Improvisation of Laboratory Apparatuses For General Science Teaching: Effects on Student’s Performance

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ABSTRACT
This study aimed to investigate the effects of the improvised laboratory apparatuses in General Science teaching on students’performance among first year high school students of Liloy National High School, Liloy Zamboanga del Norte during the first and second grading of academic year 2012 – 2013. Quasi – experimental design 10 utilizing the Pretest – Posttest non-equivalent Group Design was used in the study. The experimental group with 44 students was given the treatment utilizing the improvised laboratory apparatuses in General Science teaching. The teacher-made-test questionnaire comprising of 50 – item test was used to determine the pretest and posttest performance of the students in the two groups. The statistical methods used were arithmetic mean, t-test for independent samples, and t-test for correlated samples. The study revealed that Science performance of the students in the experimental group was greatly influenced by the improvised laboratory apparatuses used in General Science teaching. DepEd officials should establish a strong standard in the utilization of improvised laboratory apparatuses and provide teachers with adequate knowledge on current research findings particularly on effective use of improvised laboratory apparatuses.

Keywords: Improvised laboratory apparatuses, filtration set-up, boyles law set-up, tyndall effect set-up, electrolysis set-up, alcohol burner, laboratory activities, manipulative activities, quasi-experimental method.

Bio-Notes
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INTRODUCTION
The concept of improvisation has become increasingly popular in the discourse of scientific experiments. The reason why several aspects of improvisation, in the context of sciences and everyday activities are dealt with in the study in order to address some of the philosophical and practical issues relevant to this emerging interest. It provides a forum for practicalising the theoretical knowledge gained in the classroom and for demonstrating the psychomotor skills of the teacher and learner who performed the experimentation. Ironically however, the activity remains not appreciated by the students as many of them see Science as abstract and irrelevant to their lives due to lack of engaging classroom laboratory equipment. It cannot be overemphasized that laboratory and field work aid in the understanding of difficult concepts in the subject,
create opportunity for the testing of facts and theories in science. Indeed, educationalists believe that learners can achieve more if given the opportunity to improvise materials needed especially for experimentation. Obviously, it gives room for the attainment of lesson objectives, since it depends on the availability of Science equipment for proper understanding, development and application (Ugwu, 2008). As a moral responsibility, every mentor should ensure that learners learn how to choose from the myriad of readily available materials and tools through improvising laboratory apparatuses. To be able to do this, teachers should be flexible, creative, and innovative in the classroom to turn learners become critical and creative thinkers.

The researcher, as of Liloy National High School, Liloy Zamboanga del Norte, imbued with the quest of improving Science performance of the first year students in Integrated Science, believes on the need to shift from a traditional way of teaching the subject to a more scientifically-improvised centered instruction. Along this premise, this investigation is conducted to determine the effects of the improvised laboratory apparatuses in teaching Science on students’ performance. The results of this undertaking would determine whether this instructional practice is effective in improving Science performance among students. By doing so, research – based decisions about students’ Science performance could be derived, developed and promoted.

**METHODOLOGY**

In this investigation, the researcher considered two teaching approaches such as utilization of Improvised Laboratory Apparatuses and the Traditional Model in teaching Science. Improvised Laboratory Apparatuses in this study included only those that were available in the school and those apparatuses that the students and the researcher were able to provide and improvised. These apparatuses included Alcohol Lamp Burner, Filtration Set-Up, Electrolysis Set-Up, Tripod, Tyndall Effect Set-Up and Boyles’ Law Set-Up.

**Alcohol Lamp Burner.** This improvised instrument comes in very handy whenever the standard alcohol burner or Bunsen burner is not available. This is made of recycled tin aluminum material hence non-corrosive.

**Filtration Set-Up.** In the process of studying particles in a mixture, it is necessary to separate the components into their solute or solvent properties. This is the function of the filtration set-up. In the set-up some laboratory apparatuses are used like: funnel, iron stand, iron clamp, tripod, wire gauze, alcohol burner and filter paper.

**Tripod.** This is a lightweight improvised instrument and together with the improvised alcohol lamp burner, can be used for activities that require heating.

**Electrolysis Set-Up.** Electrolysis is the process of causing a chemical change to occur by passing electricity through a conducting solution.

**Tyndall Effect Set-Up.** In an open system where dust is present, light scattered and appears as a beam wherein dust particles appear as bright tiny speaks. In a colloidal solution, the path of the light beam is not visible. This phenomenon is called tyndall effect.

**Boyles’ Law Set-Up.** At constant temperature, the volume of a gas increases as pressure decreases; and vice versa.
Quasi – experimental design 10 utilizing the pretest – posttest non-equivalent. Group Desiwas used in the study. This design utilized two groups which were the experimental and control groups. The experimental group, I – Einstein with 44 students, received the experimental treatment utilizing the improvised laboratory apparatuses in teaching Science while the control group, the I- Oxygen with 50 students, was exposed to the traditional method of teaching Science. The questionnaire determined the pretest and posttest performance of the students in both the control and experimental groups.

RESULTS AND DISCUSSION

Table 1. Pretest Performance Profile of the Control and Experimental Group

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>A.M.</th>
<th>D</th>
<th>H.M.</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>50</td>
<td>18.40</td>
<td>Fair</td>
<td>25.00</td>
<td>-4.01*</td>
</tr>
<tr>
<td>Experimental</td>
<td>44</td>
<td>21.36</td>
<td>Good</td>
<td>25.00</td>
<td>-1.54ns</td>
</tr>
</tbody>
</table>

Legend:
d.f.= 92
α = 0.05
The pretest performance of the control and experimental group did not exceed the Dep-Ed passing standard. Pretest performance of the control group was 18.40 while the experimental group 21.36 in which both were far behind the Dep-Ed passing standard of 25 which is the 50 percent of the total items tested as shown in table 1. The study of Arcilla (2009) substantiated the finding of the present investigation. The study revealed that majority of the students in the control and experimental groups were low achievers in Science as evidence by the pretest results.

**Table 2** Test of Difference on the Pretest Performance between the Control and Experimental Group

<table>
<thead>
<tr>
<th>Group</th>
<th>A.M.</th>
<th>S.D.</th>
<th>t-value</th>
<th>P</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>18.40</td>
<td>11.64</td>
<td>-1.36ns</td>
<td>0.178</td>
<td>HO not rejected</td>
</tr>
<tr>
<td>Experimental</td>
<td>21.36</td>
<td>10.13</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Legend:
- d.f. = 92
- α = 0.05
- ns = not significant (HO not rejected)
- * = significant (Reject HO)

There was no significant difference in the pretest performance in Science between the control and experimental groups as shown in table 2.

**Table 3** Posttest Performance Profile of the Control and Experimental Group

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>A.M.</th>
<th>D</th>
<th>H.M.</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>50</td>
<td>16.78</td>
<td>Fair</td>
<td>25.00</td>
<td>-6.75*</td>
</tr>
<tr>
<td>Experimental</td>
<td>44</td>
<td>34.60</td>
<td>Very Good</td>
<td>25.00</td>
<td>6.82*</td>
</tr>
</tbody>
</table>

Legend:
- d.f. = 92
- α = 0.05
- ns = not significant (HO not rejected)
- * = significant (Reject HO)

Table 3 shows the post test performance of the control group at 16.78 failed to reach the Dep-Ed passing standards of 25 while the posttest performance of the experimental group of 34.50 was approximately higher to the Dep-Ed passing standard of 25. Agbugon (2008) supported the finding of the present study that there is evidence that educational achievements are positively influenced by improvised laboratory apparatuses as revealed in the study he conducted.

**Table 4** Test of Difference on the Posttest Performance Between the Control and Experimental Group

<table>
<thead>
<tr>
<th>Group</th>
<th>A.M.</th>
<th>S.D.</th>
<th>t-value</th>
<th>P</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>16.78</td>
<td>8.61</td>
<td>9.57*</td>
<td>0.00</td>
<td>HO rejected</td>
</tr>
<tr>
<td>Experimental</td>
<td>34.60</td>
<td>9.96</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Legend:
- d.f. = 92
- α = 0.05
- ns = not significant (HO not rejected)
- * = significant (Reject HO)
There was a significant difference in the posttest performance in Science between the control and experimental groups as shown in table 4. This implies a significant variation between the performance of the students using the traditional method of teaching and the performance of students using the improvised laboratory apparatuses in teaching the subject.

**Table 5 Test of Difference on the Pre-post Performance of the Control Group**

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean</th>
<th>S.D.</th>
<th>SE Mean</th>
<th>t-value</th>
<th>c.v.(t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>18.40</td>
<td>11.60</td>
<td>1.60</td>
<td>0.79ns</td>
<td>1.96</td>
</tr>
<tr>
<td>Posttest</td>
<td>16.78</td>
<td>8.61</td>
<td>1.20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Legend:
- d.f. = 92
- α = 0.05
- ns = not significant (HO not rejected)
- * = significant (Reject HO)

There was no significant difference between the pretest and posttest performance in Science of the control group as shown in table 5. This indicates that there was no improvement in Science performance after the intervention.

**Table 6 Test of Difference on the Prepost Performance of the Experimental Group**

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean</th>
<th>S.D.</th>
<th>SE Mean</th>
<th>t-value</th>
<th>c.v.(t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>21.40</td>
<td>10.10</td>
<td>1.40</td>
<td>6.59*</td>
<td>1.96</td>
</tr>
<tr>
<td>Posttest</td>
<td>34.60</td>
<td>9.96</td>
<td>1.40</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Legend:
- d.f. = 92
- α = 0.05
- ns = not significant (HO not rejected)
- * = significant (Reject HO)

Table 6 reflects the test of difference between the pretest and posttest Science performance of the experimental group in Science. A closer look at the table reveals that the students in the experimental group obtained a mean score of 21.40 in the pretest and 34.60 mean score in the posttest which provided a mean difference of 13.20. This shows that the performance of students in the experimental group improved after exposing them to improvised laboratory apparatuses in teaching Science.

**Table 7 Test of Difference on the Mean Gain Scores between the Control and Experimental Group**

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean Gain</th>
<th>S.D.</th>
<th>SE Mean</th>
<th>t-value</th>
<th>c.v.(t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>-1.62</td>
<td>7.00</td>
<td>0.99</td>
<td>7.53*</td>
<td>1.96</td>
</tr>
<tr>
<td>Posttest</td>
<td>13.20</td>
<td>12.10</td>
<td>1.70</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 7 presents the test of difference on the pretest and posttest mean gain in in the scores between the control and experimental groups. As revealed in the table, the mean gain score obtained by the control group was – 1.62, while the mean gain score obtained by the experimental group was 13.20. These mean gain scores registered a mean gain score difference of 11.58. This means that there is a significant difference in the mean gain scores obtained between the two groups after exposing them to the interventions. This finding is corroborated by Astin (2005) whose study revealed that the increased level of academic achievement of experimental group was due to the teaching of Science concept through improvised apparatuses.
CONCLUSION

Based on the findings, the study concludes that both the control and experimental groups fail to reach the DepEd standard of 25 during the pretest. The knowledge of the students on the topics included in this experiment is equivalent or significantly comparable before the intervention. The study also concludes that the control group scores failed during the conduct of the posttest while the experimental group barely passes the examination. That both the interventions make little improvement in the Science performance of the students which means students perform better during the posttest than during the pretest. Moreover, performance of students in Science among the experimental group is greatly influenced by the improvised laboratory apparatuses used in the teaching of Integrated Science.

REFERENCES