Olivia Schmidt
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VISION OF THE FUTURE CLASSROOM: Instructional Technology Learning Theories, Models and the Future of the Technological Classroom

Teachers face the challenge of preparing a diverse student population for an information age saturated by a sea of digital technologies, which they are expected to utilize in the classroom. It is now widely accepted that students' learning is enhanced through the use of technology, and it is necessary to develop technology skills in order to be "...productive members of society" (Davies and West, 2014, p. 841). With the increasing number of available educational technologies for every subject, grade level, and learning style, alongside the inescapable reality that technology is now at the core of everything we do - it has become standard that 'productive' educators, too, would learn how to leverage these tools to deliver enhanced learning experiences and assessments. Already, classrooms across the nation have been transformed by digital native students who are far more confident than their instructors in their ability to navigate technology, and who often guide their teachers through bug fixes, glitches, and other common tech errors. The integration of newer technology into the classroom occurs concurrently with students' and teachers' evolving expertise; the rate of development for products that offer solutions to the education industry will not slow down. Thus, it is crucial to consider the most effective methods for integrating these tools, how to best support teachers along the way, and assess and improve teachers' current knowledge levels.

Learning theories, such as constructivism, behaviorism, and connectivism, are shaping these modern conversations surrounding technology integration. For example, Wilson (2017) specifies the basic precepts of constructivism, which assert that learning is an active process of making meaning through our experiences, that cognitive challenges/problem-solving activities are learning opportunities, and that learning is a social activity (p. 61). With this understanding of constructivism, educational technology could support this theory by offering opportunities for differentiated learning, encouraging collaboration, and grounding abstract concepts in the personal experiences of learners (i.e., through personalized learning software). Constructivism is not the sole learning theory to guide technology integration; what an instructor views as effective for learning will determine what learning theories they reference from. The behavioral learning theory, for instance, may be more appropriate for educators who value repetition and positive reinforcement in their teaching strategies. The future classroom of an educator who is influenced by behaviorism and who is working to condition students' behavior would be attracted towards integrating technology that introduces reward systems, as can be found in digital games.

Before establishing a foundational understanding of learning theories, a crucial first step toward effective technology integration is defining teachers' familiarity with technology, as they directly oversee the instructional processes and strategies for their students. Given

instructors' driving role, it is essential to equip them with appropriate professional development (PD) opportunities and tools to acquire technological expertise (Rehmat and Bailey, 2014, p. 744). One model in instructional design literature – The technological pedagogical and content knowledge (TPACK) – is especially useful for equipping teachers with the skills to advance their use of technology: "...educators have adopted the TPACK model as a tool for understanding and advancing preservice and inservice teachers' ability to integrate technology into their instruction." (Ottenbreit-Leftwich and Brush, p. 177). It is assumed that, if educators have a strong TPACK, they should be able to effectively integrate technology into their classrooms. The inevitable integration of technology into future classrooms will come alongside district and administrative expectations that the technology is being used meaningfully, and that current teacher abilities are assessed and deficiencies addressed. Models like TPACK might be used on a larger scale to measure and monitor teachers' effectiveness, with PD recommended when teachers are weak in certain areas of the framework.

The types of 21st-century skills teachers are expected to impart to their students are what teachers' will be actively learning themselves; the future classroom will include a blend of teacher-student, generational-specific knowledge. While a teacher might have the expertise to use technological software designed for adaptive learning and formative assessment, a student may be more familiar with the trend of digital games in the classroom and adapt quickly to game-based learning (GBL) strategies. The future of the classroom will ideally be guided by educators who are trained with the knowledge of how various technologies can be used in their teaching, alongside students who are familiar with and motivated to use these emerging technologies. While learning technologies have been used in the classroom for decades, more recent developments in technological innovations, such as GBL, mobile learning, massive open online courses (MOOCs), etc. have entered the classroom. Some of these future enhancements of instruction, facilitated by technology, include "...fostering more inquiry-based learning, supporting personalized learning, and engaging students in content via alternative strategies." (Ottenbreit-Leftwich and Brush, p. 177). One of these 'alternative strategies' is the use of digital games, which teachers define as "... both drill-and-practice activities with rewards and more sophisticated educational games that have rules and mimic mainstream games." (Ottenbreit-Leftwich and Brush, p. 178). Digital games are positioned to be effective tools when aligned with "...instructional outcomes and strategies within the constraints of the medium, a given environment, and a set of learners." (Van Eck et al., 2017, p. 278). The following section goes into further depth about the definition of GBL and digital games, its place as an instructional technology trend, and what theories support its use in the classroom.

VISION OF AN EMERGING TECHNOLOGY: Game-Based Learning and the Future of Education

Game-Based Learning (GBL) Defined

Game-Based Learning (GBL) has been getting a large amount of attention from practitioners, developers, and educational publishers who are interested in the positive effects of games on learning and facilitating students' 21st-century skill development. As broadly defined by Perrotta et al. (2013), GBL is "...the use of video games to support

teaching and learning". A more precise definition by Perrotta et al. (2013) describes GBL as "...a form of experiential engagement in which people learn by trial and error, by role-playing and by treating a certain topic not as 'content' but as a set of rules, or a system of choices and consequences" (p. 7). Van Eck. et al (2017) outline the key features and elements of effective educational games: "... [games] should be active, goal-oriented (with goals valued by the players), contextualized, and designed with adaptive challenge and support" (283). An educational game that includes these elements would instill a sense of achievement in players that would, in turn, build students' motivation and engagement for future activities that combine game-like elements with authentic experience.

Game-Based Learning and the Future Classroom

What will GBL look like in future classrooms? Implementing a game-based approach to instruction comes with several considerations, such as contextual factors (e.g. student characteristics, class resources, etc.) and accommodating students with diverse learning styles. As Van Eck et al. (2017) state concisely, "Games are not appropriate for all outcomes, all learners, in all venues, and at all times [...] As with all media and modalities, games are effective when they align with instructional outcomes and strategies within the constraints of the medium, a given environment, and a set of learners" (p. 278). There are specific critiques for GBL, such as being a complex learning environment, wherein players must attend to different locations on the screen and engage with tasks that have multiple variables (Wouters & van Oostendorp, 2013, p. 251). This brings to light the question of whether GBL can effectively engage students in the material; ultimately, it will depend on the instructor and the quality of their instructional design and support. Van Eck et al. provide several suggestions for how games can best be designed for teaching, alongside how assessment goals can be met through a design framework called evidence-centered design (ECD). Evidence-centered design shows how "...knowledge is developed and demonstrated throughout the instruction (game) itself", and is "critical for instructional designers who want to work with games." (p. 278). Using frameworks like ECD, teachers seeking to incorporate games into their classrooms in the future would be able to accomplish supportive pedagogical strategies such as "(a) delivering timely and targeted feedback," and "(b) presenting a new task or quest that is right at the cusp of the student's skill level." (Van Eck et al., 2017, p. 281).

Learning Theories that Support Game-Based Learning

Gameplay and game design necessitate that students and teachers have some technological literacy, so this medium works well when combined with a technology integration model like TPACK, which helps teachers with developing their pedagogical knowledge in preparation for emergent technologies like games. When using games as a mechanism for facilitating learning, teachers would merge their technological knowledge (i.e. knowing how to use the technology) with their pedagogical content knowledge (i.e. understanding how their students learn best, and best practices to teach) to produce something new (e.g. a lesson that utilizes games effectively, and that all students can engage with). In addition to the TPACK framework, GBL is supported by a number of learning theories. Plass et al. (2015) state that "...game designers use behaviorist elements, cognitivist elements, and constructivist elements, and often various combinations of them, in the design of games for learning." (p. 261) which have been covered briefly below:

Behaviorism: Digital games often contain reward systems (experience points, social rewards, monetary rewards, etc.) that maximize motivation and condition players to have a learning response that helps enable retention. This attempt at the modification of behavior, through incentive systems, is based on B.F. Skinner's behavioral theory - how the consequences of a behavior determine whether it is repeated and considered to be learned. Plass et al. (2015) describe further developments in how instructional designers consider the role of motivation in GBL, which they state has shifted away from behaviorist constructs and toward the expectancy-value theory, self-determination theory, self-efficacy theory, attribution theory, achievement goal orientation theory, and interest theory (p. 268).

Constructivism: Constructivism is the concept of "learning by doing" and designing "authentic" learning tasks that reflect the real-world. In constructivist learning environments, Driscoll (2017) states that "The learner actively imposes organization and meaning on the surrounding environment and constructs knowledge in the process." (p. 57) This learning theory can be implemented through several means and mechanisms; for instance, individual students learn how to solve problems and make decisions through games. In-game tasks could be customizable to the players' learning goals, needs, and other contextual factors. Plass et al. (2015) provide an example of a game based on a constructivist approach: "...players set their own challenges, make available tools with which to construct a response, and provide a system of peer feedback." (p. 262).

Cognitivism: "Cognitive theories stress the acquisition of knowledge and internal mental structures . . .[they] focus on the conceptualization of students' learning processes and address the issues of how information is received, organized, stored, and retrieved by the mind." (Ertmer and Newby, 2013, p. 51) With this definition in mind, instances of cognitivism in GBL would be players absorbing what is presented in the game, organizing this information as visual-verbal representations in memory, and recalling prior knowledge. Instructional designers/game developers should consider what elements of the game, and what learning mechanics, would be presented to engage the learner in a way that stimulates the intended cognitive outcomes.

Different models of learning in GBL - from behaviorism, constructivism, to cognitivism - rely on the concept of "play", which Van Eck et al. (2017) describe as an intrinsically motivating, voluntary, and risk-free environment where users can experiment without worry for severe consequences (p. 278). Plass et al. (2015) remind us that playfulness, and the play phenomenon, exist regardless of whatever model of learning a game is based on; play is an "enriching yet orthogonal dimension." (p. 261)

Example of Game-Based Learning in the Classroom

Minecraft Education Edition (Minecraft Edu) is a platform for learning based on the original game, Minecraft, and published by the same developers. Minecraft Edu is used as a GBL tool in the classroom by supporting collaborative learning, critical thinking, and problem-solving in the immersive environment of the blocky, three-dimensional world. The education edition shares the same platform as the original version, so its playing environment contains many of the classic in-game resources, elements, and features. The distinction between the two editions lies in their function: one is for entertainment purposes and the other is for educational purposes. Minecraft Edu is well aligned with constructivist

theory, as players must be active participants in their cognitive development; through play in Minecraft's environment, players build learning experiences through experimentation and learning by doing.

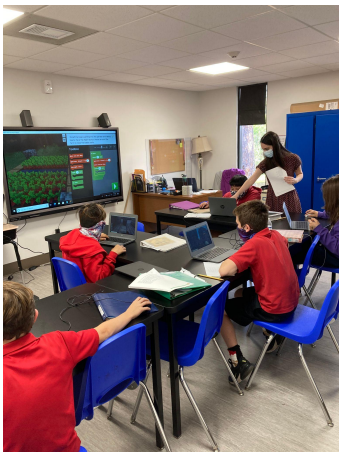

Image 1: In the background, I guide a student through the steps of a block coding exercise

Last year, I worked with a small group of 5th-grade students and facilitated the 2020 Minecraft-run, Code.org-sponsored "Tale of Two Villages" lesson (Image 1). Rather than building a small farming homestead in survival mode or plotting the biggest fantasy castle in creative mode, students attempted to bridge peaceful ties between two at-odds villages using block-based or Python code. Students had the liberty of choosing the programming language which felt most comfortable, though students who were interested in Python were encouraged to try their hands at it during this safe playing environment.

In this lesson, students were tasked to create coding solutions that included events, sequences, and loops, and to break down the steps needed for problem-solving. The progressive completion of these coding puzzles would lead to the growth of a tree, situated in the middle of the two villages. Once all puzzles were completed, and the tree had reached its fully matured stage, the two villages were brought together, with the tree representing the combining of the two villages and the importance of inclusion, compassion, and empathy for our neighbors (Image 2). Minecraft Edu offers hundreds of lessons for nearly every subject, created by educators around the world and for students of all ages. I chose the "Tale of Two Villages" lesson to meet my specific instructional goals, though Minecraft Edu as a game-based learning (GBL) tool is incredibly versatile that can be used across different subjects, contexts, and learner needs to increase student engagement and motivation.

Image 2: Students pose in front of the fully matured village tree

Potential benefits and concerns of Game-Based Learning

There are a number of potential benefits being advanced for why games are effective learning tools, some of the most frequently suggested characteristics being increased student engagement and motivation, improved attitudes toward learning, and increased self-efficacy (Pan, 2021, p. 2). Plass et al. (2015) provide another supporting argument for the use of GBL - its safe, low-consequence, playful nature, which encourages students "...risk-taking, trying new things, and exploration." (p. 261) Practical concerns associated with GBL could include the insufficient/ineffective integration of games and game-related technologies into the classroom, low learner participation, technical issues and errors, game activities that are ill-fitted for the facilitator's learning goals, etc. As discussed earlier, it is a crucial first step that teachers have good technological literacy skills to carry out GBL successfully. In addition, teachers should have the background knowledge about GBL necessary to solve the inevitable technical problems that will arrive during gameplay sessions and in the process of

instruction. To address these concerns, Pan (2012) recommends that teachers should be "...optimizing instructional design, developing diversified teaching evaluation methods, supporting learners' individualized learning and creating teaching situations" (p. 8). It is also important to consider that not all teachers, despite PD opportunities and adequate technological literacy, will be keen to adopt games to engage students with learning in the classroom. While most teachers are "generally positive about the use of video games in the classroom," games will not replace traditional learning styles until there is strong evidence that GBL is more impactful (Perrotta et al., 2013, p. 10). The benefits and concerns described above can be justified by past literature reviews, reports, and research findings from the authors outlined in this paper. In my own teaching practice, In my experience using games in the classroom, such as the "Tale of Two Villages" lesson, I've found some clear benefits (engagement and motivation) and challenges (creating a learning environment that is adapted to all learners' ability with games).

AUTHOR'S RECOMMENDATIONS

To provide some final words of support for my peers who are educators, and for those who are currently in the role of an educational technologist/instructional designer, I have come up with several recommendations that should help us to move forward with games as an effective GBL tool. These recommendations were based on my own experiences, blended with the findings of the authors cited in this paper.

(1) It is imperative that teachers have technological literacy skills;

(2) Integrating gaming into teaching should be done with a clear pedagogic vision;

(3) Learning theories and models should be used in the design consideration of games;

(4) To increase motivation and retention, embed reward systems and incentives into the design of the lesson;

(5) Include player adaptability and customizability to challenge and meet the needs of individual students;

(6) Provide dynamic feedback to scaffold gameplay;

(7) Include an ongoing assessment of players' knowledge, performance, and skills;

(8) Acknowledge the importance of players' experience, attitudes, and beliefs.

My **first recommendation** is based on the findings of Rehmat and Bailey (2014), who stress the importance of using models like TPACK, alongside courses that teach technology skill training (p. 745). Van Eck et al. supplied the reinforcement of my **second recommendation**, as they assert that games are effective when designed with a clear understanding of "...instructional outcomes and strategies within the constraints of the medium, a given environment, and a set of learners." (Van Eck et al., 2017, p. 278). My **third recommendation**, which deals with learning theories, comes from Plass et al. (2015), who state that play is "orthogonal to learning theory." (p. 258). The **fourth and fifth recommendation**, which discusses motivation and player adaptability, is based yet again on

the research of Plass et al. (2015). Plass et al. (2015) relate motivation and engagement to the incentive systems of games, "...[rewards] that aim to encourage players to continue their efforts and feedback that attempts to appropriately modify their behavior." (p. 264). For player adaptability, "Learner engagement is facilitated in part by the many ways of making a game adaptive, customizable by the player, or combinations of them, in the design of games for learning." (Plass et al., 2015, p. 261). Van Eck et al. provides support for the recommendation of my **sixth and seventh recommendation**s; they stress the importance of feedback in "...knowing how knowledge is developed and demonstrated throughout the instruction (game) itself." (p. 278), and of ongoing assessment in "...a key challenge facing learning game designers [...] is assessment. Assessing performance [...] requires us to know how the problem is solved incrementally, over time, and through the application of specific enabling skills [...]" (p. 278). My **final recommendation** is reinforced by Wilson (2017), who discusses how instruction should be designed around authentic experience, the pursuit of personal interests, and opportunities for the expression of personal beliefs (p. 62).

References

Davies, R.S., West, R.E. (2014). Technology Integration in Schools. In: Spector, J., Merrill, M., Elen, J., Bishop, M. (eds) Handbook of Research on Educational Communications and Technology. Springer, New York, NY. https://doi.org/10.1007/978-1-4614-3185-5_68

Driscoll, M. (2017). Psychological Foundations of Instructional Design. In R. A. Reiser & J. V. Dempsey (Eds.), *Trends and Issues in Instructional Design and Technology* (4th ed., pp. 52-60). Pearson.

Ertmer, P. A., & Newby, T. J. (1993). Behaviorism, Cognitivism, Constructivism: Comparing Critical Features from an Instructional Design Perspective. *Performance Improvement Quarterly*, *6*(4), 50–72. https://doi.org/10.1111/j.1937-8327.1993.tb00605.x

Ottenbreit-Leftwich, A. & Brush, T. (2017). Integrating Technology into K-12 Education. In R. A. Reiser & J. V. Dempsey (Eds.), *Trends and Issues in Instructional Design and Technology* (4th ed., pp. 176-184). Pearson.

Pan, L. (2021). *How to Implement Game-Based Learning in a Smart Classroom? A Model Based on a Systematic Literature Review and Delphi Method*. Frontiers. https://www.frontiersin.org/articles/10.3389/fpsyg.2021.749837/full

Perrotta, C., Featherstone, G., Aston, H. and Houghton, E. (2013). Game-based Learning: Latest Evidence and Future Directions (NFER Research Programme: Innovation in Education). Slough: NFER.

Plass, J. L., Homer, B. D., & Kinzer, C. K. (2015). Foundations of Game-Based Learning. *Educational Psychologist*, *50*(4), 258–283. https://doi.org/10.1080/00461520.2015.1122533

Rehmat, A. P., & Bailey, J. M. (2014). Technology Integration in a Science Classroom: Preservice Teachers' Perceptions. *Journal of Science Education and Technology*, *23*(6), 744–755. http://www.jstor.org/stable/24026310

Van Eck, R., Shute, V., & Rieber, L. (2017). Leveling Up: Game Design Research and Practice for Instructional Designers. In R. A. Reiser & J. V. Dempsey (Eds.), *Trends and Issues in Instructional Design and Technology* (4th ed., pp. 277-285). Pearson.

Wilson, B. (2017). Constructivism for Active, Authentic Learning. In R. A. Reiser & J. V. Dempsey (Eds.), *Trends and Issues in Instructional Design and Technology* (4th ed., pp. 61-67). Pearson.

Wouters, P., Nimwegen, C., Oostendorp, H., & Spek, E. (2013). A meta-analysis of the cognitive and motivational effects of serious games. *Journal of Educational Psychology*, *105*(2), 249–265. https://doi.org/10.1037/a0031311