Bringing the Real World into Online Learning: Teacher Notes From an Online, Fun Chemistry Course

Dr Ajita Deshmukh

Abstract

As teaching-learning processes transitioned into remote learning due to the Covid-19 pandemic, there were several out-of-formal-class measures that were undertaken by many government and non-government institutions. Different experiments were conducted to make the most of remote learning by merging formal and informal learning, as well as exploring alternative pedagogical approaches.

This paper documents the strategies implemented, and the fun activities incorporated in one such experiment, an online course conducted for 8-11-year-olds, where they were taught chemistry through active learning and game-based pedagogies. This paper, derived from the field notes taken during the course, observes the participants' engagement in the course and outlines the strategies adopted for blending the virtual and real worlds.

Keywords: integration of offline activities, blended learning, alternative pedagogy, art integrated science, activity-based pedagogy

Introduction

Covid-19 caused drastic changes around the world. Educational institutions have had to remodel their teaching practices. In many parts of the country, the use of 'Emergency Remote Teaching' (ERT) technologies, solely based on the understanding of the teachers and institutions without any specific training, led to chaos. ERT included passing notes over WhatsApp, replication of traditional teaching practices in physical spaces with the only change being the online medium of delivery, among other things. Furthermore, in many institutions, there was no ERT at all, due to several factors.

Since March 2020, many students have been subjected to long screen-time as they started attending online classes. A popular media in such synchronous classes was the video, typically, a passive resource for educational transactions, which increased the screen-time duration. Large part of teaching-learning happened with information being transfered from the teacher, with students' microphones and videos being muted. Such practices can lead to a false notion that online teaching-learning is ineffective. However, it is contended that integrating online and offline learning experiences can lead to effective learning. The crux is in designing learning experiences that integrate online teaching with offline household experiences to help construct knowledge. This paper elaborates the design of such an integrated program, and discusses the involvement and engagement of students.

Literature Review

Research on pandemic-enforced remote teaching has revealed that the wellbeing of students is effected due to stress and lack of social connect (Calao, et al., 2020). It is also accepted that social and emotional connect is largely due to the 'fun' element of social activities in the physical classroom. ERT missed the 'having fun together' element due to physical distancing requirements. Specialy devised and adapted games can help in inducing the fun element even in virtual classrooms. A number of studies have been conducted on game-based learning (GBL), a constructed activity that includes elements of game mechanics into non-game settings (Brown, et al., 2019; Lengyel, 2020). GBL arouses curiosity, competitive spirit, and creativity to establish and construct concepts (Boyle, 2011), and enrich learning experiences of students in higher education (Campos, et al., 2020). GBL is reported to have increased learning outcomes (Wardoyo, DwiSatrio, & Ma'ruf, 2020), and impacted the development of 21st century skills (Qian & Clark, 2016; Al Fatta, Maksom, & Zakaria, 2019). GBL has been implemented in multiple settings, including in training and education, as well as through social media (Pho & Dinscore, 2015). GBL provides opportunities to enhance critical thinking, reasoning, and problem-solving skills to enhance specific learning goals and outcomes, increasing productivity in technical and engineering students (Talib, et al., 2019).

Methods and Processes

A. The Course

The course aimed to teach fundamentals of Chemistry in a 'fun' way, and was designed for the 8-11 age group. The topics included learning about metals, metalloids, and non-metals; their properties; uses; and the periodic table. The course was offered for a period of one week, daily, for one hour in the evening. In order to maximize attention and participation, all the (roughly) 120 students who enrolled from across India, were split into three batches of 35 students each. This was also in line with RTE norms of pupil-teacher ratio (PTR) of 30 for primary classes. The instructors, timings, support team, platform, and course curriculum was consistent across all three batches.

B. Course Design and Active Learning

Active learning strategies were the pedagogic foundation of the course, videos were consciously avoided. Activities were designed in a game-based manner (individual and group), which required the students to collect material that's easily available in their immediate surroundings.

The games were designed considering popular games like Housie and Scavenger Hunt, and modified as required, for online purposes. Each game allowed students to construct their knowledge of chemistry. After the completion of the activities, each participant shared their understandings, and the instructors facilitated their learning by clearing their misconceptions. The participants were allowed to use paper-pen as well as ICT tools, but this course did not involve training the participants on the ICT tools.

A few of these games can be accessed here.

Observations

The instructors and the course team members were observant of the interactions and participation of each student. Field notes were maintained in a google document, so that each member could note their observations, and it could be used to solve any technical, implementation, or academic issues.

C. Course Design and Delivery

It is essential to consider the limitations of material availability at students' end in a hybrid/flexible pedagogy setup, especially one that focuses on 'active learning' strategies. It calls for deep thinking in design. A dedicated extra half an hour – the 'zero hour' at the beginning of the course was used to tackle technical difficulties or any other difficulties related to the course faced by the young learners. As a strategy, the students were informed beforehand that they would have to introduce themselves by talking about their hobbies,

other activities, a recent book that they read, etc., which would help them get to know each other. Their general interests and reading interests ranged from astronomy to science and art. This half an hour allowed them to know a bit about each other, which helped in the formation of teams and, generally, supported interactions. It was observed that the children were well aware of the mechanics of online interaction. In case there were multiple hands raised, or two children unmuting and speaking at the same time, they would pause and give each other the chance, or rely on us to take the call on who speaks first. No child 'bulldozed' other children. This indicates that that this generation (belonging to the specific socio-economic background of children who enrolled) is used to social interactions over the virtual space.

D. Active Learning

During Scavenger Hunt, children had to fetch things made of a certain element in a fixed time. The clues were given not by directly naming the element, but by mentioning its properties. Most of the children could fetch articles within the time limit fixed for the activity. It was noted that the students were very calm and mostly were able to find things in proximity. When the children had to fetch articles made of aluminum, it was noticed that children got back packs of medicines like Crocin/Dolo. This proved to be a striking reminder of the grim pandemic times that we all were in the midst of. The objects that the children fetched were used for a discussion on classification of elements.

The story of Mendeleev's periodic table was shared in the form of a comic book using the 'share screen' feature, followed by discussions. The session dealt with the conceptual shift from atomic weight to atomic number, and from Mendeleev's periodic table to the Modern periodic table, concluding with its popular representation.

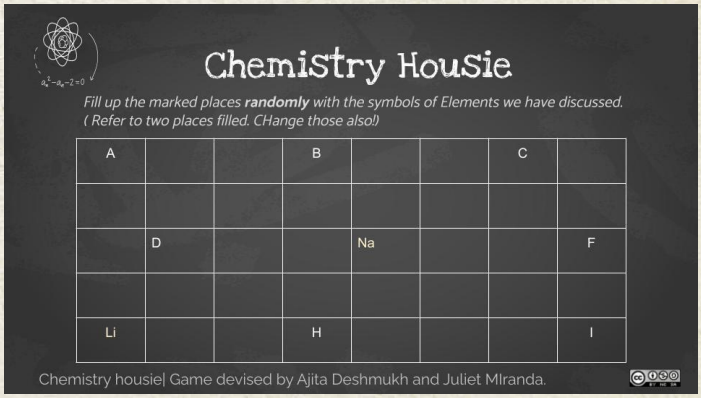

Fig. 1. The housie ticket with instructions and example

Most children knew how to play Housie, and were able to create housie tickets at their end as per the given instructions. The game was designed as edutainment, where the clues for the 'housie elements' were given in terms of properties of the elements in order to reinforce

their learning about the elements within the context of the periodic table. The Housie game was played for three criteria: the quick five, completed row, and full house. Participants would have to 'raise their hand', if they completed a criteria, switch on the camera and show us their Housie ticket. The ticket would then be verified by the course team and the winner of the round would be announced.

The collaborative strategy game, 'Sink My Ship', was far more immersive as reported by the students. The participants had to work together in teams that were randomly assigned, with one objective of 'sinking the ship' of the instructor on the basis of their knowledge of elements and periodic table. The 'ship' would be an element symbol displayed on the screen. The teams worked in cohesion to add up and use their elements efficiently to sink the instructor's ship without any confusion or conflict. The course team monitored and tracked the participants. Correct answers to puzzles and quizzes were totalled to declare winners. There was no observable difference in the participation of male and female students in this course.

E. Assessments

Since the course was based on 'fun-learning', it was imperative that the assessment also incorporated the fun element. The assessments were distributed throughout the course for better engagement. These games were used as formative assessments with a focus on 'assessment for learning', so as to construct knowledge – the basis of science education.

The summative (end-of-course) assessment was designed to integrate art and science to allow the students to creatively express themselves, a quality often found to be high in this age group. For the final assessment, children had to draw/trace a superhero – could be existing, adapted, or a newly-created superhero – and assign specific properties of various elements to their superhero. There was no restriction on the medium of their creation. They were asked to submit their creations in pdf/video format, either over email or via WhatsApp to the course team members. The course team members helped the students with technical aspects and other doubts encountered during the entire assessment.

Limitations Of The Study

Since enrollement into the course was voluntary, the intrinsic motivation of students was high, and this led to the smooth conduct and eventual success of the course. Whether the same outcome is attained in a compulsory course would require further research. The other limitation was that the enrolled students in this course had the basic technological competencies to participate in an online course. Implementating such fun-learning pedagogy for other age groups, including for students in higher classes and for other subjects and disciplines, would require further research. Another important limitation was the availability of devices to conduct the course online, although as these games are originally played in in-person environments and are adapted for online environments, these methods are amenable to in-person learning as well.

6. Summary And Conclusions

To overcome the persistent challenges of student engagement and motivation in online, offline, or hybrid modes of learning, it is advantageous for educators to implement fun-learning and/or game-based learning. Research indicates that experimentation and personal experience is important to the process of learning. The course provided multiple opportunities for students to experience things in a fun-learning way. Teachers should, therefore, look at strengthening their professional competencies in this area. Novel pedagogical strategies will have to be explored, implemented, and documented by educators at various levels of formal education, with an aim to have learner-centric educational transactions that can be adapted for remote and hybrid learning. Student wellbeing is the critical part of a successful pedagogy, and teachers have to make conscious effort towards the same.

In conclusion, given the reality of the virtual and the physical worlds merging and blending into a stabilized hybrid, this paper outlines strategic steps that could be taken in order to successfully implement fun-learning in the virtual mode ◆

References

1. Colao, A., Piscitelli, P., Pulimeno, M., Colazzo, S., Miani, A., & Giannini, S. (2020). *Rethinking the role of the school after COVID-19.* Lancet Public Health 2020, 5, p. 370.

2. Boyle, S. (2011, October). *An Introduction to Games based learning.* UCD Dublin. https://www.ucd.ie/t4cms/UCDTLT0044.pdf.pdf

3. Brown, C, L., Comunale, M. A., Wigdahl, B., & Urdaneta-Hartmann, S. (2018). *Current climate for digital game-based learning of science in further and higher education.* FEMS Microbiology Letters, 365(21), p. 237. https://doi.org/10.1093/femsle/fny237

4. Campos, N., Nogal, M., Caliz, C., & Juan, A. A. (2020). *Simulation-based education involving online and oncampus models in different European universities.* International Journal of Educational Technology in Higher Education, 17(1), pp. 1-15.

5. Al Fatta, H., Maksom, Z., & Zakaria, M. H. (2019). *Game-based learning and gamification: Searching for definitions.* International Journal of Simulation: Systems, Science & Technology, 19, 10-5013.

6. Lengyel, P. S. (2020). *Can the game-based learning come? Virtual classroom in higher education of 21st century.* International Journal of Emerging Technologies in Learning, 15(2). https://doi.org/10.3991/ijet.v15i02.11521

7. Qian, M., & Clark, K. (2016). *Game-based Learning and 21st century skills: A review of recent research.* Computers in Human Behavior, 63, pp. 50-58.

8. Pho, A., & Dinscore, A. (2015). *Game-based learning.* Tips and Trends. https://acrl.ala.org/IS/wpcontent/uploads/2014/05/spring2015.pdf

9. Sardone, N. (2018). *Attitudes toward game adoption: Preservice teachers consider game-based teaching and learning.* International Journal of Game-Based Learning, 8(3), pp. 1-14. https://doi.org/10.4018/IJGBL.2018070101

10. Talib, C. A., Aliyu, F., bin Abdul Malik, A. M., & Siang, K. H. (2019). *Enhancing students' reasoning skills in engineering and technology through game-based learning.* International Journal of Emerging Technologies in Learning, 14(24), pp. 69-80. https://doi.org/10.3991/ijet.v14i24.12117

11. Vlachopoulos, D., & Makri, A. (2017). *The effect of games and simulations on higher education: a systematic literature review.* International Journal of Educational Technology in Higher Education, 14(1), pp. 1-33. https://doi.org/10.1186/s41239-017-0062-1

12. Wardoyo, C., DwiSatrio, Y., & Ma'ruf, D. (2020). Effectiveness of game-based learning–learning in modern education. In G. Agustin (Ed.) *3rd International Research Conference on Economics and Business* (pp. 81- 87). KnE Social Sciences. https://doi.org/10.18502/kss.v4i7.6844