An Active Learning Model Employing Flipped Learning and Gamification Strategies

Darina Dicheva and Christo Dichev

Winston Salem State University
Winston Salem, NC, USA
{dichevad,dichevc@wssu.edu}

Abstract. The presented here instructional model is based on two premises derived from psychological and learning theories. The first is that students take greater control on their own learning, which implies active learning where the instructor acts as a mentor. The second is that the learning environment enables interplay between the extrinsic forces acting on learners and the intrinsic motives and needs inherent in human nature. We claim that such a model can be built by leveraging strategies from both flipped learning and gamification.

Keywords: Active Learning, Flipped Learning, Gamification, Motivation

1 Introduction

We are witnessing a change in the traditional teacher-centered instructional model, which has been established to fit well to the brick-and-mortar schools. That model had been affected by the boundaries of the traditional school – the physical, temporal, organizational, and other boundaries. For example, those boundaries have helped in managing the access to scarce printed resources; courses have emerged naturally out of the boundaries of classes, what teachers know, and the need for scheduling; terms are designed to fit the 'natural' boundaries of holidays, etc. [1]. All these boundaries target to solve the problem of making an efficient use of scarce resources.

Human learning in the before-school times has been boundary-free and significantly different. The natural learning has always been ubiquitous, contextual, activity-based, social, and led by intrinsic motivation. Subsequently, with the continuing advances in the technological arena and in the different areas of the society and the dramatic progress and increase of human wellbeing, it is just natural for some of the existing boundaries of the formal education model to be crossed. It is difficult to predict what exactly the future education will look like without all those boundaries, including the accreditation. Yet, various novel instructional approaches and strategies have started to emerge. While to a large extend they are more or less within the traditional boundaries, they do focus more on the learner and less on the standard lecturing. They feature more flexibility, ubiquitous learning, active learning, etc. Most of them rely on the use of online content and on self-learning. Examples comprise online courses, including MOOCs, and flipped classrooms.

A common problem of the two mentioned instructional models, which rely on learners' self-study at home, is that leaners often do not do their assigned work. This entails employing methods that can boost learners' motivation and engagement so as to improve their performance and achievements. In this paper we propose a novel instructional approach that combines elements of flipped learning and course gamification: *gamified mentored learning*. Before presenting it, we briefly discuss flipped learning and gamification whose basic principles back the soundness of the model.

2 Flipped Learning

Flipped Learning is defined in [2] as "a pedagogical approach in which direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creatively in the subject matter." This model leaves class time open for interactive learning activities, which cannot or is difficult to be automated. In essence, "flipping the classroom" means that students gain first exposure to new material outside of class, usually via reading or lecture videos, and then use class time to do the harder work of assimilating that knowledge, through practicing, problem solving, discussion, or debates. In terms of Bloom's revised taxonomy (2001), this means that students are doing the lower levels of cognitive work outside of class, and focusing on the higher forms of cognitive work (application, analysis, synthesis, and/or evaluation) in class, where they have the support of their peers and instructor [3].

The theoretical foundations that justify dropping the in-class lecture delivery include student-centered learning theories and methods such as active learning, problem-based learning, experiential learning, collaborative learning, cooperative learning, peer-assisted learning, and peer tutoring (see for example [4]). The student-centered learning theories provide the theoretical basis for the design of the in-class activities in flipped learning. Constructivism and collaborative learning stem from Piaget's theory of cognitive conflict [5] and cooperative learning stems from the zone of proximal development theory of Vygotsky [6].

The flipped learning model has attracted significant attention in the educational community. Around 2012 there was a boom of publications on instructor and student perceptions on flipped classrooms considering it as a highly successful practice. Then there was a decrease of the enthusiasm with publications analyzing the pros and cos of teaching in a flipped classroom. However, recently a revival is noticed with teachers blending the flipped classroom approach into their traditional curriculum, using the method more selectively [7]. The overview of empirical studies related to the flipped classroom by Bishop and Verleger [4], concludes that students' performance has been reported to improve compared to performance of students in a traditional classroom setting and student opinions tended to be positive, but there were invariably a few students who strongly disliked the change. Among the other findings were that many instructors instituted a required pre-class quiz on the lecture material; students

preferred live in-person lectures to video lectures, but also liked interactive class time more than in-person lectures, and shorter videos were preferred.

The flipped learning model is considered to be useful if students are motivated to do independent work and enjoy more collaborative in-class sessions [7]. This observation points to a serious challenge since as Sappington et al. [8] among others show, college students don't generally complete reading assignments.

3 Gamification

A key premise for the success of the growing alternatives of traditional education, e.g. online and flipped learning, is students motivation and engagement in the instructional process. It derives from the need of more self-regulation, intrinsic motivation, time management, and independence of the learner. This implies that the students not only need to have the internal push to complete a task, but also to be able to complete the task independently and to keep themselves on track without constant monitoring.

On the other hand, games are well known stimuli that drive people to take voluntary actions in a predictable way. Thus a natural idea is to harness the characteristics of games that give rise to this phenomenon and put them to use in learning situations where engagement is lacking. Researchers have been attempting to isolate and identify the attributes of video games that stimulate motivation, engagement, and perseverance. This research has led to the "gamification" trend.

Gamification is the use of game thinking and game mechanics in non-game contexts to engage users in solving problems [9]. It has become a popular tactic to encourage specific behaviors and increase motivation and engagement. Though commonly found in marketing strategies, it is now being implemented in educational programs as well to help educators find the balance between achieving their objectives and catering to evolving student needs [10]. A number of instructors have been exploring the concept of gamification with the intention to use it as a tool for engagement and motivation. A systematic mapping study of the use of gamification in education is presented in [11].

The growing popularity of gamification comes from its potential to foster motivation, behavioral changes, friendly competition and collaboration in different contexts. The theoretical foundations of this are several motivational theories and models that can impact users' behavior [12]. Maslow [13] explains that human behavior is need-based and goal-oriented: it is driven by people's desire to satisfy physical and psychological needs and these needs are what motivate them into actions. Maslow's hierarchy of needs is represented in a hierarchical pyramid with five levels: physiological, safety, belonging, esteem, and self-actualization. The four lower levels are considered physiological needs, while the top level is considered growth needs. The lower level needs must be satisfied before higher-order needs can influence behavior. Pink [14] hypothesizes that in the modern society where the lower levels of the Maslow's hierarchy are more or less satisfied, people become more motivated by other intrinsic motivators. These intrinsic motivators are: autonomy, mastery and purpose which focus on our innate need to direct our own lives (autonomy), to learn and create new

things (mastery), and to do better for ourselves and our world (purpose). His work is based on the Self-Determination Theory (SDT) proposed by Deci and Ryan [15], which posits that humans continually and actively seek challenges and new experiences to develop and master. Self-Determination Theory states that to have a positive well-being, people need to feel that they have control over their situation, feel competent, and connected to others. Conditions supporting the individual's experience of *autonomy*, *competence* and *relatedness* are argued to foster the highest quality forms of motivation and engagement for activities, including enhanced performance, persistence, and creativity. According to [16], in order to be intrinsically motivated to perform a task, a person must be kept in a state between an anxiety and boredom known as *flow*. Clear goals, a sense of control, immediate feedback and a balance between skill and challenge are some of the factors that contribute to flow.

4 Gamified Mentored Active Learning

The presented here instructional model is based on two premises rooted in the above described psychological and learning theories. The first is that the students have to have much more control on their own learning (promoting autonomy). This implies active learning where the instructor is acting as a mentor to the learners. The second is that the learning environment has to facilitate the interplay between the extrinsic forces acting on learners and the intrinsic motives and needs inherent in human nature (SDT). We claim that such a model can be built by leveraging strategies from both flipped learning and gamification. From the flipped learning we take the pre-class home reading/video watching and the in-class activity-based work. However, the latter features a far less controlling role of the instructor in class:

- Students complete pre-class work to familiarize themselves with the factual knowledge (e.g. by watching short videos and/or reading text).
- In the beginning of the class, the instructor answers questions on the pre-class reading and may present a short explanation for topics considered difficult.
- The active learning in class includes problem solving, collaborative work on projects, labs, discussions, group work, etc., mentored by the instructor.

Differently from the typical flipped classroom practices, no graded quizzes (including such with clickers) are recommended in class to test whether students have done the pre-class reading or in-class work), since this is a very strong demonstration of the controlling role of the teacher. Instead, we recommend promoting interest based on active involvement and variety, curiosity and challenges; fostering an environment where it is safe for students to fail, but which does not allow the failure to define them; breaking the in-class work into manageable steps coupled with instant feedback with optional grading for completion. One motivator supporting this approach is the availability of a variety of (automatically checked) practice exercises and quizzes for student self-learning and self-assessment, which completion should be additionally stimulated by relevant gamification mechanisms. This should also replace the typical for the flipped classroom practice of assigning after-class homework that usually leads to a very high load on students demanded by the flipped class.

Considering the gamification elements that can be used for gamifying a course, it is neither possible not desirable to suggest specific game mechanics and dynamics since those depend on the specific course, instructor, students, context, etc. However, based on empirical evidences we believe that the following game mechanisms provide a good assortment for practical course gamification: accruing points, rapid feedback, freedom to fail, unlocking content, virtual currency, skill points, progress bar, leaderboard, avatars, rewards/incentives, and social engagement (collaboration and friendly competition). The guiding strategy for choosing a particular configuration of game mechanics includes: reward behaviors that are under students' control; reward effort not talent; create little quick wins at regular intervals; enable measuring progress and achievement; focus on students' individual progress rather than on their performance in relation to their peers; enable combining game elements with intrinsic factors.

We piloted the proposed model in a Data Structures course, aiming at reducing the high rate of drops and failures. We redesigned the course employing methods and techniques from both the flipped learning model and gamification. Flipping the classroom allowed us to introduce programming labs in class, which is not typical for the standard way of teaching this course. Unfortunately, we could not include everything that we wanted, since we did not have appropriate technological support, especially with regard to applying game mechanics and dynamics. The employed gamification elements included: accruing points (max 1000 points), rapid feedback (max 24 hours), freedom to fail (allowed multiple submissions of labs and home assignments), and social engagement (collaborative problem solving and pair programming). We wanted to include also unlocking content (early personalized release of content and labs), virtual currency (rules for earning and spending course bucks), skill points, progress bar, avatars, rewards, and a leaderboard, but we did not have appropriate support in the course delivery system used on campus (Blackboard).

Our experience of piloting the proposed instructional model revealed the necessity of a new type of educational software that can support intelligent mentoring of gamified flipped learning formal classes or informal groups of learners.

5 Conclusion

It is reasonable to assume that in the foreseeable future the formal education, which features accreditation, will continue to exist. While this implies that some boundaries will remain in place, we anticipate that many will fade away, in particular those that are related to the dominant controlling role of the teacher in class. The idea of having a mentor instead of a teacher is not new. The problem is that the instructor cannot be replaced by a mentor in the traditional educational process. Instead, new instructional models are needed that from one side ensure the learner-centered, active learning and from another, reinforce the intrinsic motivation for learning. In this paper we proposed one such method where gamification is used to effectively complement and support the flipped model of learning. As most instructional approaches, this model is not one-size-fits-all. Rather, it needs to be tailored to individual classes, students, and learning objectives. In this context we rely on two important assumptions for its suc-

cess. We presume that: (1) gamification is carefully designed and implemented by experienced instructors to suit the specifics of the learning context, and (2) an appropriate intelligent educational software support is available. Regarding the former, more studies are needed to generate empirical evidence for the efficacy of using different game mechanisms and their combinations in different learning contexts to improve student motivation, engagement, and academic performance. As to the latter, easy-to-use tools for automatic generation, checking, and personalized delivery of abundance of practice exercises are needed, as well as course gamification platforms that can efficiently support instructors of academic courses or mentors of self-organized learning groups who want to gamify learning experiences.

6 References

[1] Dron, J. Pushing Boundaries: Why E-learning Is Not Like P-learning. Presentation at *E-LEARN 2015*, Kona, Hawaii, 2015.

[2] Flipped Learning Network (FLN). 2014. The Four Pillars of F-L-I-P™. Available at flippedlearning.org/cms/lib07/va01923112/centricity/domain/46/flip_handout_fnl_web.pdf

[3] Brame, C. J. 2012. Flipping the Classroom. Available at https://cft.vanderbilt.edu/wp-content/uploads/sites/59/Flipping-the-classroom.pdf

[4] Bishop, J. L. and Verleger, M. A. The Flipped Classroom: A Survey of the Research, *120th ASEE Annual Conf. and Exposition*, Atlanta, June 23-26, 2013.

[5] Piaget, J., Elkind, D. and Tenzer, A. *Six psychological studies*. Random House NY, 1967.

[6] Vygotsky, L.S. *Mind and society: The development of higher mental processes*. Cambridge, MA: Harvard University Press, 1978.

[7] Patriquin, A. Pros and cons of teaching a flipped classroom. (2015) Available at https://blog.versal.com/2015/06/10/pros-and-cons-of-teaching-a-flipped-classroom/

[8] Sappington, J., Kinsey, K. and Munsayac, K. Two studies of reading compliance among college students. *Teaching of Psychology*, 29(4):272–274, 2002.

[9] Deterding, S., Dixon, D., Khaled, R. and Nacke, L. From Game Design Elements to Gamefulness: Defining Gamification, in *MindTrek*, Tampere, Finland, 2011.

[10] Huang, W. and Soman, D. A Practitioner's Guide To Gamification Of Education, December 10, 2013. Available at http://www.rotman.utoronto.ca/-/media/files/programs-and-areas/behavioural-economics/guidegamificationeducationdec2013.pdf

[11] Dicheva D., Dichev C., Agre G. and Angelova G. Gamification in Education: A Systematic Mapping Study, *J. of Educational Technology and Society*, Vol. 18(3), 75-88, 2015.

[12] Dichev, C., Dicheva, D., Angelova, G., Agre, G. From Gamification to Gameful Design and Gameful Experience in Learning. *J. Cybernetics &Information Technologies, 14(4)*, 2014.

[13] Maslow, A. H. *A theory of human motivation*, *Psychological Review*, 50 (370), 1943.

[14] Pink, D. *The Surprising Truth About What Motivates Us*, New York: Riverhead, 2009.

[15] Deci, E., Ryan, R. *Intrinsic Motivation and Self-determination in Human Behavior*, NY: Plenum Press, 1985.

[16] Csikszentmihalyi, M. *Flow: The Psychology of Optimal Experience*, New Yok: Harpers Perennial, 1990.