic needs.	4.56	0.49	Strongly Agree
3. I collaborate effectively with peers to exchange information and ideas.	4.76	0.42	Strongly Agree
4. I actively seek out additional information to deepen my understanding of topics	4.42	0.49	Strongly Agree

5. I can adapt my information management strategies to different scientific disciplines.	4.62	0.48	Strongly Agree
Weighted Mean		4.59	
SD		0.10	
Verbal Interpretation		Very Great Extent	

The results proved that the impact of teaching techniques in chemistry on students learning competency in terms of managing of information enables them to collaborate effectively with their peers in exchanging information and ideas ($M=4.76$, $SD=0.42$) by strongly agreeing on the statement. On the other hand, their managing information skills can be enhanced by effectively locating relevant information since they strongly agree on the statement ($M=4.56$, $SD=0.49$).

The level of students' learning competency in terms of managing of information attained a weighted mean score of 4.59 and a standard deviation of 0.10 and was Very Great Extent among the respondents.

It only means that students showed a high level of managing information skills in chemistry, as reported by the respondents based on their experience. Having a positive effect on managing information skills or information literacy skills encourages ability to synthesize information from multiple sources and seeking out additional information to deepen their understanding of topics assisting students in utilizing ideas they have learned and empowering students to apply their understanding of the concepts learned.

Table 11. Level of Student Performance in terms of Diagnostic test and Summative test

Score	Diagnostic		Summative		Descriptive Equivalent
	f	%	f	%	
41 - 50	0	0.00	2	4.00	Outstanding
31 - 40	0	0.00	27	54.00	Very Satisfactory
21 - 30	18	36.00	15	30.00	Satisfactory
11 - 20	32	64.00	6	12.00	Fairly Satisfactory
0 - 10	0	0.00	0	0.00	Did not meet Expectation
Total	50	100	50	100	
Weighted Mean	19.26		30.78		
SD	3.92		6.81		
Verbal Interpretation	Satisfactory		Very Satisfactory		

Table 11 presents the level of students' performance in terms of diagnostic and summative test. For diagnostic test, out of total number of fifty respondents "11 to 20" received the highest frequency of thirty-two (32) or 64.00% of the total population with descriptive equivalent of Fairly Satisfactory. While the scores of "21 to 30" received the lowest frequency of eighteen (18) or 36.00% of the total population with descriptive equivalent of Satisfactory. With a (Weighted Mean = 19.26, SD = 3.92) it shows that level of Student Performance in diagnostic test has a descriptive equivalent of Satisfactory.

For summative test, out of total number of fifty respondents the scores "31 - 40" received the highest frequency of twenty-seven (27) or 54% of the total population with descriptive equivalent of Very Satisfactory. While the scores "41 - 50" received the lowest frequency of two (2) or 4% of the total population with descriptive equivalent of Outstanding.

With a (Weighted Mean = 30.78, SD = 6.81) it shows that level of Student Performance in summative test has a descriptive equivalent of Very Satisfactory.

This exhibits that diagnostic and summative assessment demonstrates the dynamic nature of student learning. It shows the effectiveness of ChemXccelerate as teaching techniques in enhancing students' learning competencies.

Table 12 Test of Difference between the Student Achievement before and after the utilization of ChemXccelerate

ChemXccelerate teaching techniques	Diagnostic test		Summative test		Mean Difference	95% Confidence Interval of Difference		t	df	Sig (2-tailed)
	Mn	SD	Mn	SD		L	U			
performance	19.26	3.92	30.78	6.81	11.52	5.674	14.71	4.54	49	0.000

Legend: *Significant at 0.05

Revealed in Table 12 is the test of difference between the student performance in diagnostic and summative test. Data obtained through a paired t-test indicated that the increase in the scores in *summative test* is significant ($p < 0.05$).

This implies that the students performed better after using the ChemXccelerate. Their level of learning of performance has significantly improved from low to very high.

The Regression Analysis shows that utilizing ChemXccelerate teaching technique have no significant effect on students' learning competencies. The F-test of the overall model is not significant ($F(4,136)$ with, $p > 0.05$) indicating that the regression model is not a good fit for the data.

From the findings above, we can infer that at 0.05 level of significance, the null hypothesis "*Is there a significant effect in utilizing of ChemXccelerate teaching technique on students' learning competencies?*" is accepted, which incites that there is no significant effect between them.

The result further implies that the respondents viewed ChemXccelerate teaching techniques certainly not affect their learning competencies. However, it suggests that these techniques may not have provided the necessary support to enhance their skills and knowledge effectively. This lack of impact on learning competencies indicates a potential need for integrating more diverse and engaging instructional methods to better cater to students' learning needs and preferences. Additionally, the data highlights the importance of assessing and adapting teaching strategies to ensure they are meeting the educational objectives and improving student outcomes. Without such improvements, students might continue to feel disengaged and unmotivated, which could further hinder their academic progress. Thus, fostering an environment that encourages active participation and hands-on learning could be pivotal in transforming their educational experience.

Table 13 Regression Analysis on the utilization of ChemXccelerate teaching techniques on students' learning competencies

Collaboration	B	SE	β	t	p
Constant	2.631	0.812		3.239	0.002
Lecture		0.094	0.246	1.743	0.088
Concept Mapping		0.128	0.026	0.152	0.880
Laboratory Workshop		0.156	0.092	0.596	0.554
Peer Tutoring		0.121	0.183	1.128	0.266
Role Playing		0.143	0.046	0.273	0.786
R-squared			0.140		
Adjusted R-squared			0.042		
Standard Error of the Estimate		0.244			
F(4, 136)				1.435	0.231
Communication	B	SE	β	t	p
Constant	3.404	1.033		3.296	0.002
Lecture		0.120	0.068	0.456	0.651

<i>Concept Mapping</i>			0.162	0.160	0.895	0.376
<i>Laboratory Workshop</i>			0.198	0.011	0.064	0.949
<i>Peer Tutoring</i>			0.154	-0.089	-0.518	0.607
<i>Role Playing</i>			0.182	0.061	0.341	0.735
R-squared				0.035		
Adjusted R-squared				-0.075		
Standard Error of the Estimate			0.310			
F(4, 136)					0.315	0.902
Creativity	B	SE	β	t	p	
Constant	4.406	0.711		6.201	0.000	
<i>Lecture</i>		0.083	-0.159	-1.088	0.282	
<i>Concept Mapping</i>		0.112	-0.143	-0.821	0.416	
<i>Laboratory Workshop</i>		0.136	0.084	0.528	0.600	
<i>Peer Tutoring</i>		0.106	-0.100	-0.595	0.555	
<i>Role Playing</i>		0.125	0.207	1.187	0.241	
R-squared			0.084			
Adjusted R-squared			-0.020			
Standard Error of the Estimate		0.213				
F(4, 136)					0.810	0.549
Critical Thinking	B	SE	β	t	p	
Constant	4.177	0.667		6.265	0.000	
<i>Lecture</i>		0.078	0.083	0.568	0.573	
<i>Concept Mapping</i>		0.105	-0.218	-1.259	0.215	
<i>Laboratory Workshop</i>		0.128	0.186	1.170	0.248	
<i>Peer Tutoring</i>		0.100	-0.134	-0.801	0.428	
<i>Role Playing</i>		0.118	0.177	1.018	0.314	
R-squared			0.092			
Adjusted R-squared			-0.011			
Standard Error of the Estimate		0.200				
F(4, 136)					0.891	0.496
Managing Information	B	SE	β	t	p	
Constant	4.124	0.723		5.704	0.000	
<i>Lecture</i>		0.084	0.269	1.948	0.058	
<i>Concept Mapping</i>		0.114	0.002	0.013	0.990	
<i>Laboratory Workshop</i>		0.138	0.109	0.719	0.476	
<i>Peer Tutoring</i>		0.108	0.159	0.998	0.324	
<i>Role Playing</i>		0.127	-0.313	-1.894	0.065	
R-squared			0.176			
Adjusted R-squared			0.083			
Standard Error of the Estimate		0.217				
F(4, 136)					1.895	0.116

*p < 0.05

4. Conclusion and Recommendations

On the basis of the foregoing findings, the following conclusion was drawn:

The study shows significant difference between the students' performance in diagnostic and summative test after the utilization of ChemXccelerate teaching techniques which led to the rejection of the null hypotheses. Hence, the utilization of ChemXccelerate teaching techniques in chemistry was effective. The study showed that when students were engaged in an interactive learning, it helps them better understand chemistry concepts. By incorporating teaching techniques, students show more interest in the subject, leading to an improved academic performance.

There is a significant effect in utilizing ChemXccelerate teaching techniques on students' learning competencies. Thus, the null hypothesis is also rejected. Denoted that the ChemXccelerate teaching techniques aid the development of learning competencies.

Based on the results and conclusions posted in the study, the following recommendations were formulated:

1. Teachers may engage students to an interactive activities when utilizing traditional method of teaching or lecture that is tailored to individual preferences.
2. Teachers may incorporate technology tools such as virtual labs, multimedia presentations, interactive simulations, and educational apps to enhance learning experiences and make abstract concepts more tangible.
3. Teachers may take the opportunity to improve their teaching techniques particularly in science education.

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