


## Chapter 4

# Hybrid and Virtual Educational Simulation Games (vESGs) for the Remote Learning Era: Design and Implementation of The GlobalEd vESG

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### **ABSTRACT**

*Virtual educational simulation games (vESGs) promote unique combinations of learning interactions and affordances to create environments with which students can engage to effectively learn about complex phenomena and processes in multiple domains. Using the GlobalEd vESG as an example case throughout the chapter, the authors discuss (1) the key functions and experiences that vESGs provide to learners; (2) the types of valuable student interactions that can be expected when playing a vESG and strategies for maximizing these interactions for learning; (3) strategies for teacher implementation and adaptation of vESGs, as well as professional development programs to support their use of vESGs in classrooms; and (4) observed benefits of using vESGs as evidenced from over a decade of implementation of the GlobalEd vESG in authentic classroom settings.*

DOI: 10.4018/978-1-7998-9235-9.ch004

## INTRODUCTION

Virtual simulations and digital games have repeatedly demonstrated promising results in providing engaging opportunities for students to learn complex information in an authentic way (D'Angelo et al., 2014; Hertel & Mills, 2002; Rutten et al., 2012). From modeling real-world phenomena to simulating the complexities of dynamic social interactions, simulations and games set the stage for robust environments and learning contexts for learning about certain concepts and processes that are difficult to learn from conventional textbook-and-lecture methods (Vlachopoulos & Makri, 2017).

In particular, **virtual educational simulation games** (vESGs) that are playable at a distance with multiple players and classrooms have emerged as a valuable educational tool in the post-COVID-19 landscape for educators who may need to move to remote or distance learning at a moment's notice. The ability to conduct robust educational exercises regardless of physical distance has great promise in promoting student growth, strong development of critical skills, and the ability to problem-solve and interact in complex domains (Gredler, 2013).

However, vESGs and other digital multiplayer games have not yet become mainstream educational tools in K-12 and college classrooms. Perhaps because of their novelty or because of the perceived lack of seriousness for learning purposes in formal classroom settings, vESGs and digital games as a whole remain to be widely accepted as a viable alternative educational mode (Kebritchi, 2010; Kenny & Gunter, 2011). Another setback toward adoption is the unique set of challenges that are often faced by teachers new to implementing games and simulations, as teachers' roles substantially change from lecturer to guide when playing live role-playing and simulation games with their classes. Because of a game-like model to learning, teachers, school administrators, policy makers, and parents alike may also not necessarily feel comfortable with the idea of education via game play in formal classrooms, despite years of research that points to the value of rich learning via play (Arnab et al., 2012). When deciding to implement a game, teachers often also require substantial professional development to implement games in a way that maximizes learning benefits for the students (Ketelhut & Schifter, 2011). To this end, much work remains to be done to promote the design rationale, learning benefits, and implementation strategies of vESGs to promote their increased use in K-12 and higher education settings.

vESGs do not simply mirror traditional classroom learning but instead provide a transformative learning experience in digital spaces. By taking advantage of the unique functionalities of networked communications technologies, social networking software, artificial intelligence applications, and data analytics, vESGs can connect students in new ways with each other to maximize the benefits of social play despite geographic boundaries or even restrictions of face-to-face contact in the post-pandemic world. Thus, a primary purpose of vESGs is to provide a unique learning experience that leverages the ability for computers modeling of complex social phenomena while maintaining an open-ended playing experience for students so that they may interact with each other and drive the play in the vESG based on their interests and collaborative development of understanding of the concepts under study (De Frietas, 2006; Gibson, 2011; Wronowski et al., 2020).

In this chapter, we describe the rationale, design, and benefits of hybrid and vESGs for use in secondary and higher education via an example case analysis of **GlobalEd**. GlobalEd ([www.gloaled2.com](http://www.gloaled2.com)) is an evidence-based multiplayer vESG that has been used for over 20 years within hundreds of K-12 classrooms in the United States and played by thousands of students over the duration of its use (Lawless et al., 2016; 2018; Riel, Lawless, & Brown, 2017). In the analysis within this chapter, the key features of GlobalEd are identified and discussed to illustrate how they can promote exciting and transformative

learning experiences through play within complex simulated real-world environments in more general contexts. Each of the principles provided in this chapter are reflective of over 20 years of iterative development of the GlobalEd vESG and its continual refinement in its technologies, approaches, and materials to both support student learning and teacher classroom implementation.

## **BACKGROUND**

A **simulation game** is one in which game-based elements are integrated into an otherwise open-ended simulation with no defined end. While simulations can infinitely remain running to demonstrate how processes play out over time, a simulation game gives players a set of objectives and scope of their play, allowing for at least one player to win the game at the end of the simulation if they meet their assigned goal. Although there are many characteristics that have been used to define games, simulations, and other similar categories (e.g., serious games, roleplaying games), the key defining features between a simulation and a simulation game is that there are always human players that play a role in the game and that there is a defined “win state” or set of goals that players have to achieve to complete the game.

By extension, an **educational simulation game** (ESG) is a simulation game that contains specific learning objectives embedded in the design, or skills and knowledge that the game designers wish the player to learn. To promote desired outcomes, game designers should focus on the specific activities and actions that students will perform in a game setting, as they are intended to elicit these learning objectives through direct experience with the game’s required actions (De Frietas, 2006). Although players of ESGs are often students in formal classroom settings, this does not necessarily have to be the case, such as in the case of corporate training programs, military training, or games designed by charitable organizations to promote awareness about social issues. Regardless of who is playing the game, what remains consistent with ESGs is that players are active agents in their play, are intentionally participating in a learning process, and are thus required to interact with tasks, challenges, or questions that address the key concepts that are to be studied. By following best practices in instructional learning environment design, these tasks should model the processes and ways of thinking that are used in the authentic contexts (Brom et al., 2019; Sauve et al., 2007).

Educational simulation games do not necessarily have to be computer-mediated, although they usually are due to the capacity for modern software to model multiple variables of the simulation simultaneously. To this end, **virtual educational simulation games** (vESGs) are more commonly used in classrooms than those that are played without digital devices, with much of the simulation work being handled by digital devices to promote focused play between players and the simulated environment. In contrast to conventional analog roleplaying or living history activities in classrooms where players have to keep track of game statistics and information, players of vESGs can instead focus on the concepts that the designers have intended for them to experience while software keeps track of the game’s operations and status.

Perhaps more importantly in vESGs, players can *interact with others both virtually and face-to-face in a hybrid manner* based on a teacher’s intended classroom structure, schedule, and the physical distance between students. Students can play in a face-to-face way within their classrooms, but also play together in an online space, as well as play with students outside of their classrooms. The ability to virtually model complex learning environments while maintaining a high degree of player-to-player interactions has gained renewed interest as a valuable approach for providing engaging learning environments when

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social distancing and remote learning may be a regular reality within the post-pandemic educational landscape (Gibson, 2011).

As a method for teaching complex topics, vESGs are useful for *modeling social interactions, processes, and cause-and-effect relationships* between actors in a system. Simulation games with human players allow for (1) modeling the intentions and goals of actors within a system; (2) revealing the various non-agentive forces and attributes of a system that influence actors' activities; (3) requiring the social and cultural norms and rules that are followed when interacting in such a system; and (4) modeling how experts within the system think and make decisions, allowing players to mimic these and apply knowledge, facts, and history in an authentic way. Because of these principles, vESGs are powerful tools for providing hands-on experience with complex concepts within multiple disciplines where social interactions and the interpretation of these interactions are critical for achieving useful outcomes (Konia & Yao, 2013). These domains include the STEM disciplines, research and development, history, economics and the behavioral sciences, international relations, policy, civics, and religion.

The play authentic roles in the game by students is also a critical function of vESGs for use as an educational approach. Essential in a vESG is an *agentive role* of the student - that they are active players in the outcome of the game. This principle leverages educational theories related to situated cognition and embodied learning, which suggest that learners will grasp complex topics more readily and understand the necessary knowledge of disciplines if they actively participate in the same contexts that this knowledge would be used or activated (Dawley & Dede, 2014; Silva, 2020). Within these perspectives, learners should thus encounter situations that are authentic or closely mirror that of the actual contexts in which they would use the knowledge, concepts, and skills that they are learning (Lunce, 2006). Additionally, modeling the ways that experts do their work, think, and learn in their field via the simulated game world enables students to learn by doing and to learn via practice within those authentic contexts (de Freitas & Maharg, 2011). Such activity within modeled game worlds helps develop personal identities and positive dispositions toward the subject under study within the game, which does not occur as efficiently within traditional learning activities that emphasize rote memorization of facts and concepts.

Within a vESG, *game elements* are added to give students a sense of direction and completion within the exercise. Game elements such as defined player roles, rules for play, and a defined "win" condition or end state can all increase engagement by giving players a directive to work toward, even if it competes with other players in the game (Sauve et al., 2007; Schute et al., 2020). A vESG that models real-world conflict, disagreements, and interactions between opposing forces can teach a great deal about how and why things happen in social contexts (Gredler, 1996). By making explicit the agendas of each player and the various forces that influence players' decisions, players can learn how real-world situations might unfold with actors that are constrained by the same social forces, resources, norms, regulations, and commitments that underlie socially mediated processes (Brom et al., 2019).

Perhaps one of the most dramatic differences between vESGs and conventional curricula and learning activities is that vESGs are *open-ended* by design, or that there is no defined ending to the game and that the narrative within the gameplay is generated in real time collaboratively between the players and teachers (Harper, Squires, & McDougall, 2000). Such an open-ended and flexible play style is often new to first-time teachers who are using vESGs and they stand to benefit from ongoing professional development to support these activities that may be new to their teaching repertoire (Lawless et al., 2016; Oliver & Stallings, 2016). In as much, there is also typically no single or "approved" way to solve any of the given challenges, problem scenarios, or tasks within a vESG, provided that the choices made by players are plausible and mirror real-world potential decisions. In other words, students define their

own outcomes in the game through their dialogue choices. The open-ended nature of vESGs provide students with ample opportunities to pursue aspects of the simulation that engage them - their interests and attempts to meet their game goals should not be rigidly restricted within the game's rules (Schute et al., 2020). As such, one of the primary jobs of teachers in a vESG is to maintain the authenticity of the simulation and determine whether the action of players remain plausible and authentic.

These key characteristics of vESGs highlight the specialized nature for these games to elicit interactions and engagement from players in ways that may not appear as easily with other educational approaches. vESGs can be administered in both face-to-face and hybrid settings, encourage agentic capacity of student players, model complex social processes, promote long-term play through select engaging game elements, and are open-ended in their design to encourage students' interest-based inquiry. With this combination of characteristics, vESGs and other simulated experiences for classroom learning provide different formats for interaction than simple rote memorization or lecture-style pedagogical approaches.

Given the above discussion, it is important to identify which design elements and features are present in vESGs so that designers of vESGs and the educators who use them are enabled to understand how to activate the purported benefits of simulated experiences for classroom learning. Additionally, it is also useful for teachers looking to implement vESGs and simulations in their classrooms to identify which elements of the simulation game elicit which types of interactions and learning to promote educators' flexibility and adaptive capacity as they implement games with the same intention as the designers (Oliver & Stallings, 2016). Therefore, the example case analysis in this chapter is intended to examine vESGs and their designs in general through documenting the specific design elements of a particular vESG called GlobalEd.

## **METHOD**

### **GlobalEd: An Example Case of a vESG Used in Authentic Classroom Settings**

To illustrate the principles discussed throughout this chapter, an example case of **GlobalEd** is described and its key features are examined to highlight the potential benefits of vESGs in comparison to other pedagogical methods. GlobalEd is a vESG that has been used with K-12 students in classroom settings in the United States for over 20 years. GlobalEd is a multiplayer vESG that is played simultaneously by 10-20 classrooms via a web-based communications environment. Interactions in GlobalEd are both face-to-face where students from the same classroom can interact together in person, but also virtually where students predominantly collaborate on the web-based communications platform. Although GlobalEd is a hybrid learning environment with both in-person and virtual interactions, it can also be conducted completely virtually during times of online or remote learning due to school closures in the post-pandemic educational landscape.

GlobalEd models social interactions that occur in an international arena of actors when faced with solving an international crisis. The crisis that students are tasked with solving is one that is small enough scope to be solvable, but large enough to have a substantial impact on the health, welfare, and security of the simulated game world. As the game is international in scope, it also seeks to mirror authentic international tensions between nations, as well as to simulate the availability of resources within both high- and low-resourced countries in determining what actions the players can take. Such a world gives players a snapshot into the realities of how complex challenges are solved while accounting for the

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socio-scientific and historical forces that influence current events and why there are no clear answers to solving even the simplest challenges in the world.

As the game opens, each player is provided a *problem scenario* that sets the context for the game. The scenario is a written document that outlines an international crisis that must be solved by the students at the end of the game. To solve the problem, players will generate written proposals that tackle the issues presented in the scenario. Players must work together during play and negotiate solutions, as proposals must have co-sponsorship from at least two country teams to proceed to be considered at the end of the game.

By design, the problem scenario is written in an open-ended way, allowing for any feasible solution or combination of proposals to successfully solve the challenge. The open-endedness of the scenario is designed to give players the ability to pursue their interests and explore realistic solutions without there being any “one right answer.” This gives students leadership over their play in the game and can thus be driven by their interests and allows the game dialogue between teams to not be restricted into a single narrative. Open-ended scenarios also provide students with agency over their play and the ability to make an impact the outcome of the game instead of feeling like they are being guided down a single path to a pre-determined conclusion. As such, GlobalEd games have infinite possibilities in how they can be played and how the dialogue of the game will branch toward finding solutions to the scenario.

In the game, students are agentive human players that work together through an authentic assigned social challenge or conflict to come to a series of agreements to solve the assigned challenge. Students each play the role of a scientific advisor to a specific assigned country. All students in a single class play the role of citizens in the same country. As 10-20 total classrooms play in a single game, students likewise play the role of 10-20 “countries” in their roles within the simulated world, as illustrated in Figure 1.

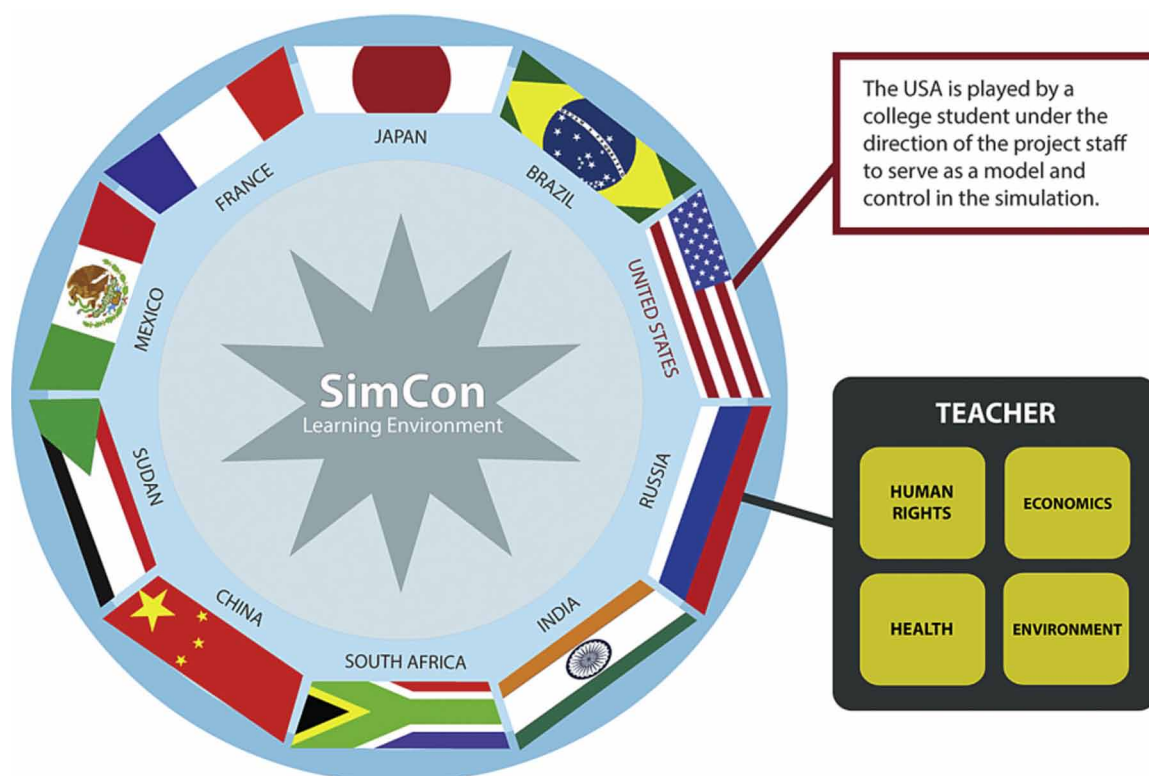
For most of the game, players (in the role of their country) participate in a simulated international negotiations summit with the other country teams that are in the game to develop a set of written proposals that solve the assigned problem scenario. A written proposal from each team is needed to complete the game. Each week, a new agenda of discussion points is provided to students to guide dialogue in negotiations toward solving the problem scenario. Players asynchronously message each other in an email-like interface to ask questions of each other, provide relevant primary resources and research, make arguments for proposed solutions, propose alliances and desire to work together on proposals, collaboratively develop solutions, and offer or withdraw support. Players can message all participants in the summit or individual teams as they work through the proposal negotiation process.

In addition to the students, one or more simulation moderators are also present to monitor the communications of the players and to guide discussion in the simulated negotiations. Moderators are named Simcon and hold administrative control over all communications in the online negotiation environment, including the ability to restrict or ban players from participating due to foul play. Simcon’s other responsibility is to guide students toward following the agenda for the week and seeking dialogue with other player teams if participation happens to be low.

Students play the game at multiple levels of participation. First, the student plays the game as an individual, where they will perform personal research and read about the given problem scenario and the issues that their assigned country will face. Students are also placed into one of four small groups within a country, each of which is focused on a particular issue area within the problem scenario: economics, environment, health, and human rights. These issue area groups form the core unit of the game and allow students to focus their work on a particular aspect of the problem. Issue area groups regularly interact within a classroom setting to share their findings and understand how each of the issue areas

influences their country's position on the problem. As players are interacting with each other in the virtual environment, the issue area groups will communicate with players from other classrooms in the same issue area group, thus enabling a multiplayer experience that fosters multiple perspectives as players develop their knowledge and skills. Thus, play consists of multiple layers: individual research and projects, issue area group work, whole-classroom projects and assignments, and multi-classroom interactions within the virtual environment.

Figure 1. GlobalEd game environment with a hypothetical set of countries



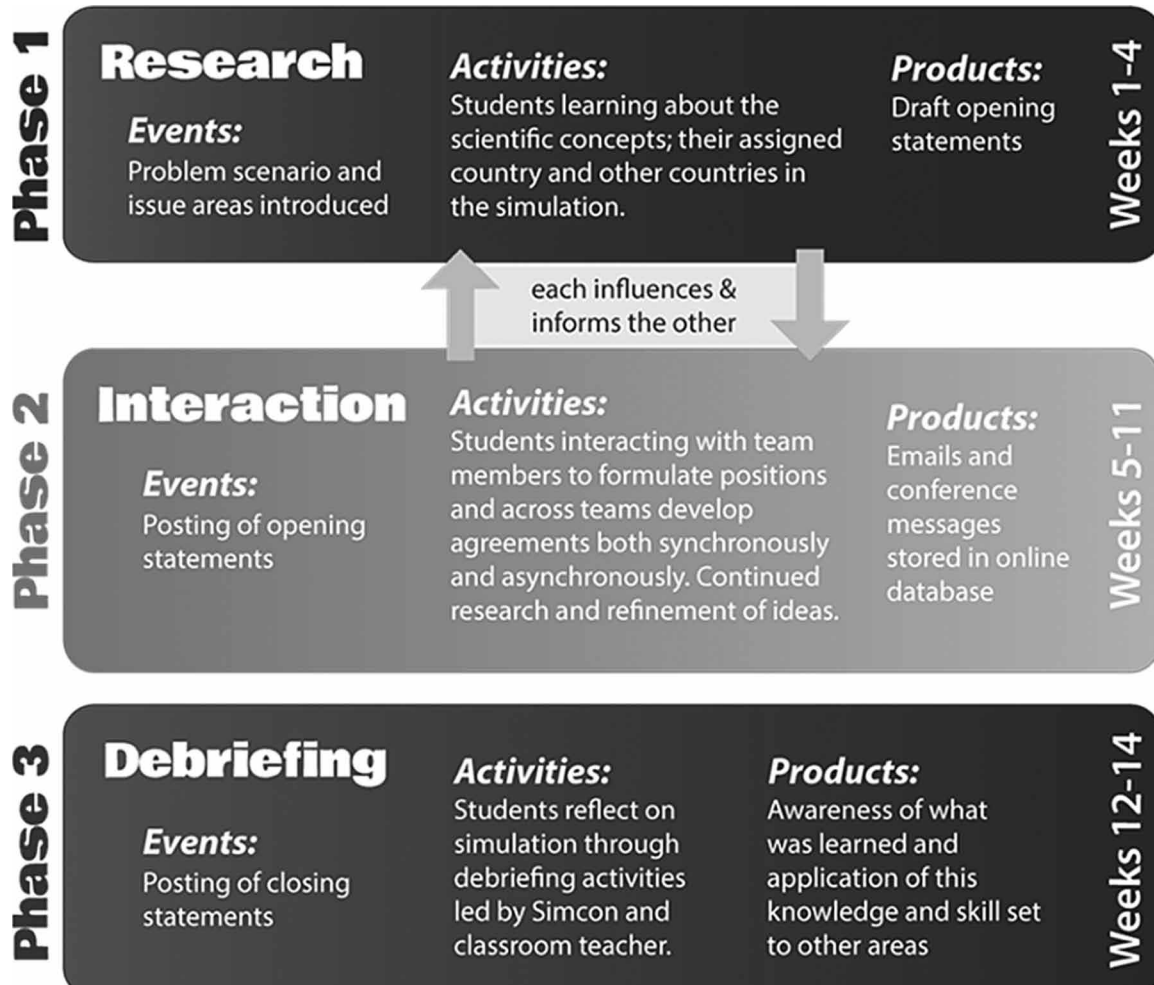
Over the duration of the game, play occurs over three phases. The duration of a GlobalEd game can last between 1 day to 14 weeks, depending on a teacher's available schedule in their classroom. However, most games last between 8 to 14 weeks. Regardless of the duration of the game, play occurs over three phases that happen in the same order for each game, which are summarized in Figure 2 for a hypothetical 14-week game.

First, in the *research phase*, players receive the problem scenario and their country assignment and then begin to seek out an understanding of the crisis that is unfolding in the scenario. Students are tasked with learning about how the problem scenario affects their country, their neighbors, and the international community. Not only are students instructed to develop an understanding of the immediate impacts on their country, but also the environmental, health, human rights, and economic impacts that may also be secondary to the initial problem. The research that players perform culminates in a written project called

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the *opening statement*, which is a brief essay that is addressed to the other teams on the country's positions, interests, and initial solutions to the problem scenario. The opening statement is then submitted to the online communications environment that mediates all the interactions within the game between players, and all player teams read the opening statements from all participating teams.

Figure 2. Three phases of play within GlobalEd over a hypothetical 14-week period



Second, in the *interactive phase*, players begin the simulated international negotiations summit by sending messages back and forth between country teams. Messaging occurs asynchronously between country teams as they ask questions of each other, promote their ideas for solutions to the problem scenario, and develop collaborative written proposals to present to the summit at the end of the game.

At scheduled intervals, all players can also simultaneously participate in live conferences to discuss the issues of the problem scenario and to collaboratively generate solutions to the proposals in real time. Because live discussions are intensive, few are conducted during the game. Live conferences occur synchronously in an instant-messaging style format, with dialogue occurring quickly between participants.



The Simcon moderator hosts the discussion and keeps students focused on an agenda for the discussion to ensure that all agenda items are discussed in the time allotted for the conference. Agendas for the live conferences are provided to players ahead of time to allow them to prepare responses for discussion, and transcripts of the live conferences are archived for players to refer to after the conferences are completed. The live conferences add a degree of urgency and eventfulness to the game by taking advantage of real-time interactions, which can be invigorating to player teams.

The interactive phase concludes with the crafting and submission of a *closing proposal* or statement at the end of the game. Each issue area group within each team publishes a closing proposal in the virtual simulation environment for consideration by the rest of the teams. Proposals must have at least two country participants as co-sponsors, so collaboration is a required aspect of the proposal process. After all proposals have been collected and reviewed, each team casts votes on their favored proposals toward solving the problem scenario. The winning team of the game is the one that receives the most votes on their proposal.

Third, in the *debriefing phase*, students are prompted to take a moment when the game ends to reflect on their experiences as players in the international negotiations summit. A guided debriefing conference is hosted by the Simcon moderator to elicit ideas and thoughts about how the game mirrors real-world interactions and how the skills and knowledge that students learned may be used within their classroom work or everyday lives. This reflection is a critical part of problem-based learning (PBL) principles to establish connections between experiences and knowledge and to increase the rate of transfer between one learning experience to another future experience (Kirkley et al., 2011; Krause & Stark, 2010).

To aid with organization and keeping players motivated, targeted game mechanics are also included in GlobalEd that make the simulation also a game-like experience. Status checks and small achievements throughout the game are provided to players to help them stay on track and know what they are working toward in the short term, especially when games can span 14 weeks. A win condition of the game is given to players at the outset to help motivate them to complete the game. Teams win the game if they develop a successful proposal to the problem scenario. A successful proposal ensures that the scope of proposed actions maintains realism in how the scenario should be solved, as well as how well other teams are collaboratively integrated into the proposal. All proposals must at least include one other team to join in, so all proposals are collaboratively written. Thus, the team who receives the most votes on their proposal at the end of the game is declared the winner, with runner ups also declared. These simple game elements help maintain a sense of urgency, objective, and direction for players and have been demonstrated to promote engagement over time.

The focus on online interactions in a web-based environment is intended to organize players' interactions and to keep track of the game's status. This includes the ability for game moderators to monitor player interactions, provide moderator tools to allow for communications to stay appropriate and prosocial, and to enable multi-classroom engagement regardless of distance. The web-based platform also allows for a dashboard of current agendas for interacting with other players, resource repository, reminders of personal team and individual goals, and status of the game. The focus on written communication in the online environment in GlobalEd allows for writing skills development, improved argumentation skills, and the ability to receive feedback from both teachers and other students.

In addition to the game itself, the developers of GlobalEd provided regular professional development opportunities to the teachers who implemented the game in their classrooms. Professional development offerings included regular weekly communications with teachers as they implemented the game, delivery

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of supportive curricular materials and worksheets, a series of informative podcasts, and opportunities for teachers to address challenges that they were facing in their classrooms as they implemented the game.

### **IDENTIFYING KEY DESIGN FEATURES OF VESGS THROUGH THE GLOBALED EXAMPLE**

The design features of vESGs are specifically intended to draw out players' long-term interactions with each other in extended dialogue, as well as to keep players' interest at a high level during the game. Thus, it is important to consider each of a game's design features to make sure that learning is occurring as intended by the development team. vESGs also often use supplementary lesson plans and curricular supports in addition to the game itself to promote specific learning objectives and to help teachers stay organized during play (Kenny & Gunter, 2011; Ketelhut & Schifter, 2011).

In this case analysis, GlobalEd's key interactions and activities were identified that characterize the game. Nine design features have prominently appeared in the game within its iterations over a 20-year span of implementing games in classrooms. Each of these nine features are critical to the play of the game and have been fully embedded into the game design, as they have been demonstrated over GlobalEd's 20-year iterative design process to improve the engagement level of students and their learning outcomes as they roleplay in the simulated game environment of GlobalEd (Lawless et al, 2016; 2018). Many of these features also appear in vESGs and classroom-based role-playing games in general, and parallels between such are discussed below.

1. **Role playing.** In vESGs, players assume an active, agentic role of a persona within a simulated game world. Although games can be fictional, a simulated world is typically one that mimics at least real-world activities, social rules, and physics. Most characters and teams are predefined by the game's rules, but some additional characters may also emerge as the game progresses. Games that have students play an agentic character most commonly employ the use of roles, complete with a set of rules on how to play the character and what is or is not allowed during play to promote authenticity. As a vESG seeks to mirror real-world processes and behaviors, roles are typically modeled after authentic jobs or tasks that occur in the real world even if the simulation is based in fiction, which allows for the simulation to remain grounded in an air of authenticity. Even in a simulated way, assuming a role and demonstrating skills has repeatedly been demonstrated as a strong method for encouraging participation among learners and developing the ability to understand the complex environments in which knowledge is used (Francis, 2011; Lave & Wenger, 1991).

As the game begins, teachers typically assign the roles to be played by the students and ensure that play is conducted authentically to the real-world analogues. Teachers may choose to rotate roles throughout the game, or pair roles with student personalities that they know would fit best. Teachers also provide guidance and coaching to the roles being played and can also play arbiter to what is allowed and not allowed if any disputes arise. Teachers are also tasked with maintaining a degree of sensitivity and awareness to any antisocial behaviors that could arise during play.

In the GlobalEd example, players are assigned the role of scientific advisors to a specific country that is invited to an international summit to solve a global crisis of high importance. As a part of their role, they are required to research the challenge facing the summit and to provide proposals to solve the crisis.

When games are played with authentic, real-world content, students have been found to better understand the complex concepts and skills associated with doing research with a variety of sources, understanding the dynamic relationships between a varied set of actors and forces that affect their decisions, and increasing their skill with written argumentation, communications, inquiry, and self-efficacy related to engaging with science and social studies concepts (De Frietas, 2006; Gredler, 2013; Lunce, 2006).

2. **Integrative interdisciplinary content.** The real world does not operate in the separated, siloed disciplines that are commonly represented in traditional education. Instead, concepts, phenomena, and processes are almost always interdisciplinary in the real world (Dickey, 2011). Thus, the GlobalEd game does not separate social studies from the science, communication, writing, and affective skills that are necessary to succeed in virtually every career in the modern knowledge economy. To this end, GlobalEd encourages players to explore the complex relationships between science, technology, and social studies content as they develop solutions to the problem scenario, giving them a richer experience with connecting the dots between disciplinary domains.
3. **Synchronous and asynchronous activities between players.** When conducting hybrid or virtual vESGs, game designs can benefit from both real-time (i.e., synchronous) and anytime (i.e., asynchronous) interactions between players. As both methods have their benefits, the GlobalEd game uses asynchronous email-like messaging for players to communicate with each other at all times of the day. Players can respond to messages when they are able. In addition, GlobalEd schedules live, real-time conferences for all players to communicate with each other simultaneously in an instant-message, chat room format.
4. **Duration of games.** Teachers implementing vESGs can find games of varied durations based on their interests and available classroom time, ranging from one day, to a week, to an entire semester or academic year. However, in the case of GlobalEd, multiple durations of games have been tested simultaneously for impact on learning outcomes, which demonstrated that although the longest duration had the highest impact on student outcomes, shorter-term games also demonstrated substantial effect sizes on student learning gains (Riel, Lawless, & Oren, forthcoming). Given these results, roleplaying and simulation games of shorter duration may still be worthwhile if curricular and classroom time is at a premium and only a short duration of time can be dedicated to play. With these results, vESGs of any duration can promote high levels of engagement and learning outcomes and teachers do not necessarily need to commit to only long-term or semester-long games.

Over its 20-year lifespan, GlobalEd durations have ranged from day-long sessions to 14-week, semester-long simulations. Each duration has its own benefits, and short-term durations may sometimes be the only feasible method of play for some teachers. However, it is certain that players in longer-term durations enjoy the ability to better understand their roles, the content under study, and the nuances of interactions with other players. To this end, day-long sessions of GlobalEd should not be discounted either, as they have historically been highly effective at providing memorable experiences with high impact concerning the content and concepts discussed in the simulation, appreciation for the historical and cultural forces that impact decisions in complex environments, and how multiplayer interactions influence outcomes among players.

5. **Individual and group work:** Play in vESGs can include both individual and group work, with each type taking advantage of the roleplaying aspect of the game. For the most part, individuals

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will be assigned their own roles to play in a vESG, although they may also be playing as a part of a team. Although individuals and teams may or may not compete against each other in the game, each individual player usually does have a specific role that needs to be accomplished to meet their goals and win the game.

Group work is also often emphasized in vESGs, particularly for those that are used in classrooms that have between 20 to 40 students in each. It is important to keep all students playing the game, and group work provides roles for each student-player in a way that can keep them engaged. Additionally, group work leverages the principles of social learning and the collaborative construction of understanding, giving students the chance to learn from each other and each build a better understanding than if they were studying by themselves (Kirkley et al., 2011; Lave & Wenger, 1991).

When playing as groups, it can be useful for teachers to separate tasks while students are playing various roles. Such tasks are based on the game and the tasks that players need to perform. In GlobalEd, players are assigned to small groups that focus on individual issue areas, such as economics, environment, health, and human rights. Each group also has multiple roles that can be assigned to improve the flow of tasks, including research, notetaking, writing, analysis, communications with other teams, and leadership. Parsing tasks within groups allows for social and collaborative learning in a low-stakes way (Lunce, 2006). In addition, all of the group work does not necessarily need to be tied to grades, as most teachers in GlobalEd choose to not grade the everyday work of groups, but instead the end proposal written by teams or individual contributions to the teamwork (Johnson et al., 2017).

6. **Challenge-based design.** vESGs often use a challenge-based design, or one that gives a common task or scenario for all players to solve. Authentic problem scenarios in vESGs are key to the simulation's believability and relevance to students' lives. The challenge or scenario in a game thus sets a context that is grounded in real-world applications. Plausible scenarios are able then to situate learning in a game environment that mimics how the world really works, which ideally can be remembered, transferred, and then used outside of the simulation after play has completed. Challenges or scenarios are also ideally crafted in a way to ensure that students engage with desired material and that the material remains interesting to them for the duration of the game. A "perfect" scenario is one in which the students dive into their roles and engage with the scenario until the game is completed.

In the example of the GlobalEd vESG, the game design is informed by problem-based learning (PBL) principles in how students are to interact, develop artifacts of their work, and reflect on their findings and experiences (Kirkley et al., 2011; Savery & Duffy, 1995). A common, open-ended problem scenario is assigned to all players to allow students to play their roles. The PBL-based framework and the problem scenario for the game also enables players to pursue their own interests and roles in the game to see where the dialogue takes them - there is no single right answer to solving a well-written, open-ended scenario. The unpredictability of the scenario's path provides a realistic context for playing the game that would similarly occur in authentic settings.

To help students get started with their problem scenario, some common supportive resources are provided to all players to start and guide their play. Each role is given a starting tip sheet on how to best play their role and what actions best exemplify their characters within the given problem scenario. Additionally, a database of useful materials to players such as primary and secondary sources, worksheets,

and game briefs all help guide players when they are “stuck” on the scenario and need a boost with what to do next with other players toward solving the scenario. Teachers are also provided a variety of differentiation materials to jumpstart activities with their students in the game when play stalls or the scenario’s tasks seem too difficult for students at varying skill levels.

7. **Sustained positive dialogue between players.** Any vESG that enables communications between players creates a rich environment where a sustained dialogue among players works to develop a collaborative, shared understanding of the concepts being analyzed, be it historical events, social studies, current events, or scientific concepts. By continually engaging with each other, players share their current understandings, solicit feedback and others’ understandings, and gather new information about the topic under discussion. As a result, all players work to collaboratively refine their understandings and build their knowledge about the game content together. GlobalEd chooses to enact dialogue in the written form, emphasizing the importance of developing written communication and scientific argumentation skills during play.

Certainly, there are ways that a vESG can be derailed in a classroom through foul play, bullying, and other antisocial behaviors. However, many other challenges arise than just foul play that a teacher must address while implementing a game in their classroom. A teacher’s job in an vESG is primarily to moderate game play and dialogue to ensure that it stays on track, encourage participation among all players, and ensure that appropriate behavior is followed by all players. This is particularly important in simulations where social processes are emulated, and in particular where social inequities or discussions about sensitive social issues might occur. Teacher-facilitators or any assistants who implement vESGs must always promote positive dialogue about sensitive issues to ensure game play can continue safely and productively.

In the example GlobalEd vESG, all player interactions are dialogue-based, be it in-person in a classroom among teams, or between classrooms interacting in the virtual web-based simulation environment. Dialogue is a focal game mechanic in GlobalEd, as it is a vehicle for fostering a continual process of understanding and refinement of the complex topics that are discussed by the students who play the role of scientific advisors working to solve the assigned global crisis scenario. Because of its complexity, no individual student will likely understand all the aspects of the problem right away. By working together to understand and solve the crisis scenario and with multiple players bringing different perspectives to the game via their roles, a greater shared understanding is typically achieved by the end of the game than if a student were to simply study the matter on their own.

8. **Reflective activities.** Reflective activities are common in vESGs to explicitly make links to the content from the game to concepts, terms, and material that is being studied. This process of reflection is critical to the process of transfer of knowledge and skills that are learned from vESGs into usable knowledge that can be later used in real-world work (Johnson, Bailey, & Van Buskirk, 2017). Because play within vESGs take place in simulated worlds that mirror the authentic work that professionals perform, knowledge transfers from the game to authentic situations may come easier than if the content is simply memorized from a book or assignment. However, reflective activities further solidify this knowledge and help make the connections visible to students after they have finished playing (Krause & Stark, 2010; Lehitnen, 2002). Reflective activities can be conducted as the game is ongoing or after the game is completed. When the game is completed,

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students can draw on their recent experiences to make links between the game and potential real-world applications or situations in which their newly learned skills or knowledge could be used.

In the GlobalEd example, players take part in a post-game live conference where a game moderator leads a discussion with players about the types of activities that the students performed while playing and how these activities might be used in real-world applications. Activities discussed include skills in research, scientific inquiry, information literacy, science and social studies content, argumentation and writing skills, and step-by-step reviews of how the players solved problems, developed solutions, and assembled materials to make a sound argument for having a winning proposal.

9. **Classroom instructional supports.** Curricular supports in games help teachers to keep the game on track, as well as promote specific tangential or supplementary learning objectives within the classroom. Lesson plans and curricular supports, such as worksheets, guided discussions, and graphic organizers help teachers make ties to curricular content with that being encountered in the game. A game as it is designed out the box may not directly touch on elements that are required by a teacher's mandatory curriculum or other content that is required to be covered. Teachers can use targeted activities like classroom guided discussions, "side quests," group analysis and reflection of what is happening in the simulation, homework assignments, and other similar supplemental activities all reinforce and make visible the learning that is happening in the game. Thus, supplemental activities that happen parallel to the game can be additionally implemented to support students as they make connections between both the content of a vESG and a teachers' goals with a class unit or course.

In our example case of GlobalEd, teachers enjoy multiple forms of curricular support to engage with additional learning outcomes, explore additional learning outcomes of interest to the teacher, and keep players organized as they navigate the game. A library of supplemental day-long and week-long lesson plans are provided to teachers with GlobalEd to help further develop specific concepts or skills of interest that are being encountered in the game, such as written argumentation skills, skills with inquiry, asking questions, conducting research, information literacy skills, interpersonal dialogue skills, and in-depth classroom studies on concepts and topics being encountered in the game. In addition, a student workbook full of lesson supports, worksheets, and graphic organizers for students are provided as supplemental material that can be used by teachers who want to simultaneously explore certain skills (e.g., research, information literacy, scientific inquiry) or knowledge (e.g., social studies, science, history content) in addition to game play.

Additionally, GlobalEd provides a two-way communication channel and ongoing professional development between game developers and teachers that can address challenges and game issues as they arise in real time during implementation. Since 2010, the program provided teachers with both live and just-in-time, on-demand support during live implementations of simulations. Teacher supports in GlobalEd are designed based on the Responsive Online Professional Development (ROPD) framework to encourage teachers to share the challenges and needs they are facing in the classroom with the game developers (Riel, Lawless, & Brown, 2017).

In ROPD, teachers who are implementing the game provide weekly feedback and comments to the game developers while they plan for their next week's activities. After receiving this regular feedback from teachers, the game developers in turn provide teachers with supportive resources and additional

on-demand training materials based on the teachers' expressed needs (Lawless et al, 2019; Riel & Lawless, 2021). As a result, regular cycles of communication between the teachers implementing the game and the game developers help ensure that the game is being implemented in ways that align with the underlying intention and goals of the game (Riel, Lawless, & Brown, 2017). Any adaptations and flexibility to the game that is exhibited by the teachers is done in collaboration with the game developers, and a common understanding is built by both sides to achieve maximum effectiveness for the students.

## **RESULTS**

### **Evidence of Learning Outcomes with GlobalEd**

The GlobalEd vESG has enjoyed over two decades of research and development. Multiple design iterations have occurred over this two-decade span, with each improving on the available technologies to classrooms, the identified needs of teachers and students who play the simulation, and the refined goals of the game developers and instructional designers who seek to improve student outcomes in GlobalEd. To this end, GlobalEd has been studied over the last ten years as to its effects on promoting student achievement and positive dispositions toward science and social studies content. Although this chapter does not present any novel findings from experimental studies of GlobalEd, research from the past ten years is summarized below. Results from these studies have repeatedly indicated both immediate short-term and long-term effects on student learning from GlobalEd and its curricular supports (Lawless et al., 2019; 2018; 2016; 2015; 2014; Riel et al., 2015; 2021; forthcoming; Yukhymenko, 2011).

First, in studies that examined written argumentation skills among students who played GlobalEd, the students who participated in the game demonstrated substantially stronger written argumentation and essay writing skills in comparisons to students who participated in a control condition. Analyses from two large-scale, multi-state experimental studies on GlobalEd with over 60 teacher and over 3000 student participants indicated significant positive outcomes with moderate to strong effect sizes (via Cohen's *d*) in comparison to students participating in a control condition of comparable normal educational practices. These positive outcomes included key learning outcomes that were the goal of the game, such as written scientific argumentation ( $d=.43-.69$ ), feelings of self-efficacy related to writing ( $d=.20$ ), and science knowledge expressed in students' writing ( $d=.20$ ) (Lawless et al., 2015; 2016).

Additionally, results from experimental studies have indicated a differential impact between students of differing demographics, with the game being particularly beneficial for students that represent traditionally marginalized populations or groups that are underrepresented in STEM-based studies and careers. Student written argumentation skills after playing GlobalEd in comparison to the control condition were observed to be higher for both urban and female students, ranging from  $d=.30$  for suburban females to  $d=.69$  for urban males, with higher fidelity classrooms likewise correlated with the magnitude of the effects (suburban females at  $d=1.71$  to urban males at  $d=2.44$ ) (Lawless et al., 2016). These results indicate that simulation games may be effective at providing substantially meaningful learning experiences for students who are underserved in educational settings, such as students in urban school districts, female students in pursuit of STEM-based studies, and students of lower socioeconomic status.

Finally, curricular supports for teachers' implementation of the game in their classrooms have also demonstrated positive effects. Teacher fidelity of implementing games based on the intended design. Effects on student learning outcomes were moderated by teacher fidelity of implementation of problem-

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based learning pedagogy, lesson plans, and specific required game element implementation. In classrooms where teacher implementation fidelity of the simulation was higher, effect sizes on student written argumentation skills were quite large ( $d=1.16$ ), whereas classrooms with low-fidelity implementations of the simulation exhibited no significant change in performance pre to post intervention ( $d=.13$ ) (Lawless et al., 2015; 2018). In another study, teachers who had a high degree of participation in the teacher professional development program saw higher student achievement among all key learning outcome goals for the game, including written argumentation skills, knowledge of science and social studies content, and inquiry skills (Riel, 2020). Concerning student affect related to game play and content, an additional study demonstrated that higher levels of teacher participation in the professional development support programs predicted higher levels of student affect, particularly with student interest in the content of study and students' feelings of self-efficacy in writing and science content (Riel & Lawless, 2021). These studies on implementation and use of professional supports highlight the importance of game designers to support classroom play via multiple avenues to ensure that games are played as they are intended by the designers.

## **CONCLUSION**

Educational simulation games have demonstrated substantial promise in providing relevant and engaging opportunities for student achievement. As a result of a global shift to remote and hybrid learning because of the COVID-19 pandemic, methods for maintaining interactivity and keeping students motivated is a critical function necessary of modern pedagogical approaches and learning environments. ESGs that are either completely virtual or contain hybrid face-to-face and virtual elements can continue to engage learners when physical proximity is not possible.

GlobalEd, the example vESG case presented within this chapter, has demonstrated over its 20-year history the benefits of virtual connections between students when playing a simulation that emulates socio-scientific processes or real-world situations. In addition, when playing a simulation game such as GlobalEd, students can connect at multiple levels, which include smaller student groups, the whole classroom, or even multiple classrooms simultaneously. This provides essential social learning opportunities that may not be achievable in a single classroom environment.

vESGs that mirror real-world situations and social processes within their designs have met with a renewed promise in meeting the learning needs of students in complex, multi-modal, and sometimes completely virtual learning contexts that have emerged by necessity from the post-pandemic educational landscape. In addition to the rich and complex learning opportunities that model social interactions provided by vESGs, students also have ample opportunities to realistically apply *in situ* the concepts, facts, and other knowledge that they learn, which is application in an authentic way that mirrors that of how these facts would be used in realistic contexts.

vESGs maximize the benefits of social interaction and leverage the unique capabilities of networked communications technologies to make the most out of virtual learning. As such, vESGs that are designed to be played either completely virtually or in a hybrid way can perhaps meet the ongoing needs of students, teachers, schools, and even districts to provide high quality educational opportunities during times where face-to-face learning is not possible.



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