

## Computing Technology in Deep Learning

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### ABSTRACT

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Currently, teachers are responsible for the students to be knowledgeable about curriculum content and to know how to motivate learning in their learners. However, evidence of student learning at the K–12 level indicates that teachers may need to give more attention to this expectation. In last years the emphasis in both, research and government policy, has been on improving the quality and depth of teaching with a view to enhance learning. This paper combines educational research with instructional technologies to build a Deep and Active Learning Model with three active dimensions (teachers, learners, and technology). Thus, a novel strategy of involvement on the part of the students in deep learning through challenges is proposed. Furthermore, we illustrate how the model helps to improve student’s satisfaction and their deeper learning. Finally, in this paper presents the research conducted with the purpose to explore effects of integrating listening, reading and writing during the lesson on English language learning for K-12 learners.

**Keywords:** Active learning, Deep learning, Challenges, Learner, Mobile Devices, K-12, Games.

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### I. INTRODUCTION

One of the central starting points in education revolves around what John Dewey said, “Give the pupils something to do, not something to learn; and the doing is of such a nature as to demand thinking, or the intentional noting of connections; learning naturally results” [3]. Many educators agree with [3], even today many researchers propose methodologies based on dynamic learning, significant, and relevant to their lives. Many proposals are based sciences that confirm the benefits of dynamic learning, reporting that neural pathways in the brain are rewarded by the release of neurochemicals. Thus, neuroscience confirms the results obtained with this type of learning. Technology significantly supports learning and teaching, and provides new opportunities to improve these activities. New technologies offer new opportunities in improving traditional learning. In this paper, we extends a classical model for engaged deep learning by adding a third dimension that represent the increasingly important role of technology [4].

We know that the students that use a deep approach are personally involved in the task, and our proposal support this characteristic through challenges in games. We should remember that “play” is a very significant activity of what life means to children (K-12) at this stage of their development.

Ramsden summarizes some characteristics respect to deep approach as follows [6]: The learner is capable to identify the arguments and concepts meaningful. Furthermore, they may relate previous knowledge with new knowledge obtaining outstanding outcomes, and even relates knowledge from other subject/course. Another relevant characteristic is that learners in this context relate theoretical ideas to everyday experience, giving benefit to their learning. In this theory, the learners are able to relate and distinguish evidence and argument. The learners may organize structure and content into a coherent whole. Finally, they may do an internal emphasis. Such students analyze and discuss widely around a given topic, to achieve higher grades on assessment tasks. Indeed, this approach to learning may be encouraged by teachers who adopt a developed theory. There are other approaches to learning are not necessarily mutually exclusive. Learners and teachers can adopt different approaches according to the task, course or the teaching context.

### II. OUR PROPOSAL

In this paper, we exploit the fact that learners are used to new technologies, since they were born with these technologies. One of the basic premises in deep learning corresponds to a participatory learning. In our proposal, we have developed a methodology based on challenges that promote and activate the participation of learners.

Our application was developed for mobile devices such as tablets due to the size of their screen. Besides, it is an intuitive device and young people to whom it is addressed are familiar with it. The first activity scheduled was “cat-crash”, which is a game with three variants.

#### A. A classical game: Cat-crash

This game is based on the classical game called “flappy bird” also known as: “Bird”. In our proposal, we trying to leave behind some of the simplicity of the former. This with the purpose of allowing the learner to get involved in a more committed way. Our game will have a limited duration monitored by an energy bar, which is consumed as much as player gives clicks. The way the character is thrown is like a cannonball, player (learner) has to choose the direction in which the character will be launched by this “cannon” rotated between an angle of 0-90 degrees (see figure 1). Player (learner) will select the direction with first click on the screen. Once he (learner) throws the character, many and different objects will appear on the screen, some of them having special effects like an extra boost or energy recovery (the energy recovery allows the player “learner” to have more time to perform the activity). When there is a collision between the character and an object, three options appear on the left side of the screen, that they correspond to possible answers, which the player can choose to get a hit (see figure 2). The game ends when the character collides with the floor. Here it is important to point out, that the teacher can modify both the objects that appear and the related answers.



**Figure 1.** Launching Characters

This game, allows for three different game modes: First, it is a quick game mode, which relies on a game base concept. Second, it is a mission mode game, where the player will have to fulfill the objectives of each mission to move forward. Third, it is a multiplayer mode game; in this case, it allows multiple players to take part in the same game in order to fulfill a common mission.

- Missions. The objectives of the missions will be the main educational content of the application. Each of these are designed for a specific subject area of learning: first, for being the first contact with the player will aim to familiarize the user with the gameplay, which in the case of our application only means a number of collisions with objects. The educational content starts in the second mission, we replace collisions by the hit that the player make when he chooses a correct answer and subject. For example, in the case of numbers objects are in relation with numbers that are shown on screen and on the options for answers. Each subsequent mission eventually raises the complexity of the relationship of objects on the screen and the answer choices in order to raise the level of difficulty of the game. This is the way our application confirms learning.
- Multiplayer. This game mode tries to create an atmosphere of cooperation between the players in the competition. This mode has its own type of missions, on the one hand the cooperatives, where players have a common mission, so each player will contribute to the ultimate goal and thus move together to subsequent missions. Otherwise competitive, players share the mission, but only to make a greater contribution for advancing on to next level. In this case, can play two or three players and requires an internet connection device.

#### B. Word Game for extending vocabulary

The second activity is the well know game as “word game”. Competition develops the learner’s motivation. Nevertheless, when teachers decide to start a competition they have to be careful because it may result in affecting feelings of inadequacy. Therefore, teachers can define rules in our application to achieve this objective. Rules establish the patterns and codes in which the game should be played. Thus, learners enjoy and follow the logic of the game, achieving at the same time the goals of the activity effectively.



Figure 2. Game for lesson 1

This game is fast-paced, but allows learners some time to think. It also encourages peer learning. When learners learn to read, they are taught that words are formed by joined several syllables. In addition, the reality is that our brains do not learn it this way if not as a whole. Besides, our brain can correctly read a word that is misspelled or just whose letters are disordered (see figure 3). Correct reading of words is with the condition that it knows the word and the first and last letters are in the correct position [6]. This activity consists in reading and writing properly some sentences on various topics with the purpose of reinforcing vocabulary.



Figure 3. Word Game for New Vocabulary

### C. Shooter Game

Third activity is based on "shooter game". Shooter games are a type of action game, which often test the player's speed and reaction time. Besides, in our proposal, we will evaluate the response to notifications each time a ship is destroyed. Most commonly, the purpose of a shooter game is to shoot opponents (aliens) and proceed through missions without the player character dies or is killed. A shooting game is a genre of video game where the player has limited spatial control of his or her character, and the focus is almost entirely on the defeat of the character's enemies using long-range weaponry. Knowing what we hear is also important, for this activity includes sounds, the game containing two elements – a "cannon" and "aliens", the aim of the player being to point the cannon at the spaceships and shoot with the goal of not allowing the aliens land on earth. Each time a ship is destroyed a word is heard and the player will see three options on the screen; when the correct answer is chosen, his next shot will be enhanced.

## III. COMPUTING TECHNOLOGY IN DEEP LEARNING

Today we live in a world immersed in the technology where the computational systems form fundamental part in the daily life of each one, is so simple that it is quite difficult to find people who do not have a telephone or an electronic device on hand. An interesting thing happens when technology is incorporated as a third dimension in the challenges-based learning (Thaddeus, 2017). Thus, emphasizing interaction with technology moves the class away from the passive traditional classroom and toward a more authentic and personalized learning experience. This model has implications for a variety of high profile educational technology issues. For instance, courses that blend face-to-face and online instruction are one the rise [5]. However, normally faculty are not provided sufficient guidance on how to integrate technology into these new online or hybrid courses.

#### IV. STUDY CASE: APPLYING THE 3D DEEP LEARNING MODEL TO A ENGLISH COURSE FOR K-12

For this study case, technology has been incorporated into this course according to the 3D Deep Learning model with the goal of moving the course toward the highly interactive and authentic learning space, where the competition is motivated through the different components of our application [5]. This research took place in the Universidad Autónoma de Puebla to support the courses offered by the faculty of languages for students K-12. The goal of this project was to provide English Language Learners with a novel tool to motivate students to learn English, by playing. This project combines the most outstanding features of the games with the topics that the course covers in level 1. For this, we selected a group of 52 learners to participate in the experiment. All participants were invited from private institutions, aged between 8 and 13 years. This tool was used to motivate the study at home or anywhere else outside of class, motivating the personal commitment through the competitions in different games.

Technology has been incorporated into this course according to the 3D deep learning model with the goal of moving the course toward the highly interactive, committed and authentic learning space. The first active technology introduced in this course was an agent for grading student projects in cat-crash. Agent allows students to get detailed feedback on their progress in learning current lesson. Furthermore, our agent grades the students work and provides detailed feedback almost immediately regardless of the time of day. In our study case, some students even played at 2:00 am, and the student will receive immediate detailed expert feedback while the project is still fresh in the student's mind.

A second technology element used in this course is the incorporation of sound, whose aim is to strengthen the listening skill. Using technology outside of the classroom to increase the human interaction within the classroom [2]. Furthermore, learners should learn to listen to communicate better and, at an early age, it is essential for this skill to be a permanent habit rather than an occasional activity. During its development, a learner has to learn to select the sound elements that are compatible with its linguistic environment, and at the same time ignore those elements that are absent from the phonetic structures that it perceives in its usual surroundings.

A third technology element included in this study case was the writing skill. This skill is developed through the word game, increasing level of complexity of sentences as you progress in the level of game. It should be noted that, the teacher could integrate new sentences that support those deficiencies detected in the classroom. In this game, we propose activities that allow to learners identifying main ideas immersed in a set of words. These activities are similar to those proposed in [3]. The purpose of this activity is for students to get practice in identifying main ideas and supporting details in a reading passage.

A final technology element included in this study case were reading and listening skills. This skill is supported by Shooter game. In this game, students must read fast to be able to respond correctly, as this increases their "lives" (that is, gives them more points and increases their opportunities to continue playing). This activity promotes fun and entertaining practice that allows learners to devote more time to their learning.

The 3D Active Learning model is not a total solution [1]. It involves treating each learning objective uniquely with the goal of increasing interactivity by the student, the faculty member and the available technology. Our proposal is one of the small steps that we must follow so that the deep learning reaches its highest level. Strategic technology adoptions are only part of this study case. The classes became more interactive, emphasizing the major challenges and opportunities that learners will be facing. Teacher and students have to be more participative and interactive through the online live lectures, which contributed to a greater learning.

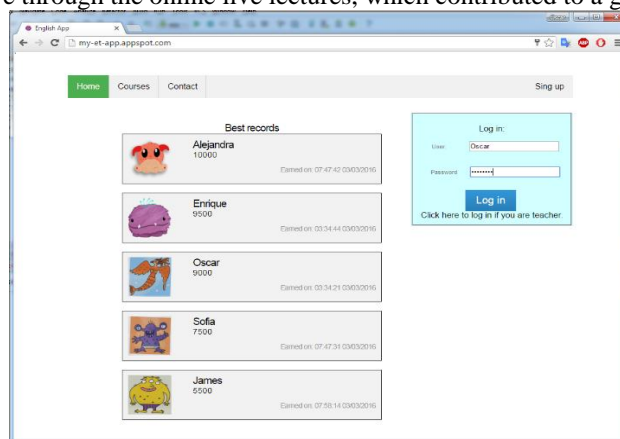


Figure 5. Results of the best scores achieved by learners

Figure 5 shows the scores reached by learners in their last activity. With technology as a mediator in learning activities, learner commits more and creates a stimulus of competence that improves his performance in English language learning.

## V. THE RESEARCH FINDINGS

Learners showed an increase in attendance, alertness, commitment, participation, and attitude. Characteristics they did not have before using our proposal. Besides, our proposal integrates activities through games whose objective is to integrate the different skills for learning a second language. "The teaching of language skills can not be conducted through separate and discrete structural elements" [6]. Integrating skills is essential for communicative competence that is the main aim of learning foreign language, for logical structuring of sentences to express ideas and desires both in oral and written form.

We have presented a new proposal for learning based on challenges immersed in simple games that invite and motivate learners to play and learn. The 3D Active Learning model allows students to learn, without them seeing this boring, tedious and annoying. Games also help the teacher to create contexts in which the language is useful and meaningful. Our proposal takes advantage of the fact that K-12 students love to play. Furthermore, using technology at school has become an important talking point across all levels from K-12, an on through higher education. All researchers agree that play includes several types of benefits such as [5, 6, 7]: Cognitive development, Affective development, social development, social development and Physical development, among other.

Teachers also valued the extended learning provided through the assigned learning activities for homework. In addition, students reported higher satisfaction with various elements of the course as captured by the university's standardized learner instructor teaching evaluation scores. Teachers observed a greater interest in the development of the activities based on games.

## VI. CONCLUSIONS

The evaluations of learners who used this tool were positively increased. The learning supported by games catches, passionate, entertains and improves both teaching and learning. Some of the emotional benefits that the learner gets with our proposal are: enjoyment; fun; relaxation; release of energy; tension reduction; self-expression and love of life. We have observed that challenge based learning is collaborative, that it promotes development of a deeper knowledge of the subjects students are studying, acceptance and solution of challenges. Furthermore, this study investigated the potential benefits of using challenges into games as a teaching and learning tool for K12 learners.

We can say that through play, children learn to regulate their behavior, lay the foundations for later learning in science and mathematics.

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## REFERENCES

- [1]. Bonwell, C.C. & Eison, J.A., *Active learning: Creating excitement in the classroom*. ASHE-ERIC (Higher Education Report No. 1. Washington, DC: ERIC Clearinghouse on Higher Education, The George Washington University, 1991).
- [2]. Bowen, J., *Teaching naked: How moving technology out of your classroom will improve student learning*, Hoboken, 2012.
- [3]. Dewey, J., *Democracy and Education: An Introduction to Philosophy of Education*. (Macmillan, 1916).
- [4]. Johnston Carol, *Fostering Deeper Learning*, in University of Melbourne, 1997.
- [5]. Keengwe, J., Onchawari, G., & Oigara, J. Promoting Active Learning through the Flipped Classroom. Model. Hershey PA: IGI Global. <http://dx.doi.org/10.4018/978-1-4666-4987-3>. 2014.
- [6]. Ramsden Paul, *Learning to teach in higher education* (RoutledgeFalmer, Taylor & Francis. 2003).
- [7]. Thaddeus R. Crews, Jr., *Active Learning Across Three Dimensions: Integrating Classic Learning Theory with Modern Instructional Technology*, *International Journal of Learning, Teaching and Educational Research*, 16(1), 1998, 72-83. 2017.

## Biographies and Photographs

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