More Fun in the Philippines? Factors Affecting Transfer of Western Field Methods to One Developing World Context

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Abstract. This paper presents some of the challenges encountered by a field research team when deploying an educational game for Physics. These included problems with site infrastructure and institutional support, logistical challenges, compliance with ethics requirements, launch delays, and student inattention or misunderstanding of directions. The paper shares these experiences with the wider community to help fellow researchers prepare, should they decide to conduct field studies in the Philippines.

Keywords: intelligent tutoring systems · research methods · field study· Physics Playground

1 Introduction

In 2012, two experienced human-computer interaction researchers said, "Fieldwork takes you to strange locations to meet new people. Despite the best-laid plans, surprises will happen and some amount of mayhem will ensue [5]." Nowhere is this more true than during attempts to transfer software or field methods from a developed country to the developing world. Because the software or field methods are usually designed in and for developed countries, the assumptions made during the design process and the circumstances surrounding deployment vary, sometimes extremely, from ground conditions in other countries. When describing the deployment of an American intelligent tutoring system in Brazil, Ogan and colleagues [4] found that most students had no computers in their homes, that teachers had little to no technology expertise and were not familiar with ways in which computers could be used for education. On a technical level, schools had a limited number of computers for student use and the ones that were available were often riddled with viruses. Other barriers discussed extensively in [2] include data costs, Internet reliability, the availability and reliability of electricity, and localization of content in terms of both culture and language.

Since 2006, the Ateneo Laboratory for the Learning Sciences (ALLS) has been conducting field studies in different schools all over the Philippines. In [6], key members of ALLS documented five of the challenges of transferring Western educational software and study methods to the Philippines. As in both [2] and [4], [6] observed that the overall level of technology adoption for education was generally low and that technology infrastructure was generally limited. [6] further added that school support, while essential, was not always easy to obtain. Students were culturally conditioned to be respectful of authority, therefore the presence of observers sometimes had an effect on behavior. Finally, typhoons are common occurrences in the Philippines. In one field experiment, they disrupted data gathering and introduced a possible confound: post-traumatic stress.

The goal of this paper is to present the challenges that confronted another ALLS research team during a more recent study. The goal of the paper is to describe additional considerations that researchers should take into account when planning field studies.

"It's More Fun in the Philippines" is the country's official tourism tagline, which presents how otherwise mundane activities such as commuting (as seen in Fig. 1) are more fun in the country by highlighting places, activities, and artifacts that are uniquely Filipino.

Fig. 1. Example poster of the "It's More Fun in the Philippines" tourism campaign.

2 Description of the Field Study

Data from 180 students was collected over three weeks from January to February 2015 in three schools (Sites A, B, and C) in different regions of the Philippines. The goals of the study were to assess the persistence and affect of students using an educational game for Physics, and to determine any differences among the different regional groups. The subsections that follow describe the methods and materials used to these ends.

2.1 Learning Environment

Data was gathered from students using Newton's Playground (now Physics Playground, PP). PP is a computer game for physics that was designed to help secondary school students understand qualitative physics. Qualitative physics is a nonverbal, conceptual understanding of how the physical world operates [7].

PP is a two-dimensional computer-based game that requires the player to guide a green ball to a red balloon. Two example levels are shown in Fig.1. PP has 74 levels that require the player to guide a green ball to a red balloon. The game presents these levels divided into eight different playgrounds. The player achieves this goal by drawing agents (ramps, pendulums, springboards, or levers) or by nudging the ball to the left or right by clicking on it. The moment the objects are drawn, they behave according to the law of gravity and Newton's 3 laws of motion [7].

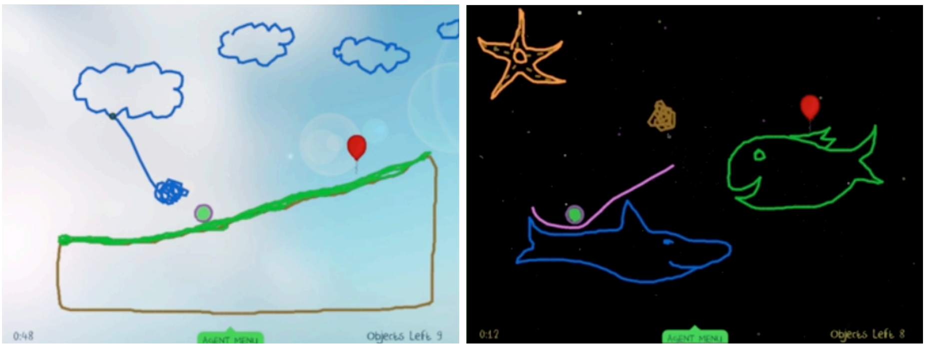

Fig. 2. Example PP levels.

A ramp is any line drawn that helps to guide a ball in motion. A ramp is useful when a ball must travel over a hole. A lever rotates around a fixed point, usually called a fulcrum or pivot point. Levers are useful when a player wants to move the ball vertically. A swinging pendulum directs an impulse tangent to its direction of motion. The pendulum is useful when the player wants to exert a horizontal force. A springboard stores elastic potential energy provided by a falling weight. Springboards are useful when the player wants to move the ball vertically. In Fig. 2, the level on the left requires a pendulum, and the level on the right requires a lever.

During gameplay, PP automatically generates log files. Each level a student plays creates a corresponding log file, which tracks every interaction the student has with the game in terms of particular counts and times for selected features of gameplay.

2.2 Participants

Data were gathered from 180 students in the Philippines, equally divided among three geographical locations in the country: 60 eighth grade students from Baguio City, 60 tenth grade students from Cebu City, and 60 eighth grade students from Davao City.

2.3 The Observation Protocol

The Baker-Rodrigo-Ocumpaugh Monitoring Protocol (BROMP) is a protocol for quantitative field observations of student affect and engagement-related behavior, described in detail in [3]. The affective states observed within Physics Playground in this study were engaged concentration, confusion, frustration, boredom, happiness, delight, and curiosity. The affective categories were drawn from [1].

Participants were divided equally among the two to three BROMP-certified observers present per session. Students were observed in 5 to 8 second intervals through each site's respective observation period, resulting in at least one observation per student per minute. If the student exhibited two or more distinct states during his or her respective observation period, the observers only coded the first state.

The observers recorded their observations using the Human Affect Recording Tool, or HART. HART is an Android application developed to guide researchers in conducting quantitative field observations according to BROMP, and facilitate synchronization of BROMP data with educational software log data.

2.4 Data Collection Methods

Before playing PP, students completed a demographics sheet and a 16-item multiple-choice pretest. Students then played the game for a certain period of time (i.e., 90 minutes in Site A, 75 minutes in Site B, and 30 minutes in Site C), during which the trained BROMP observers coded student affect and behavior on the HART application. After completing gameplay, participants completed a 16-item multiple-choice posttest. The pretest and posttest were designed to assess knowledge of physics concepts, and have been used in previous studies involving PP [7].

3 Challenges Encountered

Poverty is intrinsic to the Philippine situation, and as such, the adoption of information and communication technologies (ICTs) in the classrooms of the Philippines has been slow and marred by hindrances and limitations. Of the 46,000 public schools run by the country's Department of Education (DepEd), for example, about 8,000 have no power, and even more have no connectivity. There also exists a tremendous need for ICT integration in pre- and in-service teacher training in order to gain appreciation for the use of technology in the curriculum and in the classroom.

As in [6], infrastructure and institutional support remained challenging. This field study also introduced new challenges in terms of logistics, compliance with ethics requirements, launch delays, and student inattention or misunderstanding of directions.

3.1 Infrastructure

In preparation for data gathering, arrangements were made with on-site counterparts to have the software installed and tested prior to the arrival of the research team. PP requires several peripherals in order to launch smoothly. An error thrown by any of these necessary components can cause faulty data capture, which can result in having to throw out gathered data, or cause the game not to run at all. The three main components necessary for PP to run are 1) the software itself, 2) a steady Internet connection not blocked by a firewall or proxy, and 3) a webcam to record the participants' facial expressions.

A previous research project outside of this project's scope already required the team to install and debug the system in the past. Hence, the research team had solutions to problems encountered before. Site A, however, experienced problems with the installation of the software and hardware drivers, which required around three hours of debugging possible conflicts in the computer laboratory's system configurations, including webcam driver incompatibilities and the unstable Internet connection. PP had been running smoothly on one machine, but continued to encounter launch errors on every other machine in the computer laboratory. The team eventually found that the machines were configured to use a virtual environment, which was causing conflicts with the PP software installation and webcam drivers. Once the virtual environment was disabled, PP ran smoothly.

PP's Internet connection posed a technical challenge. The Internet connection was essential for the game's timing functionality to run smoothly. The timing functionality's main purpose is to synchronize all interaction events with Internet time, allowing for a unified set of timestamps for all the participants, as well as for the BROMP coders. Having to synchronize multiple data sources (including human-recorded data) into a single time-stream is a challenge all on its own; having to deal with time inconsistencies in the process makes the task much harder, and the resulting analyses less accurate.

This timing functionality on PP can be turned off optionally (though it is not advised), requiring the research team to take note of session start times manually. Computer labs are usually protected by firewalls and proxies, and as such, the research team had made it a point to request for a firewall exception and for proxies to be disabled a week before data gathering. The research team had to disable the timing functionality of the software in Site B because the administration would not allow addition of a firewall exception for the timeserver. Another solution to this issue could be the use of a local time server.

Another critical issue of PP is that, in order to ensure that the interaction logs and video files are properly saved to secondary storage, the software must exit cleanly. On several occasions, the research team observed that the software did not exit properly. This was consistently experienced in Site B, wherein the software had to be forcefully terminated before log files could be retrieved from temporary folders. Conversely, the problem was only encountered on two occasions in Site A, and never in Site C.

3.2 Institutional Support

Institutional support, in this case, refers to the willingness of the institution to participate in the study and their readiness to make adjustments to accommodate the arrangements required to properly conduct the study. These adjustments include, but are not limited to, scheduling of the experiment and access to the computer laboratories and the students.

The research team received some resistance from the school administration in Site B. Consent forms had been distributed to participants a week prior to data gathering, but had not been collected at the time of the research team's arrival. This caused concerns about research methods and scheduling, which ultimately led to the delay in system configuration and installation. School officials did not allow the local ground team to begin software and hardware installation until two days before the beginning of data gathering. Fortunately, installation and launching in Site B ran smoothly, and data gathering was able to proceed as scheduled.

The study was designed to be conducted over a period of three hours, allotting 30 minutes each for both the pretest and posttest, as well as delays in arrival and about 90 to 120 minutes of interaction with the software. Site B allotted only two hours for each session, including buffers for delay in arrival, introductions, and the administration of the pretest and the posttest. As a result, students were only able to interact with the software for 70-75 minutes per session.

Site C posed the most limitations in the schedule for data gathering. Instead of the prescribed three-hour period, each session was only allotted about 90 minutes, including the delayed arrival of the participants and the administration of the pretest and the posttest. To maximize the allotted time, PP was launched on each system before the participants arrived, which minimized the problems usually encountered when launching the software. As a result, students only interacted with the software for 30-45 minutes.

The final component of the study's design was the administration of a delayed posttest. Local teams in each site were instructed to administer a posttest exactly one week after a participant's interaction with the software. Due to the limited time, restricted by the school's schedule of activities as they were already on their final weeks of the semester, the delayed posttest was not administered to participants in Site C.

3.3 Logistics

Two local high schools took part in the study in Site A. Students here needed to travel from their high school campuses to the site where the study was conducted. School A had asked the research team to arrange for transportation of their participating students one week ahead of data gathering: from their high school to the data gathering venue, and vice versa once the session was over. As a result, members of the team were able to commission transportation for the 30 students coming from School A.

Conversely, School B instructed their students to proceed to the venue on their own. Because students had to manage their own transportation and because their commute was not properly managed, more than half of the time allotted (i.e., about an hour and a half) for the data gathering session was spent waiting for the participants to arrive. The delay caused the research team to shorten the interaction time with the software. For the succeeding groups of students from School B, the research team hired a shuttle service to transport the students to the venue in order to ensure timely arrival.

3.4 Compliance with Ethics Requirements

In line with university's guidelines on ethical research, the team was required to prepare and collect informed consent forms from each participant and his/her parents. While the study's data collection methods were non-invasive, the requirement applied to this study because interacting with the software required capturing the participant's face on video throughout the session.

Although arrangements were made with the partner schools in advance, only School A in Site A was able to distribute and collect the consent forms prior to the scheduled data gathering sessions. In effect, counterparts in Site A collected the consent forms from School B after the study was conducted, then sent the forms to the research team via courier. Similarly, counterparts in Site B also collected the consent forms one week after the study was conducted, and scanned copies were electronically sent to the research team.

Site C, being the last leg in the data gathering push, presented the most difficulty as their school year was already coming to a close. A week after data gathering had concluded, the research team’s main counterpart in Site C said that, with the limited time and schedule constraints, it was going to be impossible to distribute and collect the consent forms. The team reached out instead to another member of the local team in Site C, and only after explaining the gravity of the situation and offering to compensate whoever can get it done was the request obliged. Consent forms were distributed, collected, and mailed back to the research team via courier within a week after contracting help.

3.5 Launch Delays

When launching PP, a number of technical problems sometimes occur. Most frequently, if the Internet is unstable when the game is launched, an error message will pop up saying that the game was unable to connect to the timeserver. Launching the game again usually resolves this issue. If the problem persists, however, the team had to resort to disabling the timing functionality of that specific machine.

Another frequent error that occurs has to do with the webcam malfunctioning. Previous experience with the webcam and its connection to PP has shown that when other applications on the machine are using the webcam, it was likely to malfunction when PP was launched. As a result, the research team usually quit all webcam-related software before launching PP. Webcam-related errors popped up on several occasions in Site A and Site B. Quitting and launching the game again usually resolves the problem as well.

Also, in order to better manage webcam software, the research team had its own set of webcams, which they install onsite immediately before data gathering. In Site C, however, because the school's officials wanted all students in each of the three participating classes to take part in the study, the research team had to use the built-in webcams of the site's machines. These built-in webcams had built-in webcam software that would pop up every time PP was launched. Because data gathering in Site C was already very limited time-wise, the research team resolved to launching the game before students arrived in order to address all launch delays before the session began.

3.6. Inattention to Directions

Not listening, reading, understanding, and paying attention to instructions also contributed to delays in gameplay. Because the timeserver synchronizes all student interactions in its logs with Internet time, it is important that all participants in each session begin at the same time. Once PP is launched, participants are asked to input a username (which is provided to them upon arrival), and to press OK. Participants will then be presented another screen to read, shown in Fig. 3, telling participants to wait for the moderator's go signal before pressing OK again. Clicking this OK button launches the game and begins the logging sequence.

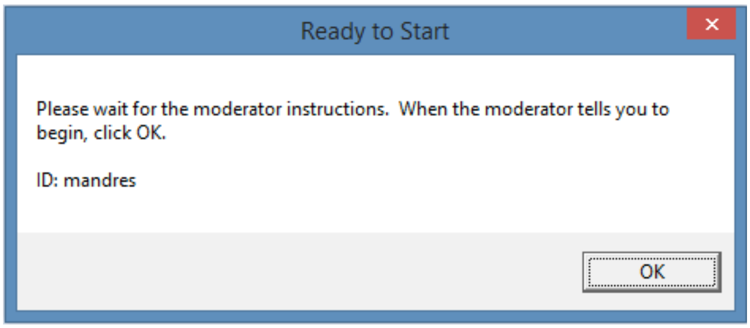

Fig. 3. Instruction screen telling participants to wait.

Participants are given the instructions to wait both verbally through the moderating member of the research team, and in writing through the pop-up screen in Fig. 3. Despite these, however, members of the research team have had to quit a game that was launched prematurely about two times every session. Once everyone is back on this screen and waiting for the go signal, participants are instructed to press OK, after which they are presented with a tutorial on how to play the game.

This tutorial ends with a string of text, instructing the students to "hit ESCAPE and select 'Quit'," as shown in Fig. 4. The research team noticed that almost half the participant population in each session gets stuck on this screen, possibly waiting for an "ESCAPE" button to come up on screen, as opposed to tapping the Escape button on the keyboard, which in turn brings the menu up, and allows the participants to click "Quit", which then brings them back to the game's main screen where they can choose what level they want to play.

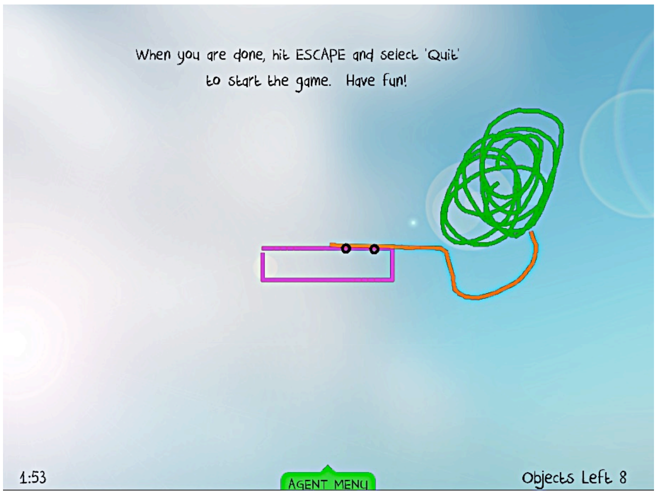

Fig. 4. Hit ESCAPE instruction.

4 Discussion and Conclusions

In an extensive literature review, [2] regards the Philippines as a significant producer of intelligent tutoring systems research outside of high-income nations. This finding implies an openness to new technology as well as commitment of Filipino researchers to collaborate with their counterparts abroad and to shepherd the deployment and study of technology use to improve educational institutions. However, many factors on the ground prevent adoption of these technologies. This paper describes some of the challenges that a Philippine team had to overcome to gather data from three local sites.

Infrastructure and institutional support were major roadblocks in the research method's smooth implementation. The learning environment used had three main components: the software itself, a stable Internet connection not blocked by a firewall or proxy, and a webcam. Any error produced by any of these three components results in faulty log capture, which eventually leads to data being thrown out. Having to ensure that each component runs without error in three separate data gathering sites in a country where education is only beginning to embrace the use of ICTs was the study's biggest hurdle to overcome. On top of this, resistance from and miscommunication with school administrators had caused the delay of both hardware/software setup and compliance with ethics requirements. The other challenges encountered during the study's execution were transportation arrangement, launch delays, and the students' inattention to directions.

All these challenges taken into consideration, there were some lessons learned in the process. In terms of dealing with institutional support and ethics compliance, starting the process early of arranging for data gathering schedules and the efficient distribution and collection of ethical consent forms. Avoiding the conduct of studies towards the end of the school year will give both the researchers and the partner institutions more time to fix issues that may have arisen during research execution. In terms of research execution itself, controlling transportation to and from the data gathering sites will ensure the participants' timely arrival, which is important especially when you are given only a certain number of hours for the session.

For educational technology adoption to widen, researchers must continue to plan for and address these challenges, and to share these experiences with the wider community to inform like-minded researchers about what to expect when conducting fieldwork in the Philippines.

Acknowledgements. We would like to thank the Bro. Robbie Paraan, S.J., Cecilie Villacrucis, and the officials at University of the Cordilleras, Bakakeng National High School, Ateneo de Davao University, Sacred Heart School – Ateneo de Cebu, Drs. Valerie Shute, Matthew Ventura, and Matthew Small of Florida State University for collaborating with us. This study was made possible through a grant from the Philippines' Department of Science and Technology Philippine Council for Industry, Energy and Emerging Technology Research and Development entitled "Stealth assessment of student conscientiousness, cognitive-affective states, and learning using Newton's Playground."

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