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Online - Merged - Offline Game -Based Experiential Learning Approach as an Innovation in Teaching Chemistry

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Abstract: *This study focused on the determination of the effect of online and offline game-based experiential learning approach as an innovation in teaching chemistry. The primary subject of this research study consists of the grade 3 students in our chosen school enrolled in the academic year 2021-2022. This study aims to teach chemistry in grade 3 learners using online-merged-offline game -based experiential learning approach as an innovation in teaching chemistry to classify the objects and materials as solid, liquid and gas based on their observable characteristics. Various test and data gathering procedures showed promising data on the success of the implementation of the said game-base experiential learning where thirteen (13) students assessed under the supervision of the chosen master teachers and grade 3 teachers. The data that this study generated in terms of the success it shown over the development of the learners were significant in terms of their level of classifying the objects and materials as solid, liquid and gas based on their observable characteristics. Challenges that were encountered by both teachers and students were highly encountered in correlation with the students' level in classifying the objects and materials. Furthermore the information gained from this study will benefit Science teachers by yielding information about the online - merged - offline game -based experiential learning approach as an innovation in teaching chemistry.*

Keywords: chemistry, experiential learning game-based, innovation

Introduction

It is therefore worrisome that students' attitude and interest in science globally has declined (Adu-Gyamfi, 2013). More so, there are many well documented studies of decline interest in science and science careers globally at the primary level (Jarvis & Pell, 2012). President Barack Obama (2009) identifies this decline in interest in science as a global issue, since it presents a challenge to the achievement of quality basic science education. This situation of lack of interest in science is also the same throughout the Caribbean (Ogunkola & Samuel, 2011). Research has shown that the only way students will develop and sustain an interest in science is if their earliest experience with science is memorable. Most researchers have agreed that the students' are more interested in science before the age of fourteen (Dogu, Dinc,&Maydan, 2007)). Therefore, students' at this age (primary school age) are at a critical period in developing an understanding of themselves and their world. Hence, the primary school level is the time when students build a fundamental understanding of science (Tilgner, 1990; Garcia, 2003).

The challenge therefore is to make science education interesting, meaningful and useful for students at the primary level. Leever (2010) reported that the quality of teaching which students were receiving has contributed to their decline in interest in science. Hence, the desired result of learning therefore depends on the teacher being in the center (Akyol, 2000 cited in Ding, Doug, & Maydan, 2007). Simply put, a good teacher is vital for primary science (Ding,Doug & Maydan, 2007).However, many primary school teachers face a trio issue when it comes to teaching science: they don't like science, they don't feel confident in their knowledge of science, and they don't know how to teach science effectively (Allen, 2006). "If teachers lack confidence in their own science knowledge, they not only have problem teaching students about science but may also give students the impression science is hard "(Leever ,2010). Further problems lie with teachers' ability to select appropriate instruction to suit the needs of students. Hence, if teachers do not understand their learners' needs, then their instructional approaches will be a hit or miss (Davis, etal , 2006). Harlen, and Holroyd (1997) postulated that teachers themselves were ready to admit their concerns about teaching science. Hence, a clearer understanding of the science. (Asian Journal of Education and e-Learning (ISSN: 2321 – 2454) Volume 07– Issue 03, June 2019 Asian Online Journals (www.ajouronline.com)

The first wave of the pandemic, which rolled across the world from January, brought with it abrupt transitions to remote learning with varied success through a range of online platforms (Durden, 2020; Lederman, 2020). In response, science teacher educators across the globe were faced with making decisions about how to best support pre service teachers learning to teach in ways that are very different from the traditional in-person instruction and field-based experiences. To further complicate this rapid transition, educators' autonomy was constrained by a range of institutional, technological, accreditation and regulatory issues. For many, this meant planning for online science teaching methods courses that were either synchronous or asynchronous, working closely with accrediting bodies and university clinical placement offices to explore alternatives to face-to-face clinical placement experiences, and negotiating variances of in-person and online student teaching experiences with school partners and hosts. Concurrent with these changes, there was an emerging societal recognition, and pressure to explicitly consider and challenge how marginalized and low-income school district partners and teacher education students were being disproportionately affected. For many science teaching methods instructors, this changed context meant contemplating for the first time whether science teaching methods courses could be effectively taught online, what social justice and equity considerations should be taken into account in online spaces, and exploring ways in which teaching online might be feasible. Even as others had begun similar explorations and to engage in research related to these questions about the promise of online science teaching methods instruction (e.g.,Wang & Wang, 2020) and related scalable equity considerations in online clinical simulations (Bornemon et al., 2020), for many science teacher educators this option had remained subconsciously subservient to the extant pressures of accreditation and traditional conceptualizations of science teacher education. However, in the context of planning for a period rife with uncertainty, questions that seemed only peripherally important pre-pandemic (e.g., Can pre-service teachers learn to teach online?) were central to decision making in the midst of the pandemic. At this moment, research like that of Watkins et al. (2020), where they supported science teacher professional learning of a responsive approach to facilitating scientific engagement online suddenly became paramount to the mission of educating future science teachers. (Todd Campbell, Wayne Melville, Geeta Verma & Byung-Yeol Park (2021) On the Cusp of Profound Change: Science Teacher Education in and Beyond the Pandemic, Journal of Science Teacher Education, 32:1, 1-6, DOI: 10.1080/1046560X.2020.1857065)

Students' understandings of solids, liquids and gases have been well researched and confirm that their early conception of these terms is shaped by their everyday use of these words. Students are frequently reported as using the word 'solid' as an adjective rather than to describe a class of substances. Typically, when students are asked for examples of each state, they are able to provide numerous examples of solids, less of liquids and only a few of gases - which reflects their common experiences. Solids are typically identified as objects that can be held, liquids as 'dishwashing liquids' that are 'runny' or 'wetting' and gases as LPG gas or propane gas that are combustible. Everyday language appears to strongly influence early student identification. For example, solid steel, liquid detergent and camping gas are frequently provided when students are asked for examples of substances in each state. (Research: Jones (1984), Krnel, Watson & Glazar (1998) Some students strongly believe that to be solid the substance must be very hard and clearly consolidated into unbreakable lumps. Substances which appear as powders or in fine granules like sand or talc are often identified as liquids because they are viewed by students as easily shaped or freely poured. Other students are comfortable with seeing powder as a solid because it will not 'wet' immersed objects. Water and water-based liquids (for example milk, sea water, cordial and lemonade) are recurring examples of liquids identified by students. Non-water-based liquids like cooking oils, kerosene, mineral turpentine, paraffin oil and oil based paints are less frequently identified. Evidence suggests that students freely associate liquids with water or assume they all contain some water because they are a liquid. (Research: McGuigan, Qualter & Schilling (1993), Krnel, Watson & Glazar (1998) (Problems with classifying solid, liquid and gas/VICTORIA State Govt./Education and Training/Last update Sept. 5, 2018 /https://www.education.vic.gov.au/school/teachers/teachingresources/discipline/science/ continuum/Pages/classifying.aspx)

Science defines the universe for us, informs our vision of human essence, and speaks to the hopes and fears of our world. It provides the great narrative of truth, meaning, and essence that we live by" (Turner, and cited by Hassard, 2012). Thinking scientifically helps us to develop new ways of thinking and widens and deepens our capacities to think (Pozo, 2008). Understanding science therefore helps children to appreciate the world around them by teaching them to make observations, collect information and to use logical thinking to draw conclusions in order to solve life's daily challenges. Hence, Science education has a major role to play in the development of informed citizens in this advanced technological era (Watters & Ginns, 2000). (Asian Journal of Education and e-Learning (ISSN: 2321 – 2454) Volume 07– Issue 03, June 2019 Asian Online Journals (www.ajouronline.com))

On a finer scale, for many whose science teacher education programs have adopted practice-based approaches to teacher education anchored in core practices (Grossman, 2018) or who have begun rethinking high-leverage core practices in justice-oriented ways (Calabrese Barton et al., 2020), questions about whether focusing on supporting preservice teachers' facility to enact core practices is possible through online experiences have emerged (Dunlap et al., 2016). Here, a focus on core practices generally entails an ensemble of teacher education pedagogies such as representing core practices, engaging in rehearsals, and coaching in clinical settings. Similarly, when centering on justice-oriented teaching this could entail recognition and disruptions that make social transformation possible. Here, representing, decomposing, and approximating practice supports the pre-service teacher to develop a deeper understanding of, and facility with, good teaching (Grossman, 2009), while simultaneously engaging pre-services in justice-oriented core practices. Such a shift involves recognizing students' lived experiences, the assets and wisdom of their communities, disrupting features of practice that previously delegitimize these newly recognized community assets, and organizing social transformation in ways that reorients discourse and interactions in classrooms (Calabrese Barton et al., 2020). Some evidence that work around core practices with pre-service teachers can continue in the pandemic in online spaces can be found in examples of research like that conducted by Sherin and Han (2004), where they used videoclubs to foster shifts from a focus primarily on teachers, toward an increased attention on students' ideas and actions in ways aligned with a focus on core practices that orient to student sensemaking (e.g., Ambitious Science Teaching; see Windschitl et al., 2018). Here, we can envision how existing video archives of classroom instruction and student interventions could be leveraged in, and beyond, the pandemic as an alternative to clinical observations when these experiences in the pandemic are not possible. These video archives might also afford pre-service teachers opportunities to see more diverse classrooms than might be available in close proximity to university teacher education programs during, and beyond, the pandemic. Additionally, some innovative models of the ways in which pre-service teachers might come to learn more about the lived lives and community assets of their students can be found in research like that of Varma (2018) who used Flipgrid™ (flipgrid.com), a technology-enhanced social learning environment, to engage student-parent pairs in connecting their interests and cultural knowledge to the learning experiences of middle school science classrooms. From this example, it can be seen how video platforms like Flipgrid offer opportunities to connect cultural knowledge and assets from home in the context of, and beyond, the pandemic. Similarly, online communities to support science teaching have emerged over the past few months. As an example, a Facebook group called Strategies for teaching chemistry online (Strategies for Teaching Chemistry Online, n.d.) (4.5 k members) provides a great community resource for science educators (both K-12 and higher education).This and other organic learning communities formed during the pandemic appear to be thriving during these times. It is important for us as a community to find ways to curate these resources and share them with pre- and in-service teachers. When these technology-enhanced tools and approaches are considered in the context of supporting pre-service teachers' facility to enact justice-oriented core practices, the promise of recognizing and disrupting practices in classrooms and schools that have failed to legitimize these cultural resources seem possible. In each of these examples, while these technology-dependent approaches may not replace face-to-face interactions in classrooms, or with families, it is clear that they can supplement these experiences post-pandemic in ways that might provide pre-service teachers possibilities to engage in more diverse representations of classroom practice and engaged communities. (Todd Campbell, Wayne Melville, Geeta Verma & Byung-Yeol Park (2021) On the Cusp of Profound Change: Science Teacher Education in and Beyond the Pandemic, Journal of Science Teacher Education, 32:1, 1-6, DOI: 10.1080/1046560X.2020.1857065)

In this light, the researchers decided to conduct this study because it was observed that the learners on the primary level had a misconception on classifying the solid, liquid and gas. This research is a way to give them solutions on their problems. In this research, the learners will be able to identify the state of matter based on their observable characteristics.

ACTION RESEARCH QUESTIONS:

The study aimed to innovate in teaching chemistry using online-merge-offline game-based experiential learning approach. Specifically, it sought to answer the following questions;

1. What are the learning achievements based on the pretest and posttest using the Online – merge – Offline Game – based Experiential Learning as an Innovation in Teaching Chemistry?

2. Is there a significant difference that exists between pretest and posttest using the Online – merged – Offline – based Experiential Learning approach as an Innovation in Teaching Chemistry?

3. How does the learner actively engage during the implementation of the Online – merged – Offline Game – based

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Experiential Learning approach as an Innovation in Teaching Chemistry as described in the following?
3.1 cognitive engagement
3.2 behavioral engagement
3.3 emotional engagement
3.4 social engagement

4. What is the attitude of the learners as exposed to the Online – merged – Offline Game – based Experiential Learning approach as an Innovation in Teaching Chemistry as described in the following?
4.1 inquiry
4.2 enjoyment
5. Is there a significant relationship between the learner's active engagement and attitude of the learners as exposed to the Online – merged – Offline Game – based Experiential Learning approach as an Innovation in Teaching Chemistry?

6. What lesson exemplar in science 1 may be developed based on the finding of the study?

METHODS

The purpose of this study is to investigate the effectiveness of online – merge – offline game- based experiential learning as an innovation in teaching chemistry in Pretest and Posttest true control group design. This study shows how this innovation helps the students to improve their experiential learning in chemistry more specifically, this study finds out what is significantly different between pretest and post-test using the online – merge offline game – based experiential learning as an innovation in teaching chemistry. This research is conducted by thirteen respondents (13) in grade three in our chosen school in San Jose Del Monte City, Bulacan during the school year 2021-2022.

The respondents of this study were thirteen (13) students, two (2) master teachers, and two (2) grade 3 teachers that are teaching English grade 3 in Bulacan Standard Academy, Incl. The respondents were purposively selected.

Survey questionnaire was given to the selected teachers to evaluate the learning materials created by the researchers that will be utilized to the thirteen (13) students. The survey questionnaire is evaluated by content, format, presentation and organization, and accuracy and up-to-dateness following the LRMDS evaluation tool. The learning materials that is to be utilized among the learners is what the teachers will use to assess the reading skills of the grade 3 students. The study uses purposive sampling technique in order to determine if there are similar traits or characteristics among the participants while engaging on the proposed online-merge-offline game-based experiential learning approach.

In order for the succession of the development of online-merge-offline game-based experiential learning, the researchers used innovation as a tool to develop and implement the game-based experiential learning. The innovation is to be utilized in order for the learners to classify objects and materials..

In conducting the study, the researchers carried out a request letter noted by the school principal and research coordinator that is sent to the school division superintendent for the approval and permits to undertake the study to the chosen school. Once approved, the researchers can now distribute the informed consent form to all the learners' parents/guardians. Another letter is to be given to the principal of the chosen school for the permission to conduct the study.

To protect the privacy of the respondents, the researchers will consider taking proper consent from all the respondents of the study. The date that will be collected will be treated with confidentiality and validity of the conduct of this study. The researchers will ensure to have a proper communication and cooperation with the participants and ensure the safety of the documents. All information shall not be exposed with/o the proper consent of the owner.

In terms of analyzing the achievement of the learners on classifying the object as solid, liquid and gas based on the assessment and evaluation of the teachers on the experiment group using the t-test of the independent means. After the pretest, next step is the intervention to be given to the experimental group. Once the intervention has been implemented, a posttest will be administered to see if there is a significant difference between the pre-test and posttest results of the experimental group. The weighted mean was utilized. The critical value and computed t value, as well as p – value and an alpha level of 0.05, were statistically considered to determine the academic achievement of the learner respondents.

RESULT AND DISCUSSION

Table 1: Student's pretest and posttest

	Pre-test Scor	Posttest Sco	Gain Score
Mean	60	103	94.29

The data being presented in table 1 shows the learners achievements after the utilization of online-merge-offline game-based experiential learning approach as an innovation in teaching chemistry. The data indicates before the implementation of the innovation the learners pretest mean score is 60, then in learners posttest mean score is 103. Hence the learners gain 44.29 %. It can be concluded that implementing the online -merge -offline game -based experiential learning approach as an innovation in teaching chemistry has a positive effect on the learner's achievement, as evidenced by the significantly greater mean in posttest than in pretest.

Table 2: A significant difference that exists between pretest and posttest using the Online – merged – Offline game- based Experiential Learning Approach as an Innovation in Teaching Chemistry

df	T-test	T-test Critical Value	Probabilit level	Decision	Interpretation
12	6.50	2.18	P < 0.05	Ho is rejected	Highly significant

Upon Computing the data, it shows that the t-value of 6.50 was exceeded in the t-test critical value of 2.18 at the degree freedom of 12. The result of the score is significant at 0.05. It implies that the null hypothesis is rejected thus, there is significant difference in pretest and posttest score of the learners in utilization of online merge offline game based experiential learning approach as an innovation in teaching chemistry.

Table 3: Learner's actively engage during the implementation of the following

Engagement	WM	Interpretation
Cognitive Engagement	3.38	PA
Behavioral Engagement	3.62	PA
Emotional Engagement	3.62	PA
Social Engageme	3.70	PA
Overall	3.58	PA

The table above shows the attitude of the learners towards online- merged- offline game- based experiential learning approach as an innovation in teaching chemistry. The data shows that the learners have positive attitude towards online -merged - offline game- based experiential learning approach as an innovation in teaching chemistry with overall weighted mean of 3.58 as described on the following domains the mean scores of the following learner's engagements; Cognitive engagement (x=3.38), behavioral engagement (x=3.62), emotional engagement (x=3.62), Social engagement (x=3.70).

Table 4: Attitude of the learners as exposed to the Online – merged – Offline Game – based Experiential Learning Approach as an Innovation in Teaching Chemistry as described in the following

Attitude of the learners as exposed to the Online – merged – Offli Game – based Experiential Learning as an Innovation in Teaching Chemistry as described in the following.	WM	Interpretatio
Inquiry	3.77	PA
Enjoyment	3.85	PA
Overall	3.81	PA

The table shows the attitude of the learner exposed to the online merge offline game based experiential learning as an innovation in teaching chemistry with the overall weighted mean of 3.81.

Table 5: A significant relationship between the learner's active engagement and attitude of the learners as exposed to the Online – merged – Offline Game – based Experiential Learning Approach as an Innovation in Teaching Chemistry

df	T-test	T-test Critical Value	Probabilit Level	Decision	Interpretati
12	3.74	2.18	P<0.05	Ho is rejected	Highly Significant

The table above shows that the t-test value of 3.74 was exceeded in t-test critical value of 2.18 at the degree of freedom of 12. The result of the score is 0.05, therefore the null hypothesis is rejected. Thus, there is significant difference between the learner's engagement and attitude as exposed to the online -merged -offline game -based experiential learning approach as an innovation in teaching chemistry.

CONCLUSION

The following conclusions are drawn based from the findings:

1. It is evident that utilization of Online-Merge-Offline Game-Based Experiential Learning Approach as An Innovation in Teaching Chemistry had a positive effect on the learners' performance, as evidenced by significantly greater mean in the posttest.

2. There is significant difference in the pretest and posttest score of the learners in the utilization Online-Merge-Offline Game-Based Experiential Learning Approach as An Innovation in Teaching Chemistry.

RECOMMENDATIONS

In the light of the findings and conclusions of this research, the following recommendations are hereby presented:

1. Science teachers must utilize the Online-Merge-Offline Game-Based Experiential Learning

Approach as An Innovation In Teaching Chemistry. The needed skills or competency-based outcome is a must for the learners to become adept in their chosen careers as prescribed by the K to 12 programs. They must embrace and commit their time to be creative, forward-looking, and adept in using available resources inside the community and construct or integrate real life experiences of the learners to connect the concepts to issues and concerns that necessitate to be spoken.

2. Educators in any field should try to apply or integrate Online-Merge-Offline Game-Based Experiential Learning Approach as An Innovation in teaching any subject because it shows a positive effect in the performance of the learners' and it is an effective means of imparting lifelong learning outcomes.
3. Science teachers should create learning strategies that will cater to different learning abilities to improve their performance.

4. Online-Merge-Offline Game-Based Experiential Learning Approach As An Innovation In Teaching Chemistry can be proposed to enhance the Science performance of the learners and further study on States of Matter to test the effectiveness using a bigger sample or different Grade level to verify the result of this study.

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