

Developing a Digital Game Teaching Refugee Students English With Science Topic

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Abstract

A digital game-based learning platform has been developed to help refugee students to learn English using science topics. The aim of the project is to verify the potential of digital games as a valuable tool for refugee students and highlight the significance of game-based language education more broadly. The game-based learning platform prototype is introduced in this paper, including the design process, the flow of the game, and educational content embedded in the game, with a focus on overcoming the challenges encountered during its development. The game will supplement the middle school science curriculum, incorporating the Kansas Science Standards and the Next Generation Science Standards. In the game, the content will be presented in the form of subtitles having both the refugee students' native language and English. We expect the game will become a free and accessible educational tool for refugee students and will contribute to the improvement of their opportunities for education, thereby alleviating the level of their lives and helping them integrate into U.S. society. The long-term benefits of this project include a safe social setting for learning, freeing up time for parents, and reducing emotional trauma.

Keywords: Digital Game-Based Learning, English Language Learners, Refugee Students

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Introduction

For refugees' successful resettlement, one of the required conditions for them is to acquire the language of the host country/community where they newly joined. It is because acquiring the host language plays a key role in their social and economic integration into their new environment. Using digital games has been gaining attention as one of the effective ways for the purpose of learning new languages. Recent research studies (e.g., Aydın & Çakır, 2022; Xu et al., 2020) have shown that digital games can provide engaging and interactive learning experiences that can foster language development.

Recognizing the importance of refugees' language acquisition and the potential of digital games in language education, we have been developing a digital game-based learning platform where refugee students, who are in the resettlement process in the midwestern area of the United States, can learn English in fun ways with science topics. In addition, the digital game-based learning platform supplements middle school science curriculum, thereby ensuring that refugee children have additional resources in catching up with their American peers.

In this paper, a prototype of the game module, which is the current stage of the game platform development process, will be introduced with the challenges we encountered and the solutions we took while developing the prototype. In addition, we will describe the prototype in terms of its design, the flow of the game, and the educational content embedded in it. Through this project, we show that digital games could be a valuable tool for refugee learners to learn English while also highlighting the potential of such games in language education more broadly.

Background of the study: About Project Education for All

Refugees are defined as individuals fleeing violent conflict or persecution by the United Nations High Commissioner for Refugees (UNHCR). Over 2000 refugees have been resettled in Wichita, Kansas. Refugees are often underserved in their host countries due to a variety of reasons, including language barriers, exclusion in the host society, and inadequate educational opportunities. Most of the refugees resettled in Wichita are from the Democratic Republic of the Congo, Eritrea, and Afghanistan.

Refugees experience disruptions in schooling. In addition, English is not their first language, and this is a significant barrier when enrolling refugee children in U.S. school districts. It is estimated that more than half of school-age refugee children (3.7 million out of 7.1 million) are out of school (UNHCR, 2018). It has been demonstrated that once refugees meet the basic needs of food, water, and shelter, their primary concern is to ensure their children can go to school (UNHCR, 2001). The percentage of refugee children who are likely to be out of school is five times higher than children who are not refugees. Regarding higher education, refugees, on average, attend college at a rate of one percent, with the international average being 34% (UNHCR, 2016). These dire statistics show the need to create easier access to education.

Traditional educational systems in the U.S. are based on a "one-size-fits-all" philosophy. Recently there have been advances in designing personalized systems, addressing the needs of individual students (Gordon et al., 2016; Andallaza et al., 2012). However, these systems are currently being tested on people from western, educated, industrialized, rich, and

democratic (WEIRD) populations who represent only 12% of the world's population. We know very little about the effectiveness of these models and systems on special populations such as refugee learners. Education is a fundamental human right, and there are many refugee children who are unable to attend elementary and middle school, thereby leading to an increase in world poverty.

With the goal of providing equitable educational access to all, Wichita State University launched a project called 'Project Education for All' by creating a 'Center for Educational Technologies to Assist Refugee Learners' in October 2020. Working together with resettlement agencies in Wichita, community members and organizations, and providers of English as second language classes (ESL), the Center works to create accessible and free educational opportunities and technologies for refugee learners. This project addresses the issue of "providing inclusive and equitable quality education" (Sustainable development goal 4, UNESCO 2030) for refugee and asylee learners in the United States.

The entire project proceeds in four phases. The first phase of the project involved the creation of the 'Refugee Learning and Resettlement Team,' a memorandum of understanding signed between Wichita State University and local resettlement agencies in Wichita. Currently, stakeholders in this team include the City of Wichita, Breakthrough Community Church, the International Rescue Committee of Wichita, the Kansas Leadership Center, KMUW, and the Community Engagement Institute at Wichita State University. In the second phase of the project, we conducted a survey to assess the needs and requirements of the African refugee community (Menon et al., 2023). With the information collected through the needs-assessment survey, in phase three of this project, we developed an innovative, digital game-based learning platform called "Gorilla Bay," which will be introduced in the following sections of this paper, for refugee students in Wichita Public Schools. The project is currently in phase four. The game will be beta tested in Wichita school districts, as well as sent out to refugee children who are not enrolled in the school districts with the help of the City of Wichita.

Digital Game-Based Learning

Simply speaking, it could be said that digital game-based learning (DGBL) is a learning/instructional approach incorporating digital games into the instructional practice and/or learning process. Since Prensky (2001) coined the term DGBL with a broad definition which is any learning activity using digital games, DGBL has gained increasing attention from educational practitioners and researchers as an effective learning method. However, the use of games in education is not new. According to Hellerstedt and Mozelius (2019), the concept of using games has a long history, and some board games like Xiangxi, Chess have been used for thousands of years for educational purposes, such as training strategic and tactical thinking, language skills, mathematics, etc. However, it is also undeniable that the various digital technology advancements have made it possible and opened opportunities to use digital games in a more sophisticated and effective way. Nowadays, the use of digital games for educational purposes is growing, with more and more schools, colleges, universities, and professional development institutions adopting this approach to teaching.

One of the reasons why the interest in the use of digital games has been growing is because DGBL has several advantages as a learning method. Games are engaging and fun, and this can help students stay motivated and focused on learning. They also provide a more immersive learning experience, allowing students to interact with the content in a way that is

not possible with more traditional teaching methods. Regarding the advantages of DGBL, research has shown that digital games are a useful educational tool for improving students' motivation, attitude, and performance (Bai et al., 2012; Beserra et al., 2014; Byun & Joung, 2018; Chen et al., 2012; Lin et al., 2013; Rayya & Hamdi, 2001; Vogel et al., 2006).

Language learning is one of the areas where DGBL has been found to have positive effects on students' learning outcomes since digital games can provide students with an interactive and engaging environment to learn a new language. In this regard, Xu et al. (2020) asserted that many studies reported that DGBL was effective for English language learning in vocabulary, pragmatics, grammar, writing, and speaking by reviewing and summarizing previous research studies. Also, Nitisakunwut et al. (2022) found that the genres, availability, and platforms of games influence the effectiveness of digital game-based language teaching.

In sum, DGBL is an effective and engaging method for learning not only in general but in the context of language learning and provides many advantages that students cannot take through traditional teaching/learning methods. It has been shown to have positive effects on students' learning outcomes, particularly in the area of language learning. As technology continues to evolve and improve, it is likely that DGBL will become even more popular and widely used in the future. Due to such benefits for the language learning that DGBL has, we have been developing a digital game titled 'Gorilla Bay' to help refugee students learn English. In the following section, the game development process will be explained briefly, followed by an explanation of the game.

Game Development

As mentioned earlier, the main purpose of this study was to develop a digital game for refugee students to learn English using science concepts. In order to decide the best game engine for the project, the game development team compared two game engines, Unity and Unreal Engine. After examining the functions and capabilities that each engine has and the skills of the game development team, the Unreal game engine was selected. Figure 1 shows the screenshots of the game editor, Unreal, when using it to design the game environment and the sequence of the game scenes.

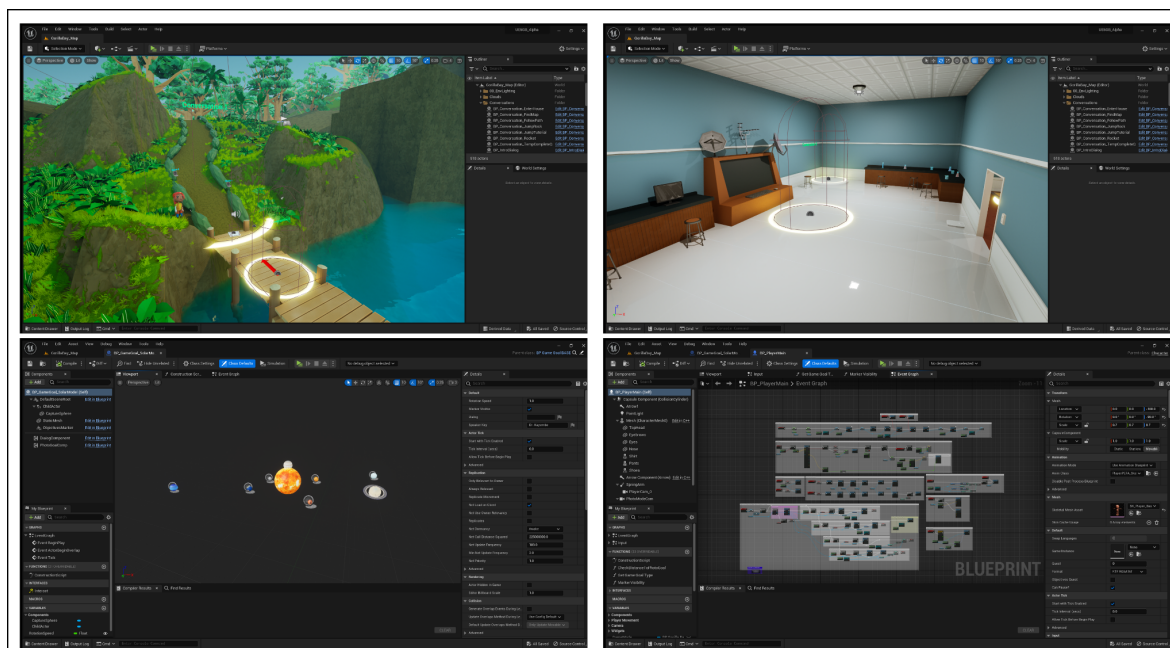


Figure 1. Screenshots of the game engine, Unreal

To maximize the learning effectiveness, the role-playing game (RPG) genre was chosen as the type of game because, compared to other game genres, RPG-type games can provide students with more opportunities to learn through solving problems and completing quests within the game environment. Previous DGBL studies pointed out the same advantage of RPG-type games. For example, Hussein et al. (2019) found that RPG is the most popular game genre for DGBL studies because learning and immersion often occur via exploration of the learning environment, interaction with Non-Player Character (NPC), customization, and controlling the game avatar while students are playing RPG type games. Therefore we expect that in the game, refugee students would interact with (NPCs) through dialogues to learn English, with the aim of being able to explain key science concepts.

After the decisions on the game engine were made and the genre that the game would adopt for the project was decided, the next task was to design the content of the game. The topics of the game content were determined through collaboration with local school teachers who teach refugee students in their classes and chosen carefully based on the Kansas Science Standards, the Next Generation Science Standards (NGSS), and the Kansas State Department of Education's English Language Arts and Literacy Common Core Standards. Since it was found that refugee students lack the opportunities to learn in the formal educational system before they arrive in the United States, unlike immigrant students, the topics were selected with caution so that the level of the content is not too difficult. Eventually, four main topics were selected, and each topic became one module. The four topics, which came from the middle school curriculum, are the solar system, the human body, states in the U.S., and life and echo systems underwater.

The game development process followed a typical game development process, as shown in Figure 2.

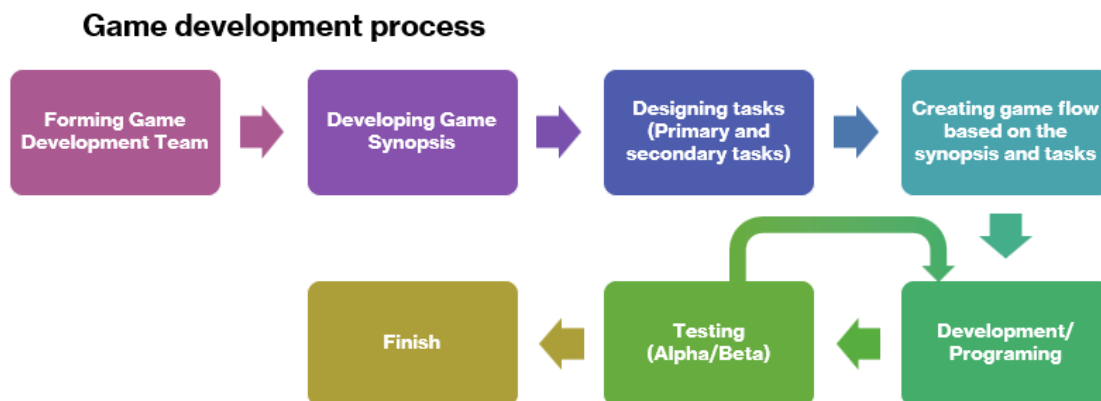


Figure 2. Game development process

First, a game development team was formed. The team members consist of the project leader, an educational technologist who has expertise in DGBL, two professionals in game design and development, and two graduate assistants. And then, through collaboration, the team tried to develop the synopsis of the game. Initially, the team made attempts to develop the synopsis by incorporating elements of the refugees' lives to make an authentic game for the refugee students because learning can occur more easily in the context relevant to learners. However, the team faced several challenges in doing so, as follows. First, the game development team had no background knowledge about the refugees' previous or current lives that could be utilized to make the game more meaningful for them. Second, the materials/resources showing refugees' lives that the game development team could use were limited. Third, it was difficult to find a good person who could write a good game synopsis/story based on the refugees' lives. To overcome those challenges, the team tried a couple of strategic plans, including a game story-making competition in which the refugee students or parents could participate, a game design workshop with refugee students, changing the game genre from RPG to puzzle-type checking vocabulary, and creating our own storyline (by the game development team). Among those strategies, the game development team tried to hold a game story-making competition for the refugee students and parents. Due to the tight time schedule, however, there were not many entries, and the quality of the work was not satisfactory. Although the competition wasn't successful as we hoped, we think the outcome would be different and meaningful if we had a longer time frame for them. After an entire project team-level consideration, the development team eventually decided to create the storyline by themselves, resulting in a synopsis for the solar system module.

Once the synopsis was created, the tasks for players (refugee students) were designed using a flow chart, followed by making NPC dialogues. And then, the game was developed through programming and coding. When a module was developed, it was tested and revised as many times as needed.

Prototype

Currently, the solar system module is the first prototype that has been developed in this project. Figure 3 briefly shows the flow of the game module. As shown in Figure 3, after starting the game, players will navigate the game area, meet NPC (in this prototype, the NPC is a scientist), receive tasks/missions/problems from NPCs, take a journey to perform the tasks or to solve problems, and then come back to the NPC, mission giver to get rewards. While playing the game, the players get the information necessary to play the game through

dialogue with the NPCs, a scientist in this module, that is presented in the form of subtitles, and the subtitles are provided in two languages, English and the refugees’ mother language. In the case of the prototype, the second language was Kiswahili (Figure 4).

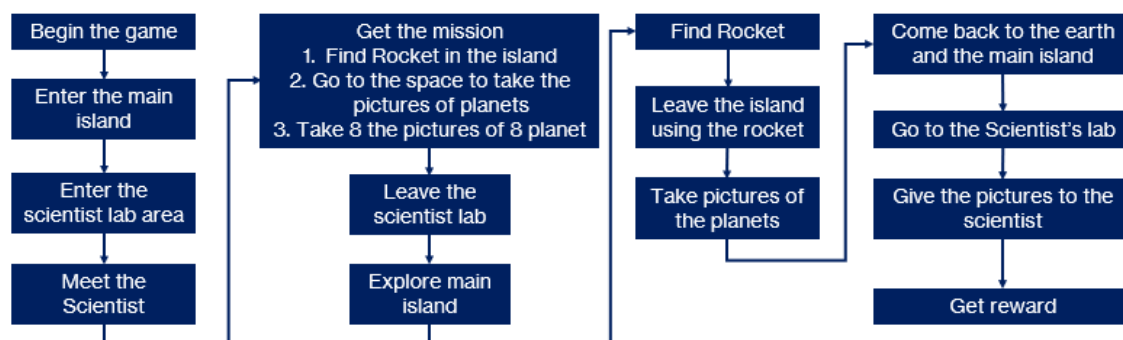


Figure 3. Game flow

Specifically, as players start this prototype game module, they are presented with the title screen first, where they can save and load the game. This feature made it possible for multiple students to play the same game. After selecting one of the save slots, once they entered their names, the game scene changed to the bay area, where an NPC, Dr. Kayembe, greets players. After a short greeting conversation between Dr. Kayembe and the players, the module starts tutorial mode. In the tutorial, through dialogue with Dr. Kayembe, players get informed about how to control their game character using a keyboard and mouse and the ways to navigate the game world, including the use of waypoints which will help players keep on track during play.

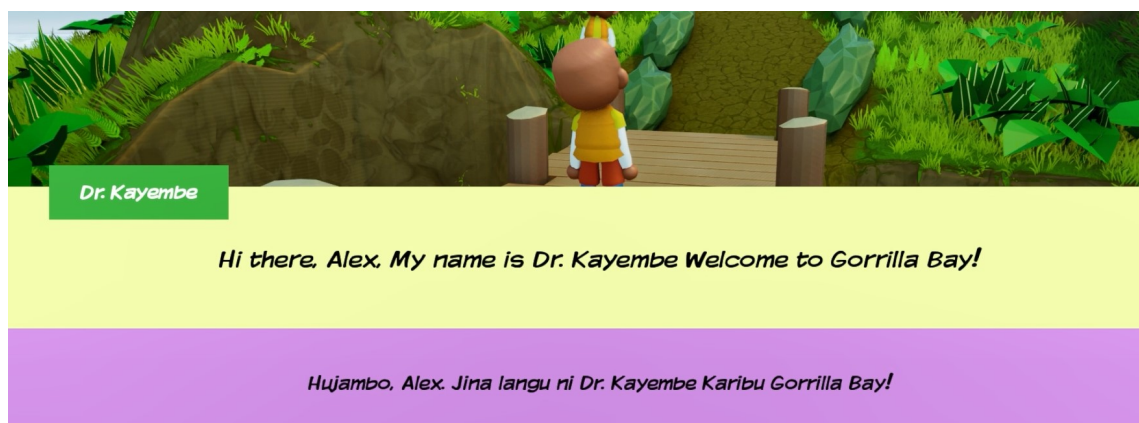


Figure 4. Subtitles in the game presented simultaneously in English and Kiswahili

Once players complete the tutorial part at the beginning of the game successfully, they start exploring the bay area to find Dr. Kayembe's science lab (Figure 5), where the players receive the first mission, which is to travel to outer space using a rocket ship and take pictures of the sun and all 8 planets. To do this, players must obtain the key first to get inside the rocket ship. Before leaving, players have the option to modify their character's look, including hairstyles, eyebrows, eyes, noses, shirts, pants, and shoes. This customization feature for changing the playing character's look will be updated with more options in the future.



Figure 5. Dr. Kayembe's Science Lab

After finding and launching the rocket, the game scene changes, showing space. In space, players play a kind of hide-and-seek game with the planets. When they see a planet, they take a picture of the planet starting with the Sun and move on until they take all the rest of the 8 planets. Players learn about the sun and each planet by taking pictures and resources stored in the library located inside the rocket ship. In the library, players also can interact with a solar system model that shows the planets orbiting around the sun (Figure 6). Once taken pictures of all the planets, players come back to Dr. Kayembe's lab and complete a test about what they have learned throughout the journey in space. If the players pass the test, they will get a token to move to the next module exploring the human body, which the development team is currently working on.

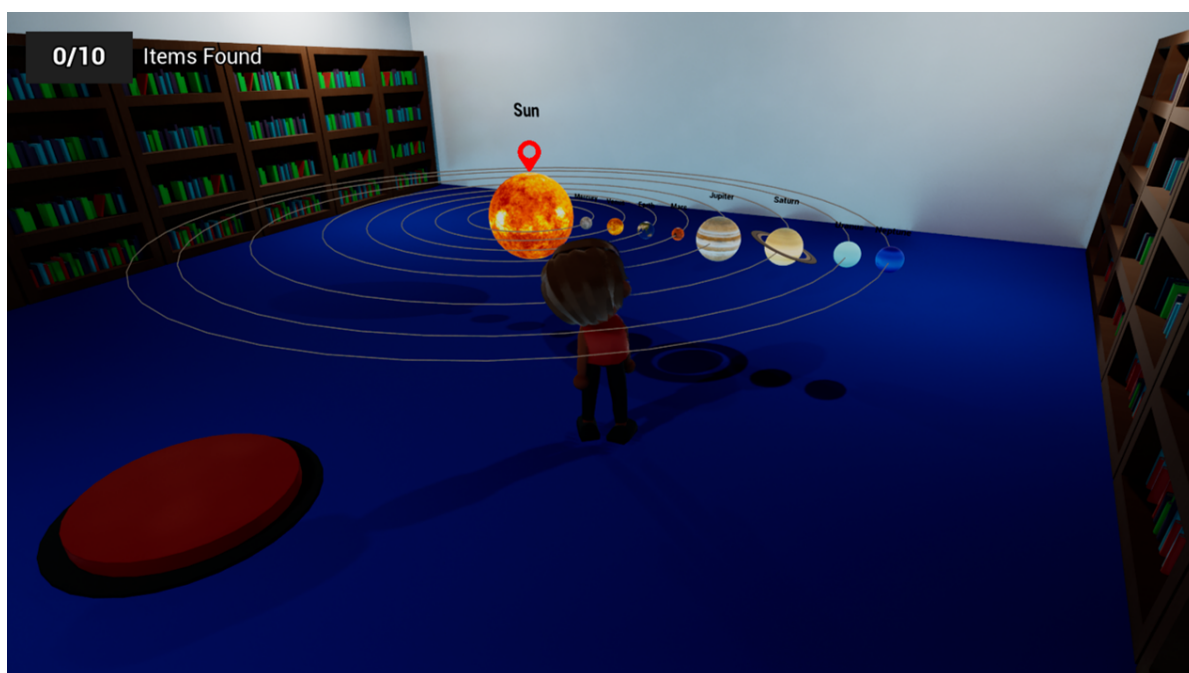


Figure 6. Solar system model in the library of the rocket ship

While playing the game, players interact with NPCs and keep receiving information necessary to play the game modules using dialogue boxes in the form of subtitles showing both English and their mother language. We hypothesized that such a way to present both languages in-game environments could help refugee students develop English vocabulary and reading skills. The effectiveness of this game will be tested through quantitative and qualitative data collection and controlled psycholinguistics experiments. Feedback will be sought from the students and the teachers using focus-group interviews. Based on the collected data, the game will be revised based on input from the teachers, refugee students, and parents.

Conclusion

The acquisition of the host language is a crucial condition for the successful resettlement of refugees, and digital games could be an effective way to help them to learn a new language. This paper introduces a prototype of a DGBL platform we developed to help refugees in the midwest area, specifically Wichita, Kansas, to learn English through science topics. The entire project aims to verify the potential of digital games as a valuable tool for refugee learners and highlight the significance of game-based language education more broadly.

In the future, the game we introduced in this paper will have both a desktop version as well as apps for both Apple and Android platforms. The game is developed to supplement the middle school science curriculum, and the modules are created using the Kansas Science Standards and the Next Generation Science Standards, as well as the Kansas State Department of Education's English Language Arts and Literacy Common Core Standards. Players have the option of personalizing their avatars, and they will complete a series of quests using role-playing that teach critical thinking skills, enhance student engagement, and improve student achievement. The unique aspect of this game-based learning platform is that the content will be presented to them in their native language (e.g., Kiswahili, Arabic, etc.) with a dictionary interface that translates the content into English. The aim of the game is to create a more engaging educational interface that fosters deep learning as well as literacy. Additionally, in our future research plan, there will be an interface for teachers and educators to immerse them in the cultural expectations of the refugee population.

The significance of this project is that it will help create free and accessible digital educational technology for refugee learners, thereby improving their opportunities for education and, a correlate, alleviating poverty. It will serve as a tool to empower refugee children and make them successful and help in integrating into U.S. society. As lack of education and poverty go hand in hand, increasing educational opportunities leads to a decrease in the world's percentage of poverty. Providing personalized game-based learning opportunities for refugee students will provide better lives and better standards of living. Education is a form of empowerment, especially for young girls. In addition, it reduces hunger, fights HIV/AIDS, spurs economic growth, and provides a foundation for peacebuilding (UNICEF, 2015).

By providing a free, accessible DGBL platform, this project will change the lives of thousands of refugees. During these uncertain COVID-19 times, the use of digital technologies is beneficial as formal school settings require money, time, and resources that they might not have access to. In addition, school districts can be spared from creating, staffing, and finding interpreters and translators. By allowing refugees to become responsible for their own learning, they can begin to learn much faster, quicker, and at their own pace.

With the current models of refugee education, refugees must wait for the government or an NGO to come in and set up paperwork, get materials, and staff the schools. Very often, this causes unnecessary delays in providing quick access to these special populations. Access to laptops, desktops, and mobile phones was assessed in a previous phase of this project, thereby ensuring that the educational platform will truly be accessible to the demographic population it is targeting.

The long-term benefits of this project include providing a safe social setting to learn, thereby helping relieve refugees of emotional trauma. Offering a digital platform for a child to learn also gives their parents time to do activities they need to do, such as searching for a job, or applying for a driving license, thereby allowing for better integration into U.S. society.

In today's current volatile world, it is important to note that many of these refugees are Africans, and they are subjected to racial discrimination, like the African Americans in society. There is an urgent need to address this issue, given what is happening in the world today. This growing gap in education between refugee children and American children will create a divide that will be too hard to close if the problem isn't addressed immediately. Thus, there is an urgency to create accessible educational tools and provide equitable education for all.

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