ISSN: 2278-4012, Volume:8, Issue:1, January 2019

Innovation for 21st Century Teaching Practices

[1] Charess E. Goles, [2] Ruby Aban- Perez and [3] Ann Carmel A. Labajo
College of Teacher Education, Cebu Normal University

ABSTRACT

Fundamental pillars of teaching require innovation in order to adapt to the changing setting of education. In particular, the study focuses on the effectiveness of two pillars of teaching practices, the lecture-style presentation and independent work, in Mathematics and Science subjects based on the data obtained from OECD and TIMSS. Exploratory data analysis using artificial intelligence revealed that there is a significant positive association between the greater use of lecture-style presentation and the higher achievement of countries in Mathematics and Science; however, there is a significant negative association between the use of independent work and the achievement in these said subjects. Thus, it is concluded that lecture-style presentation increases students' Mathematics and Science performance; though, pure form of the teaching practice suffers the students' application of concepts which are essential when new concepts are involved and the students cannot respond to the situations appropriately. Moreover, independent work is seen as essential as lectures because the guidance of the teacher is needed in order to facilitate the utilization of the abundant yet unnecessary knowledge in order to optimize Mathematics and Science learning. Therefore, an innovation of the lecture-style presentation and independent work must be adapted by teachers in Mathematics and Science instruction in the 21st century arena.

Keywords: **Innovation, teaching, practices,**

INTRODUCTION

Teaching, like any other human endeavor, needs to adapt to the changing landscape of education. This evolution must be systemic, consistent, and scalable; therefore, school teachers, college professors, administrators, researchers, and policy makers are expected to innovate both in the areas of theory and practice of teaching.

Lecture style of presentation, if taught well, can be an effective tool in the classroom. This is indeed very essential as this helps the students learn to think about the key concepts of a specific subject rather than just transmitting information from the teachers to the students. Although this model of teaching is frequently criticized, but it is able to survive as a primary tool in teaching in the face of many technological advancements (Riddell, et.al, 2011). Sammons et al (1995, p.8) said that one of the best ways to teach children is to change how students learn, and how performance is assessed with innovative methods that today's student can appreciate and learn

ISSN: 2278-4012, Volume:8, Issue:1, January 2019

from. Ramgir 2017 said, the youth of today is capable of more than what schools are allowing them to demonstrate, so it is high time it is treated as an opportunity for innovation rather than speeding up progress which might not bear fruit in the long run. This innovative initiative can go a long way to help students broaden their minds and become receptive to new ideas without restrictions. Two fundamental pillars that require innovation and thus being used in different disciplines.

This study focuses on the innovations that may be derived by considering these fundamental elements of teaching (Peter Serdyukov, 2017). This paper revolves around the assumption that these teaching practices namely; Lecture-style presentation and Independent work may have great effects to the subjects Mathematics and Science.

CONCEPTUAL FRAMEWORK

The Conceptual Framework of the study emphasizes the relationship of Lecture-style Presentation and Independent work and how it affects the performance of the students in the subject Mathematics and Science. It can be best illustrated in Figure 1 below.

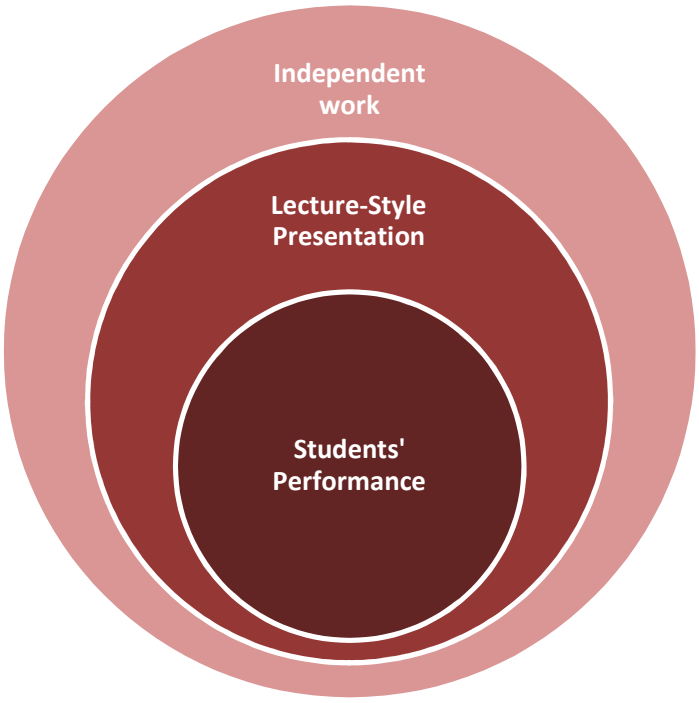


Figure 1. Conceptual Framework of the Study

Two fundamental pillars that require innovation are the **Lecture-Style Presentation** and **Independent work.** Lecture Type Presentation is an excellent lecture that provides the ideas and the outline of the material that a teacher presents to the class where the learners are guided

ISSN: 2278-4012, Volume:8, Issue:1, January 2019

through. It will help the students explain and simplify key concepts. Independent work means students take part in the activities and work together. It is not to listen and memorize but to show the method, think critically, and its application to the daily work. It also enables the students to work by thinking creatively.

Students' Performance the students' performance can be accomplished when at a later age they have been how to adjust their learning on their own, set their own academic aims, improve approaches to meet these goals and to reflect on the academic performance. Both independent work and lecture type presentation are consistent in promoting high levels of students' performance by teaching and learning smarter but not harder. Hence, both independent work and lecture type creates a positive response to increase the performance of the learners.

METHODS

The study employed exploratory data analysis in order to determine the correlation of the teachers' teaching practices and the students' performance in the subject Science and Mathematics. In the context of the study, students' performance is based on the 2015 results of Trends in Mathematics and Science Survey. There were fifteen (15) countries that were included in the study as areas of interest in the data exploration.

Furthermore, the exploratory analysis utilized the available data of the countries on Organization for Economic Co-Operation and Development (OECD) (http://stats.oecd.org) for the mean of the percentage of class time spent on lecture-style presentation and percentage of class time spent on independent work for the subjects Mathematics and Science for the fifteen (15) countries.

To determine the effect of the mean of the percentage of class time spent on lecture-style presentation and percentage of class time spent on independent work to the students' performance in TIMSS, the data are subjected to regression analysis using genetic algorithms. Specifically, data science application is utilized to determine the best-fit model equation of the relationship of independent variables (x) or the means of the percentage of class time spent on lecture-style presentation and percentage of class time spent on independent work to the dependent variable (y) or the students' performance in TIMSS, to be represented as:

Means of percentage of class time spent on lecture-style presentation = f {TIMSS}

Means of percentage of class time spent on independent work = f {TIMSS}

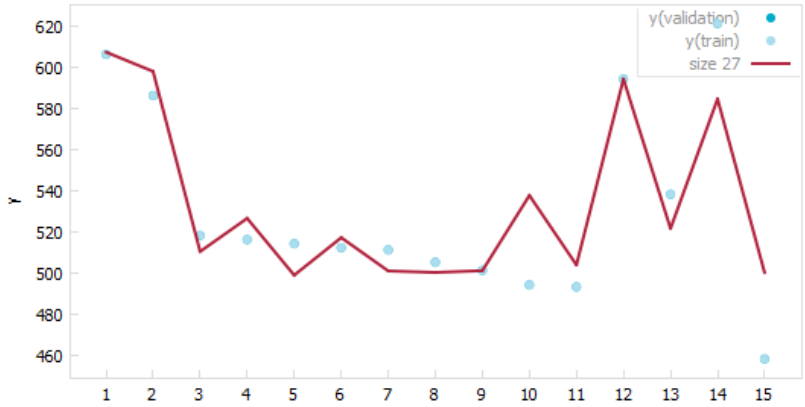
The formula building blocks are set as c_, x_, +,-,*,/,cos and sin, and the confidence test run is set at 100%

RESULTS AND DISCUSSIONS

Lecture-Style Presentation in Mathematics

ISSN: 2278-4012, Volume:8, Issue:1, January 2019

Student's performance could vary depending on several factors. One of the factors that could greatly affect student's performance is the teaching styles of the teachers. The most common and traditional teaching method used by the teachers is the Lecture-style presentation. Given the method, students' performance in the subject Mathematics in TIMSS may have effects as illustrated in the graph below.



$Y = f(x)$
$Y = 545 + 0.000879x^4 – 4.91x – 2.08e – 5x^5$
R-squared = 0.80985315

Figure 2. Percentage of Time Spent on Lecture-Style Presentation in Mathematics and TIMSS in Science

As shown in Figure 2, the increase of the percentage of time spent in Lecture-style presentation in the subject Mathematics has positive effects in the students' average performance in their TIMSS. As the percentage of time spent in Lecture-style presentation increases, the average performance of TIMSS in the subject Mathematics also increases. Poor performance of the students is accounted to the decreasing utilization of lecture-style presentation among the teachers.

The correlation of the lecture-style presentation in the subject Mathematics can be best elucidated in the model

$$Y = f(x)$$

where x is….

$$Y = 545 + 0.000879x^4 – 4.91x – 2.08e – 5x^5$$

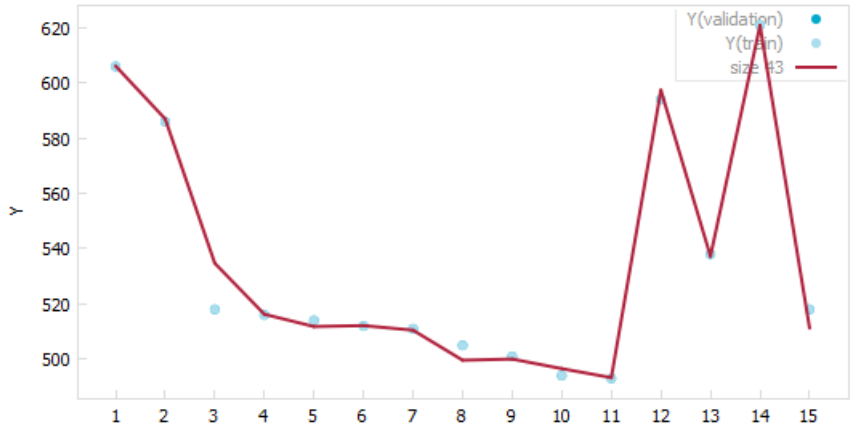
ISSN: 2278-4012, Volume:8, Issue:1, January 2019

This model explains 82% R-squared which shows variable variation in its model equation. The model almost predicted all the means in the average performance of the TIMSS in Mathematics and the percentage in the class time spent in lecture-style presentation, therefore, the best fit model to explain the variables in describing innovation in teaching styles.

Lecture style presentation is an extreme form of guided independent work. This is an innovative view of the otherwise independent teaching styles adapted by the teacher. Although it is found that this extreme form of independent work enhances performance, it suffers from non-robustness of learning i.e. when new situations are presented, involving concepts from the lecture, the students may not be able appropriately respond.

Independent Work in Mathematics

Independent work is another type of teaching styles adapted by the teachers these days. The effects of independent work in the subject Mathematics can be best explained in the illustration below.



Y = f(x)

$$y = 2.17e3 + 117\cos(x) + 1.68x2\ 11.8\cos(2.55e5\ \cos(x)) + \frac{-8.2e3 - 2.5e3\ \cos(x)}{x} - 95.2x$$

R-squared = 0.98287346

Figure 3. Percentage of Time Spent on Independent work in Mathematics and TIMSS in Mathematics

There is a decreasing trend in the percentage of time spent on independent work in the subject Mathematics with the average performance in the TIMSS in the subject as shown in the

ISSN: 2278-4012, Volume:8, Issue:1, January 2019

graph. As presented, the increase in the percentage in the class time spent on independent work in Mathematics is also the opposite which is the decreasing results of the average performance of the students' TIMSS in the said subject. This shows that the students' poor performance in the TIMSS can be due to more time spent on independent work rather than lecture-style presentation.

The results of the percentage of time spent on independent work in the subject Mathematics as based on the average performance of the students in their TIMSS can be best explained in the model

$$Y = f(x)$$

Where *X* is…

$$Y = 2.17e3 + 117\cos(x) + 1.68x2\ 11.8\cos(2.55e5\ \cos(x)) \underset{x}{+ \frac{-8.2e3 - 2.5e3\ \cos(x)}{}} - 95.2x$$

This model shows 98% R-squared which explains most of the variability of the response data around its mean. This model best fits the data on the percentage of time spent on independent work in Mathematics and the average performance of TIMSS in the subject.

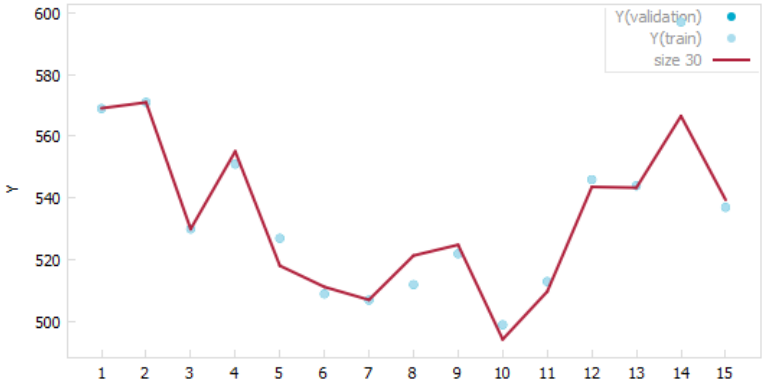
Independent work requires exploration of the concepts. If such explorations are not guided by principles, then the natural tendency of the student is to widen the search space without necessarily understanding the crucial points of the concepts which the teacher desires to impart. When reckoning time comes, such as when a standardized test is administered, the students actually know many unnecessary details of the concepts and missing the fundamental knowledge tested in such standardized examinations.

Thus independent work must be done within a set of parameters specified by the teacher.

Lecture-style Presentations in Science

As students move through school, attitudes to school in general, and science in particular, become less positive (Speering, W, et.al 1996). Science for some is difficult while others may have positive attitude towards the subject. Nevertheless, teachers teaching approaches may have effects to the students especially on how they deal the subject. The relationship of the percentage time spent on lecture-style presentation in Science and the average performance of TIMSS in the subject can be illustrated in the graph below.

ISSN: 2278-4012, Volume:8, Issue:1, January 2019



Y = f(x)
y = 530 + 35.3 sin (X) + 15.5sin(1.81 + 1.9e4X) – 1.53X sin(0.465 + X)
R-squared = 0.89159185

Figure 4. Percentage on time spent on Lecture-style Presentation in Science and TIMSS in Science

As presented on the graph, it was found out that as percentage of time spent on lecture-style presentation increases, the average performance of the students in their TIMSS for the subject Science also increases. Thus, the students' limited time for lecture may result to the poor performance in their TIMSS in the subject Science.

The relationship of the lecture-style presentation in the subject Science and their average performance in TIMSS can be best expounded in the model

$$Y = f(x)$$

where x is…

$$Y = 530 + 35.3 \sin (X) + 15.5\sin(1.81 + 1.9e4X) – 1.53X \sin(0.465 + X)$$

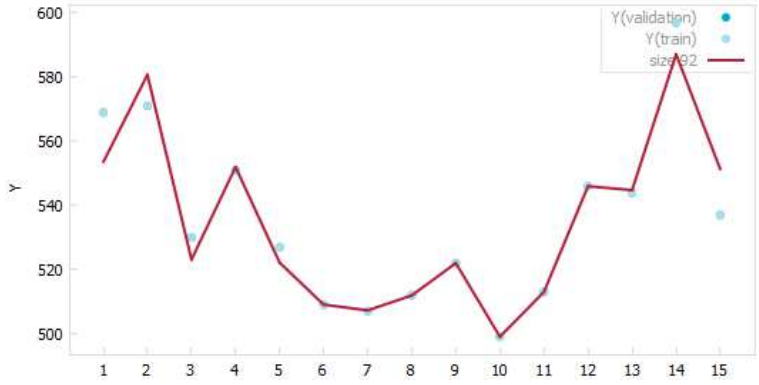
This model indicates 89% R-squared which means that the predictability of the data is visible. The said model almost predicted all the means in the percentage of time spent in Lecture-style presentation and the average performance of TIMSS in the subject Science.

Lecture-style presentation for the subject Science is seen to be very effective to achieve higher students' performance in the TIMSS. This teaching style is an extreme form of independent work. Students when taught primarily through lecture-style presentation may achieve higher performance in the TIMMS yet may seem low in other aspects of learning which is the application of concepts taught and hence may not be able respond aptly in certain situations.

ISSN: 2278-4012, Volume:8, Issue:1, January 2019

Independent work in Science

Independent work in Science is a common teaching style adapted by the teachers. The said teaching style though can be effective for other disciplines as well. The illustration below shows the graph of the relationship of the percentage of time spent on Independent work and the average of performance of TIMSS in the Subject.



Y = f(x)
Y = 544 + 2.25x sin(0.114 – 555x) – x – 61.3sin(0.114 – 555x) – 18.5 sin(0.114 – 555x))
R-squared = 0.93422661

Figure 5. The percentage of class time spent on Independent work in Science and the average performance of students in TIMMS in Science

As illustrated, when independent work increases, the performance of the students in their TIMSS for the subject somehow decreases. Thus, the students average performance in TIMSS have negative effects due to increasing levels of the percentage of time spent on Independent work in the subject rather than the lecture. The said correlation between the percentage of time spent on Independent work and the TIMSS can be best described in the model

$$Y = f(x)$$

Where x is…

$$Y = 544 + 2.25x \sin(0.114 – 555x) – x – 61.3\sin(0.114 – 555x) – 18.5 \sin(0.114 – 555x))$$

The model with the R-squared of 93% shows flexible distinction among the data in its model equation. The model has almost projected all the means in the percentage of time spent on Independent work and the average performance of the students in TIMSS.

Many teachers want their children to learn independent learning. Because of this, students are engaged more in the said teaching style. However, there could be a gap between what the teachers want their students to learn and what they are actually doing. Independent work indeed

requires guidance from their teachers. Since independent work requires exploration to other fields in the subject, thus, teachers' supervision is a must in order for the students to be focused specifically to the concepts needed in the subject as it is important when answering standardized exams.

CONCLUSION

Students' performance in achievement tests is highly accountable to the teaching approaches of the teachers. Two common teaching approaches, Lecture-style presentation and Independent work have been utilized to teach the students in the subjects Mathematics and Science. Lecture-style presentation, as the key concepts of the subject is said to increase the students' performance in their TIMSS. Lecture-style, being the extreme form of guided independent work of the students is an innovative way of the so-called independent work. Therefore, even if lecture-style presentation increases the students' performance in achievement and standardized tests, it should also be integrated with independent work so as to make the students effective in most situations and conditions. Independent work on the other hand, decreases students' performance in TIMSS in both subjects. As this is mainly used to receive and absorb the concepts, such explorations must also be guided with concepts. Therefore, independent work must be done within the limits and boundaries conscientiously given by the teacher.

Lecture-style presentation, being the oldest and effective teaching approach to teach Mathematics and Science must then be innovated with independent work so as to help students respond appropriately to the concepts of the subject. Independent work must also be utilized as one of the approaches to teach Mathematics and Science but within the parameters of clearly stated by the teachers to guide the students especially in exploring the concepts of the subject.

REFERENCES

Riddell, J. B. et.al., (2011). Harvard Study Shoes that Lecture-Style Presentations Lead to Higher Students Achievement, 203 (912-8675), Retrieved from http://educationnext.org/ harvard-study-shows-that-lecture-style-presentations-lead-to-higher-student-achievement/

Sammons et al (1995, p.8). Key Characteristics of Effective Schools: A review of schools effectiveness research. London Univ., England.

Ramgir, Mayur (2017). How innovative teaching methods can boost learning. Retrieved from http://www.nydailynews.com/life-style/innovative-teaching-methods-boost-learning-article-1.2943846

Peter Serdyukov, (2017) "Innovation in education: what works, what doesn't, and what to do about it?", Journal of Research in Innovative Teaching & Learning, Vol. 10 Issue: 1, pp.4-33, https://doi.org/10.1108/JRIT-10-2016-0007