

Gamification of Interaction of Energy and Economic Incentive in Household Environment as a Holiday Assignment of the 7th Standard Students

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Abstract- Science teaching does not always involve big Lab set up and high-tech apparatuses, however teaching learning process of science could be innovative-in approach by using simple low-cost experimental models. This study identifies gamification as a self-directed literacy model to establish stimulatory tasks thereby achieve enhanced learning and application-based adaptability of the learnt skill-set. Model for gamification comprised of five-step process: “understanding the target student population and relevant context of topic to be taught”, “defining learning objectives”, “structuring the experience”, “identifying the resources”, and “applying gamification elements”. Target student population in this study was middle school, 7th standard students and gamification task was auditing and reducing electricity bill. Students were explained about the section of the electricity bill comprehensively. Learning objectives were to identify how to lower the electricity bill by identifying areas of reduction of the bill. Students were asked to structure their learning by understanding the house environment and modifications that can aid in reducing the electricity charge. The resources suggested were taking off any gadgets that remain in the socket, insulating the windows and minimizing opening of doors, keeping temperature of air conditioning at a regular level. Students learnt the gamification elements of reducing the energy loss and conservation as the primary endpoint of this teaching/learning model. Students also learnt selection of key areas of improvement as an economic incentive and lastly, they integrated the concept of energy and economic incentive in their household environment.

Keywords: Active learning, Audit, Gamification, Resources, Economic incentive, Self-directed approach.

Introduction

Science teachers often come across the challenges in clarifying key scientific concepts as applied science due to various limitations for example larger class strength, cumbersome practical models due to involvement of chemicals, apparatuses, individualized attention in the actual class room settings. Thus, educators often land up becoming reluctant to carry activities in class room

that could yield in conceptualization of the key scientific phenomenon and their applicability in day-to-day activities.

Tools and models that can help students attain better outcomes by designing interventions to engage students in real-time activities could help fill such gaps of individualized attention for each student, self-directed learning, translate the scientific concepts in their daily activities and observations (Panesar-Aguilar and Aguilar, 2017). Such interventions take the form of small changes in context that might have large outcomes. In addition, the effects of gamification can often be complemented with interventions that are longer lasting and longer-term adherence to a task at hand. In this study, we focus on one such set of interventions collectively known as gamification (Huang & Soman, 2013).

Gamification (McGonigal, 2010) in simple definition is creating communities around a game that involve an intellectual work that is performed as a simple task explaining the concepts as an outcome of the simple task figuratively. This study hypothesized gamification of energy loss and energy conservation techniques translating their application in cost reduction of monthly electrical bill as a longitudinal study. A self-directed literacy model (Grow, 1991) to establish stimulatory tasks thereby achieve enhanced learning and application-based adaptability of the learnt skill-set was the goal of this research design. With this gamification model, primary endpoints were to establish self-directed learning of scientific key concepts, their application, and lastly understanding of the selectivity of scientific concepts by impending real-time needs.

Methodology

This study was undertaken as a summer holiday assignment for the 7th standard students of the 2014 batch at the Bal Bharti Public School (BBPS), Noida UP India. Research design was structured as a two-time point longitudinal evaluation of monthly electrical bills, one for the month of May 2014 as the baseline assessment, and a subsequent one (after a month) post implementation of the research paradigm.

Model for gamification (Arnold, 2014) comprised of five-step process: “understanding the target student population and relevant context of topic to be taught”, “defining learning objectives”, “structuring the experience”, “identifying the resources”, and “applying gamification elements”.

Students went through the learning process of the gamification task of a scientific concept as a classroom learning module. The application of five-step process of gamification model for this assignment is as follows:

1. Understanding the target student population and relevant context of topic to be taught: students were taught about the concepts of energy loss, enthalpy and Gibbs energy (Lampinen & Fomino, 1993) as a pre-assignment education module.

2. Defining learning objectives: students were informed to read and understand the monthly electricity bill that they receive as their household amenity. They were asked to identify the bill and what sections of the bill are modifiable by energy conservation methods. Students were asked to review their house environment and the utilities that are involved in energy consumption for example: air conditioning, water heater usage, plugs and their usage.
3. Structuring the experience: Students were asked to apply energy conservation methods for a month and thereby reducing the subsequent electricity bill.
4. Identifying the resources: Students were asked to maintain the air conditioning appliance at a temperature based on daily weather changes, insulate the windows, and minimize the usage of door to minimize the inflow of heat energy from external environment (outside temperature) to the isolated environment (house temperature).
5. Applying gamification elements: students were explained to unplug unused appliance from the electrical supply lines, lower the temperature of the water heater and insulate the windows with insulating tapes. They were also suggested to install a self-closing tool for the door, when door in open position is not needed.

Students were asked to make a log for the daily activities that they performed for this project and estimate what areas they worked on, what areas they could improve and how did they observe loss of and use of electrical energy. Students were asked to discuss about the findings once they returned from the summer vacation back to school with both their logs of activities, pre-assignment and post-assignment electrical bills.

Result/Findings

Students could identify modes/usage of electrical energy in their household as a self-directed observation that they could relate to their electricity bill as the second step of the gamification process during their holidays. They also effectively could read and understand the electricity bill that they receive for their household electrical supply (Fig. 1).

Structuring of the experience of the students yielded key results. Some of the patterns for the loss of energy that the students addressed were windows and door that remained open and unattended, which could identify their learning process of addressing the question. They also discussed that temperature regulation of air conditioning was not particularly maintained by the weather pattern as it was not an attended for by the household member as an area of priority concern. Students could identify how the loss of electrical energy was happening due to area of transduction of heat energy coming from the external environment (Figure 2). They also remarked on unplugging of unused appliances and additionally searched for energy efficient light bulbs and tube lights, which appeared as an added self-directed application of the knowledge and learning also talking about the resources that were used and implemented as the fourth step of the

gamification process. Lastly, students searched for methods of insulation and few of them used insulation tapes on windows to reduced heat energy entering their household as resources, which showed their ability to apply the gamification elements as the final step of the process.

The students could explain their electricity bill and the reduction of charges as an outcome of this study design. In this process, they could learn about a compounding chemistry phenomenon of energy loss, enthalpy, and parts and mechanisms of Gibb's energy.

Discussion/Analysis

Students of 7th standard not only could rationally understand a scientific concept but also apply it in a project with their ease of home environment. Students were informed and taught about electrical energy, energy loss and enthalpy as a class module, however its application was translated as a self-learning tool using the gamification model to conceptualize as an activity that focused on self-directed learning and presenting the outcomes as a scientific project. Our hypothesis that self-directed learning using gamification design showed significant efficacy in enhancing the understanding of class curriculum. The students of 7th standard progressed through the five-step project effectively and obtained a clear understanding to apply a concept from chemistry subject into economic incentive and energy conservation as a cost-effectiveness tool as well.

A progressive school system is made up of progressive teachers/educators who develop progressive students with wholesome intelligence, prepared for the world, which awaits them leading to a progressive society. There are difficulties that the science and mathematics teachers face in addressing the coursework and simultaneously facilitate the students to hypothesize the topics by application (Li, 1998; Midgley, Feldlaufer, and Eccles, 1989). One of the learnings through the time has been that a good teacher is a lifelong learner and a child learns by doing, by discovering and not by listening submissively to a display of factual knowledge. It is only in this active and creative process leading to discovery that the child finds joy, concentration becomes spontaneous and teacher gains satisfaction.

Conclusion

How the philosophy and mechanics of 'learning by doing' using gamification concepts at BBPS, Noida is encouraging to bring the scientific concepts in application by motivating the students to toy with practical ideas, filling in execution gaps and emerging with innovations that matter. These original works of scientific art present the scientific excellence sprouted in our classrooms and motivating students to implement their visions.

We as teachers through our teachings possess the responsibility of kindling in our students that scientific bent of mind, scientific curiosity and logical approach which is so essential for handling day to day situations in a mature way (Figure 3). It is our responsibility to unite the students and make compatible groups which work together, come up with marketable innovations ready for acceptance by the society, thus making a base for them to become

entrepreneurs, scientists in this India where startups are mushrooming and welcomed; and scientific instructions are emerging with notice to the western world.

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