

Student Off-Task Behavior in Computer-Based Learning in the Philippines: Comparison to Prior Research in the USA

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Over the last several decades, there has been considerable evidence that off-task behavior is less common in East Asia and Southeast Asia than in the United States. However, comparisons have been confounded along several dimensions, including differences in curricula and research methods. In this paper, we use quantitative field observations in three studies to compare the rates of off-task behavior and other disengaged behaviors among students in the Philippines and USA. In each study, students use the same intelligent tutoring software, controlling for both curriculum and study method. We find that students in the Philippines exhibited significantly less off-task behavior than students in the USA. However, another form of disengaged behavior, termed gaming the system, appeared to be more common in the Philippines. In follow-up studies, we study other school settings and other adaptive educational technologies in the Philippines, finding similarly low levels of off-task behavior. These findings suggest that international differences in off-task behavior are not just due to confounds in curriculum or research methods. However, at the same time, these findings suggest that disengagement may differ internationally in more complex fashions than was previously thought.

INTRODUCTION

Off-task behavior has been viewed as a major problem in North American and European schools for over a century (Currie, 1884, cited in Berliner, 1990), and it remains a concern today

(Blatchford, Bassett, & Brown, 2005; Public Agenda, 2004). Off-task behavior can be defined as any behavior that does not involve the learning task or material, or where learning from the material is not the primary goal (Karweit & Slavin, 1982). Off-task behavior can take a number of forms, including off-task conversation with other students (or the teacher), interacting with materials other than the learning materials (such as a magazine), and sleeping in class (see Allday & Pakruar, 2007). Over the last several decades, there has been considerable evidence that off-task behavior is less common in East Asia and Southeast Asia than in the United States. However, comparisons have been confounded along several dimensions, including differences in curricula and research methods. In this paper, we examine the differences in the off-task behavior exhibited by students in the Philippines and in the USA, using the same educational software and study protocol. We use field observation methods to estimate the incidence of off-task behavior in each setting, as well as another disengaged behavior common in intelligent tutoring systems: gaming the system (Baker, Corbett, Koedinger, & Wagner, 2004). We also observe students in the Philippines using additional types of educational software, to validate that the pattern of off-task behavior seen in that first study is not characteristic of only one piece of educational software.

Understanding whether the national difference in off-task behavior previously studied in traditional classrooms will hold in educational software (which interacts with students in the same fashion in every country), will help us to narrow down which factors explain those previous observations.

OFF-TASK BEHAVIOR: THEORETICAL PERSPECTIVES AND PAST RESULTS

A common belief about off-task behavior is that every moment spent off-task, however it is used, is time not spent learning. This view was first expressed as an explicit theoretical hypothesis in Carroll's (1963) Time-on-Task hypothesis, within the Model of School Learning. This hypothesis is also found in later models of school learning, such as Bloom's (1976) Theory of Human Characteristics and School Learning, and Fisher et al.'s (1980) Academic Learning Time construct.

The relationship between off-task behavior and learning has not been universally negative (e.g., Fredrick, Walberg, & Rasher, 1979; Karweit and Slavin, 1981; Kreijns, 2004), but the preponderance of evidence appears to suggest that off-task behavior is associated with poorer learning in a variety of instructional settings (Lahaderne, 1968; Cobb, 1972; McKinney et al., 1975; Fredrick & Walberg, 1980; Karweit & Slavin, 1981, 1982; Caldwell et al., 1982; Rossmiller, 1986, cited in Berliner, 1990; Goodman, 1990; Lee, Kelly, & Nyre, 1999; Baker, Corbett, Koedinger, & Wagner, 2004). In particular, the few results where off-task behavior was not associated with poorer learning appear to be primarily in collaborative learning settings, where off-task behavior may improve classroom social relationships, resulting in improved participation and more effective collaboration (Kreijns, 2004).

The concern with off-task behavior, and the underlying disengagement that it reflects, has continued even as classroom pedagogy changes. Increasingly, classroom learning involves not just learning from teachers, classmates, and books, but also from working with adaptive educational technologies such as intelligent tutoring systems (Koedinger & Corbett, 2006). Though some research has suggested that this type of technology increases engagement compared to traditional curricular approaches (Schofield, 1995), off-task behavior persists in classrooms using adaptive learning technologies (see Baker, Corbett, Koedinger & Wagner,

2004; Rowe et al., 2009; Cetintas et al., 2009). In addition, new forms of disengagement emerge in students using adaptive educational technologies, perhaps most notably “gaming the system,” in which the student attempts to succeed in an educational environment by exploiting the properties of the system rather than by learning the material and using that knowledge to answer correctly (Baker, Corbett, Koedinger, & Wagner, 2004). Examples of gaming the system include repeatedly and systematically guessing, and rapidly requesting additional hints until the software gives the student the answer.

In accordance with the evidence that off-task behavior is associated with poorer learning, and the belief that modifying pedagogical approaches can improve engagement (Bozack et al., 2008; Kelly & Turner, 2009), a number of projects in the last 20 years have attempted to decrease students’ off-task behavior (Abramowitz, O’Leary, & Rosen, 1987; Moore, Sweeny, & Butterfield, 1993; Reid & Harris, 1993; Dalton, Martella, & Marchand-Martella, 1999; Clare et al., 2000; Brooks et al., 2003). Approaches that focus on self-modeling and self-monitoring have been particularly successful (Clare et al., 2000; Brooks et al., 2003; Dalton et al., 1999). Many successful interventions for off-task behavior, however, are relatively difficult to scale across entire classrooms, and hence the vision of universal interventions (cf. Walker, et al., 1996; Kerr & Nelson, 1998) for off-task behavior that are as effective as individualized classroom management has still not been realized.

OFF-TASK BEHAVIOR IN EAST ASIA AND SOUTHEAST ASIA

One path that has been suggested for understanding how to address off-task behavior in the United States is to study classrooms where off-task behavior is less common, in order to understand why off-task behavior is less common in those settings (Winter, 1991). In specific,

researchers have noted that classrooms in East Asia and Southeast Asia appear to have less off-task behavior than classrooms in the United States. While teachers in these regions often report off-task behavior as a problem in their classrooms (Winter, 1991; Weisz et al., 1995), students engage in significantly less off-task behavior in Asian classrooms than in Western classrooms. Weisz et al. (1995) report an average of half as much off-task behavior in classrooms in Thailand as in classrooms in the USA, using similar field observation methods. Multiple reports have suggested that off-task behavior is quite rare in Japanese classrooms as well (Abiko & George, 1986; Bennett, 1987). These findings have led researchers to suggest that off-task behavior may be a key component of differences in educational outcomes between East/Southeast Asia and the United States, and that bringing off-task behavior in US classrooms into line with East and Southeast Asian classrooms may help to close this gap (see Chase & Mueller, 1989).

It is not clear, however, that instructional strategies from Asian classrooms will be successful in reducing off-task behavior and improving learning in American classrooms. Importantly, it remains unclear why students go off-task to such different degrees in Asian and Western classrooms. Thus far, a primary hypothesis for this difference is that cultural factors, including the cultural characteristics of both students and teachers, explain the difference in incidence of off-task behavior (Abiko & George, 1986; Winter, 1991; Weisz et al., 1995). Though there are many cultural differences between East and Southeast Asian cultures, some characteristics are relatively common across cultures in this region. One key cultural difference between Western students and East and Southeast Asian students is the individualist/collectivist dimension. Americans in particular typically describe themselves as individualistic (Welzel, 2006; Inglehart, 2009; Hofstede et al., 2010). Compared with East and Southeast Asian students, Western students prefer to choose their own goals and to have more exciting, varied experiences.

Southeast Asian students, on the other hand, describe themselves as obedient and tend to value collectivistic traits such as honoring their elders (Grimm et al., 1999; Helmke & Vo, 1999; Welzel, 2006; Inglehart, 2009; Hofstede et al., 2010). Lynch (1984) argues that behaving in a socially acceptable fashion is more important in the Philippines than in the USA, and Filipino students tend to blend their authority figures' wishes, expectations, goals, and standards into their own personal motivations (Bernardo, 2008). Similar patterns have been observed in Chinese learners as well (Tweed & Lehman, 2002), compared with learners in Western countries. In cultures that value individualism, people's life satisfaction is seen as being a result of the experience of positive emotions (Suh et al., 1998). In collectivist cultures, life satisfaction stems equally from respecting social norms and experiencing positive emotions (Suh et al., 1998). Another key cultural difference is the value given to studying and academic effort. Chinese and Japanese parents tend to place much greater emphasis on studying and academic effort than American parents do (Stevenson & Lee, 1990; Stevenson, Chen, & Lee, 1993), and tend to rate their children as lower-performing (Stevenson, Chen, & Lee, 1993), causing them to emphasize effort to a greater degree. For this reason, Stevenson, Chen, and Lee (1993) argue that "the achievement gap... is unlikely to diminish until, among other things, there are marked changes in the attitudes and beliefs of American parents and students about education." Similar patterns were found between Vietnamese and German students, where Vietnamese students reported putting significantly more value and effort into academic activities than German students (Helmke & Vo, 1999).

However, it is difficult to be certain how large a role cultural differences play in driving student behavior, because curricula also vary widely between countries (Ginsburg et al., 2005; Stigler et al., 1997). Differences in curricula can have substantial impacts on student engagement

in learning (e.g., Schofield, 1995), suggesting that differences in curricula may pose an alternate explanation for why off-task behavior is less common in East Asia and Southeast Asia.

Determining whether cultural or curricular factors are a better explanation of the difference in off-task behavior between countries will be an important step in understanding the roots of disengagement worldwide. If curricular factors better explain the difference, it would suggest that more research should go into determining which curricular differences reduce off-task behavior. These differences could then be adapted relatively smoothly by classrooms in countries where off-task behavior is more common. By contrast, if differences are culturally driven, the challenge will be greater. Cultural factors are fairly stable over time and difficult to intentionally manipulate (Hofstede, Hofstede, & Minkov, 2010), though systemic school reform projects have been successful at changing classroom culture in specific schools (see Ross et al., 2007). Hence, a finding that differences in off-task behavior are culturally driven would indicate that it will be challenging (though not necessarily impossible) to use practices from Asian classrooms to influence off-task behavior in American classrooms. An understanding of which hypothesis better explains international differences in off-task behavior has the potential to guide future research on how to influence off-task behavior in countries where it is prevalent.

However, the interpretability of research on international differences in off-task behavior has generally been limited by two confounding factors. First, research on off-task behavior in East Asian and Southeast Asian settings has often been conducted using different protocols (and by different research groups) than research in Western classrooms. It has been shown that even small differences in research protocol can lead to substantial differences in observed off-task behavior (Karweit & Slavin, 1981, 1982). Second, most research has confounded culture with curriculum and teaching practices. In the cross-cultural comparisons listed above, students using

different curriculum have been compared. Even if the same textbook is utilized in two countries, teachers may utilize it differently. Within this paper, we present studies designed to address these limitations.

FACILITATING CROSS-CULTURAL COMPARISON WITH INTELLIGENT TUTORING SYSTEMS

Recent developments have increased the feasibility of studying off-task behavior in different countries in a less confounded fashion. Specifically, adaptive learning technologies such as intelligent tutoring systems are now becoming increasingly incorporated into classrooms worldwide. Intelligent tutors are a type of educational technology that pose problems for students to solve and provides hints and feedback tailored to their individual learning. The most widely used intelligent tutoring system in the United States is the Cognitive Tutor software for mathematics, which is now used by 6% of high school students nationwide each year (Koedinger & Corbett, 2006). Intelligent tutoring software behaves in a predictable fashion no matter which student is using the software, reducing potential curricular confounds between countries. While some researchers have proposed that intelligent tutors should interact differently with learners in different countries (cf. Blanchard & Ogan, 2010), an intelligent tutor not designed specifically to do so will produce the same baseline experience for students in two different countries, with differences driven solely by the actions of the student himself or herself. As such, these tutors may serve as a useful tool for studying differences between learners in different countries.

The use of intelligent tutors as a tool for international research was pioneered by Nicaud and colleagues (2006), who presented a comparison of tutor use in India and France, finding that students tend to work at a similar rate in India and France, but persevere to a greater degree in

India. Another study using tutors as a tool for international research was conducted by Baker and colleagues (2010), who studied the dynamics of academic emotions of students using intelligent tutors in the Philippines and USA, finding similar patterns between countries. Ogan and colleagues (2012), however, have found that collaborative patterns among students using intelligent tutoring systems differ considerably between Latin America and the USA. Hence, adaptive educational technologies appear to be a reasonable context in which to study international differences.

Furthermore, off-task behavior is sufficiently common in these types of educational technologies to make it feasible to study the behavior. In a study involving observations of 70 middle school students in two Pennsylvania schools, Baker, Corbett, Koedinger, & Wagner (2004) found students to be off-task 15% of the time while using Cognitive Tutor software for mathematics. In a study involving observations of 179 eighth-grade students in North Carolina, Rowe et al. (2009) found students to be off-task 15% of the time while using an intelligent tutor for science. In a longitudinal study involving 18 observation sessions of 12 elementary school students in Indiana, Cetintas et al. (2009) found students to be off-task 33% of the time while using an intelligent tutor for mathematics. Overall, these studies find a proportion of off-task behavior similar to the prevalence seen in classrooms using more traditional instructional methods (Lee, Kelly, & Nyre, 1999; Lloyd & Loper, 1986).

Since intelligent tutoring systems control for curricula without reducing off-task behavior, they provide an opportunity to study the differences in off-task behavior between countries. So far, however, there has been no research comparing off-task behavior within intelligent tutoring systems between Western countries such as the United States, and countries in East Asia and Southeast Asia. To our knowledge, the only published study of student off-task behavior in these

regions within intelligent tutoring systems involved university students (Gobel, 2008), a population that differs considerably from the high school, middle school, and elementary school students primarily studied in the United States.

RESEARCH FOCUS

In this paper, we examine the differences in the off-task behavior of students using intelligent tutoring software in the Philippines and the USA. We investigate whether Filipino students using intelligent tutors exhibit significantly less off-task behavior than American counterparts, in line with the previously observed patterns of off-task behavior in traditional classrooms in East Asia and Southeast Asia. To answer this question, we observed students in both the USA and the Philippines, using the exact same educational software and study protocol. The protocol is focused on estimating the incidence of off-task behavior, as well as another disengaged behavior common in intelligent tutoring systems: gaming the system (Baker, Corbett, Koedinger, & Wagner, 2004). We also observed students in the Philippines using additional types of educational software, to validate that the pattern of off-task behavior seen in that first study was not characteristic of only one piece of educational software.

Understanding whether the national difference in off-task behavior previously studied in traditional classrooms will hold in educational software, will help us to narrow down which factors explain those previous observations. If off-task behavior in educational software is comparable in the USA and the Philippines, it will suggest that differences in classroom practice and/or curricular design are more likely to explain the differences in off-task behavior. By contrast, if off-task behavior is more common in the USA even in educational software, it will suggest that cultural factors are the more likely explanation.

STUDY ONE

In our first study, we analyze the frequency of off-task behavior among roughly similar populations of students in the United States and Philippines, using the exact same educational software and the same study protocol.

POPULATION OF RESEARCH (STUDY 1)

This study compares two groups. The first group consisted of 53 students from two public schools in the suburbs of Pittsburgh, PA. The second group consisted of 60 students from a large public school in an urban area of Quezon City (a part of Manila), the Philippines.

There is no easy matching of schools between the Philippines and the USA, as the overall structure of how cities and metro regions are organized and populated differs greatly between the USA and Philippines, but efforts were made to ensure that the American population and Filipino population represented comparable demographics within their respective countries. The participating schools in both countries consisted predominantly of students from the local ethnic majority (i.e., Filipino students in the Philippines, white students in the USA). In both countries, students were drawn from a population which was neither unusually wealthy nor experiencing unusual degrees of poverty. Students in the USA were in mainstream mathematics classes (neither gifted nor special needs), and students in the Philippines were in both “science” and mainstream mathematics classes (neither of these tracks were gifted nor special needs, however the science track is considered to be more academically rigorous than the mainstream track). Both populations had an approximately equal number of males and females. In both countries, student ages ranged from approximately 12 to 14.

One difference between the populations was in terms of prior use of adaptive educational technology. The schools in the USA regularly use intelligent tutoring systems and related types of educational software, whereas the schools in the Philippines do not typically use these technologies. Rather than a confound, we consider this an inherent attribute of learning in the two settings in the early part of the 20th century – intelligent tutors and other types of adaptive educational technologies are now a routine part of education in many American schools, but remain rare in public schools in the Philippines (Rodrigo, 2004). The uptake of educational technology is driven both by economic and cultural factors, and as such is part of the “natural” or ecologically valid conditions of learning today, in different settings. In other words, if a school in the Philippines in the year 2012 routinely used intelligent tutoring software for instruction, it would be sufficiently atypical of schools in the Philippines to raise questions about the validity of conclusions for the general population of Filipino students.

SYSTEM USED (STUDY 1): COGNITIVE TUTOR

In both the USA and Philippines, students in Study 1 used a short Cognitive Tutor unit on scatterplot generation and interpretation (Baker, Corbett, Koedinger, & Wagner, 2004). Within Cognitive Tutors, each student works individually with the computer software to complete mathematics problems. A Cognitive Tutor breaks down each mathematics problem into the steps necessary to solve it, making the student’s thinking visible. As a student works through a problem, a running cognitive model assesses whether the student’s answers map to correct understanding or to a known misconception (Anderson, Corbett, Koedinger, & Pelletier, 1995), and errors are flagged. Cognitive Tutors give tailored feedback when a student’s answer is indicative of a known misconception. In addition, Cognitive Tutors offer multi-level on-demand

hints to students. When a student requests a hint (by clicking a button), the software first gives a conceptual hint. The student can then request further hints, which become more and more specific until the student is given the answer. The hints are context-sensitive and tailored to the exact problem step the student is working on. In addition, the problems a student receives are individualized based on automated assessments of how well the student understands the mathematical skills and concepts taught in the lesson (a discussion of the computational approach used to produce these assessments is given in Corbett & Anderson, 1995).

STUDY METHOD

In both the USA and Philippines, students used the tutor software for 80 minutes. However, due to the different time scheduling practices of the schools, students in the USA used the software during two sessions on separate days whereas students in the Philippines used the software during a single session. In both the USA and Philippines, students had not explicitly covered scatterplots in class prior to the study. Before using the software, students viewed conceptual instruction, delivered via a PowerPoint presentation with voiceover and some simple animations.

We repeatedly collected data on each student's pattern of behavior during tutor usage, using the quantitative field observation method from (Baker, Corbett, Koedinger, & Wagner, 2004). In this method, each observation lasted twenty seconds, and the coder repeatedly observed each student in a specific order determined before the class began. During each observation, the observers stood diagonally behind or in front of the student being observed and avoided looking at the student directly (cf. Baker, Corbett, Koedinger, & Wagner, 2004), in order to make it less clear when an observation was occurring and to minimize the risk of observer effect. Any behavior by a student other than the student currently being observed was not coded. Each

observation lasted for 20 seconds – if a student was inactive for the entire 20 seconds, the student was coded as being inactive. If two distinct behaviors were seen during a single observation, only the first behavior observed was coded.

Behavior categories were coded using the following coding scheme (cf. Baker, Corbett, Koedinger, & Wagner, 2004):

1. **On-task** – working within the tutor
2. **On-task conversation** – talking to the teacher or another student about the subject material or tutoring software
3. **Off-task conversation** – talking about any other subject
4. **Off-task solitary behavior** – any behavior that did not involve the tutoring software or another individual (such as reading a magazine or surfing the web)
5. **Inactivity** – instead of interacting with other students or the software, the student instead stares into space or puts his/her head down on the desk.
6. **Gaming the System** – systematic and rapid submission of incorrect answers or use of help, with several such actions taking place during the 20-second observation period. Gaming has been found in the USA to be associated with significantly poorer learning (Baker, Corbett, Koedinger, & Wagner, 2004), is associated with boredom (Baker et al., 2010), and with negative attitudes towards computers and mathematics (Baker et al., 2008).

For the purposes of this study, coding categories 3-5 were considered off-task.

The observation team in the Philippines was led by the first author, while the observation team in the USA was led by the second author. In each setting, there were three observers, only two of whom recorded observations during any given study session. The first and second authors have collaborated repeatedly on the use of quantitative field observation methods (see Rodrigo, et al., 2007), and significant effort was made to use identical observation procedures and coding schemes. The primary difference was that students used school computer labs in larger groups in

the USA than in the Philippines, a standard practice in the schools due to the number of computers available. As a result, fewer observations were coded per student in the USA than in the Philippines (similar numbers of students used the software for the same amount of time in both countries, but there was significantly more total coder time in the Philippines due to the smaller groups using the software at any given time). In the USA, 490 field observations were conducted, for an average of 9.2 per student. In the Philippines, 1251 field observations were conducted, for an average of 20.9 per student.

Both teams conducting observations in the current study have previously achieved inter-rater reliability between 0.70 and 0.85 when coding student behavior with this method (Baker, 2007; Rodrigo et al., 2007; Baker & de Carvalho, 2008; Rodrigo et al., 2008; Baker et al., 2011), and observations of this type have been used to develop automated detectors of student off-task behavior which can predict student post-test scores (Baker, 2007; Cetintas et al., 2009). (We do not use off-task behavior detectors in this paper because they have not yet been validated to be accurate across different cultures).

RESULTS

[Place Table 1 approximately here]

From the quantitative field observations, we computed an approximate percentage of time that each student was off-task and then calculated the average time off-task for each group under

study. The incidence of off-task behavior was highly different between the students in the USA and the Philippines, as shown in Table 1.

Students in the USA were off-task an average of 19.7% of the time ($SD = 17.8\%$), which is within the typical range reported in traditional classrooms in the USA and similar to the proportions observed in prior research conducted with intelligent tutoring systems in the USA. By contrast, students in the Philippines were off-task an average of 2.7% of the time ($SD = 5.2\%$). The difference between off-task behavior in the two countries was large – a 3.26 SD difference. This difference was statistically significant, $t(111) = 7.02$, $p < 0.0001$.

Interestingly, however, the proportion of gaming the system was higher in the Philippines than in the United States. Students in the USA gamed the system about 5.3% of the time ($SD = 9.9\%$), in line with gaming frequencies observed in previous studies of the scatterplot tutor lesson (Baker, Corbett, Koedinger, & Wagner, 2004). Students in the Philippines gamed the system about twice as much: 10.7% of the time ($SD = 15.3\%$). The difference in gaming frequency between the two countries was considerable, though smaller than the difference in off-task behavior – a 0.54 SD difference. The difference in gaming frequency was statistically significant, $t(111) = 2.17$, $p = 0.03$.

As such, the frequency of off-task behavior was substantially lower in the Philippines than in the USA, corresponding to previous results along these lines in traditional curricula. However, students in the Philippines may have simply replaced off-task behavior with gaming the system, a different disengaged behavior. We return to this possibility – and its implications – in the discussion section of this paper.

STUDIES TWO AND THREE

The results of the first study suggest that students in the Philippines are off-task a significantly lower proportion of the time than students in the USA, when using the exact same curriculum and when studied using an identical protocol.

In the second and third studies presented in this paper, we investigate the possibility that this difference may be isolated specifically to the Cognitive Tutor software used in that study; that perhaps there is some factor of Cognitive Tutor software that specifically engages students in the Philippines. To this end, we study students using two additional intelligent tutoring systems. These two studies are conducted with an identical observation protocol to the protocol used to study off-task behavior in the Scatterplot Tutor. In specific, we study students using Aplusix and Ecolab/M-Ecolab. We also study a broader sample of students, to establish the general nature of the findings of Study One – moving from public schools to private schools, a broader age range, and including schools in a second province of the Philippines, Cavite. Details on the two systems and the populations are given in the following sections.

SYSTEM USED (STUDY 2): APLUSIX

Aplusix (Nicaud et al., 2004, 2007) (<http://aplustix.imag.fr/>) is an intelligent tutoring system for mathematics. Topics are grouped into six categories (numerical calculation, expansion and simplification, factorization, solving equations, solving inequations, and solving systems), with four to nine levels of difficulty each. Aplusix presents the student with an arithmetic or algebraic problem from a problem set chosen by the student and allows the student to solve the problem one step at a time, as he or she would using a paper and pen. At each step, Aplusix displays

equivalence feedback: two black parallel bars mean that the current step is equivalent to the previous step, while two red parallel bars with an “X” mean that the current step is not equivalent to the previous step. This informs the student about the state of the problem in order to guide him or her toward the final solution. Students can end the exercise when they believe they are done. Aplusix then tells the student whether errors still exist along the solution path or whether the solution is not in its simplest form yet. The student has the option of looking at the solution, a “bottom out” hint with the final answer.

POPULATION OF RESEARCH (STUDY 2)

Data were collected in four private schools in Metro Manila and one in Cavite, a province to the south of Metro Manila. Participants included 140 students in the first year of high school, and 29 middle school students, aged 12 to 15. The high-school students had approximately equal proportions of males and females, while the middle-school students were all male (they were studying at an all-male school). All students were using the software for the first time. The students used the software for 40 minutes. Observations were conducted by pairs of two observers, out of a pool of four observers. A total of 3,640 observations were collected from the high school students, with average inter-rater reliability of $\kappa = 0.78$ across pairs of observers. 696 observations were collected from the middle school students, with average inter-rater reliability of $\kappa = 0.62$ across pairs of observers.

SYSTEM USED (STUDY 3): ECOLAB/M-ECOLAB

Ecolab is educational software designed to help students learn the ecological and feeding relationships between different animal species (Luckin & du Boulay, 1999). Ecolab is based on

the metaphor of an ecology laboratory and enables learners to add plants and animals to a virtual environment as well as to view that environment from different perspectives such as an energy view or a web diagram.

M-Ecolab extends Ecolab to incorporate motivationally adaptive scaffolding (Rebolledo-Mendez, du Boulay, & Luckin, 2006), adding an affective companion, Paul. If M-Ecolab detects that the student is currently in a low state of motivation, Paul appears with a worried facial expression and says: “You’re doing well but now try to do even more actions within the activity and if you make an error try again to do the correct action!” A more detailed description of M-Ecolab’s motivational support is provided in (Rebolledo-Mendez, du Boulay, & Luckin, 2006).

POPULATION OF RESEARCH (STUDY 3)

The Ecolab/M-Ecolab observations were conducted in two private middle schools in the Philippines, one in Cavite and one in Quezon City. A total of 180 students participated, 90 per system, aged 9 to 13, with students randomly assigned to use one software package or the other. The population included an approximately equal number of males and females, and none of the students had used either Ecolab or M-Ecolab before this study. Students used the software for 40 minutes. Observations were conducted by 2 observers at a time, out of a pool of 3 observers. A total of 4,566 observations were collected. Each pair of observers’ inter-rater reliability was tested, and the average κ was $\kappa = 0.75$ for Ecolab observations and $\kappa = 0.77$ for M-Ecolab observations.

RESULTS

From the quantitative field observations, we computed an approximate percentage of time that each student was off-task and then calculated the average time off-task of each group under study. As in the first study, the incidence of off-task behavior was quite low for the students in the Philippines, as shown in Table 2. Students using Aplusix were observed to be off-task less than 1% of the time. The students using M-Ecolab and Ecolab exhibited slightly more off-task behavior: respectively, 2.7% and 4.5%. These proportions of off-task behavior were comparable to the frequency of off-task behavior in the Philippines in the first study, and substantially lower than the frequency of off-task behavior in the USA in the first study or in prior research on off-task behavior in the USA. As such, these results continue to provide evidence for off-task behavior being generally lower in the Philippines than in the USA, among students using adaptive learning technologies.

Unlike in the first study, the frequency of gaming behavior within the second and third studies was low. 3.3% of behavior in Aplusix was gaming the system, and under 1% of behavior in Ecolab and M-Ecolab was gaming the system. Since the samples differed between the first study and the second and third studies, it is not appropriate to statistically compare between studies. It is not particularly surprising that gaming frequency varied between systems – gaming frequency is already known to vary considerably between different learning environments (Baker et al., 2009). However, this finding suggests that even if students in the Philippines game the system in some educational software, they do not do so in all educational software. Hence, it will be relevant to understand what factors lead Filipino students to game the system to different degrees in different learning systems.

[Place Table 2 approximately here]

DISCUSSION AND CONCLUSIONS

Within this paper, we have presented a study comparing off-task behavior in the United States and Philippines, using the same curriculum and research protocol, and two further studies on these behaviors in the Philippines with different curricula but the same research protocol. The difference in the degree of off-task behavior between the United States and the Philippines, within the educational software studied in this article, is quite striking. In particular, the results of the first study suggest that the previously observed differences in off-task behavior between the USA and Asia cannot be attributed simply to differences in curricula. This allows us to focus on differences in the people involved, their culture, and their classroom culture.

One factor that may limit the generalizability of these findings is that the research population in the studies presented here was drawn from a relatively small part of each country. Though the sample size in general was comparable to or larger than the other cross-cultural studies reported in this paper, it is important to note that differences within a country can be quite substantial. The USA samples were drawn from a relatively demographically average part of the United States (the suburbs of Pittsburgh, PA); however, previous research in the USA suggests that populations with much higher or lower socio-economic status would have had different degrees of off-task behavior and gaming (see Baker & Gowda, 2010), though all samples in (Baker & Gowda, 2010) had substantially more off-task behavior than seen in the Philippines in this paper. Most of the Philippines samples were drawn from Metro Manila, the capital of the Philippines. Aside from being densely populated, the area also has the highest functional literacy rate in the country (Philippines National Statistics Office, 2006), and the highest proportion of households with electronic media devices such as televisions and personal computers (Philippines National

Statistics Office, 1994). Clearly, replicating this study in a wider variety of schools within both the USA and Philippines will be an important step towards understanding how general these findings are.

One of the key interpretations for these findings comes from the research discussed earlier on cultural differences between the USA and Philippines. Past research had characterized Philippine society as one in which respect for authority and obedience are considered more important than independence and self-direction (Grimm et al., 1999; Helmke & Vo, 1999; Welzel, 2006; Inglehart, 2009), a pattern seen throughout East Asia and Southeast Asia. The same survey characterized the United States, by contrast, as a society that deemphasizes respect for authority and values independence over obedience. Correspondingly, socially acceptable behavior is considered more important in the Philippines than in the USA (Lynch, 1984). These observations are consistent with findings from other cross-cultural studies. North American children are raised to act in self-directed and autonomous manners, following individual personal styles (Smetana, 2002). Off-task behavior is also related to how willing a student is to be noisy and social, versus being shy and quiet. Being shy and quiet is construed differently in Western and East and Southeast Asian societies: Westerners tend to interpret shyness as proof of immaturity or social ineptness and therefore meet it with disapproval (Rubin et al., 2002), whereas shy East Asian children receive affirmation and acceptance (Chen et al., 1998). In general, Filipino students tend to blend authority figures' wishes, expectations, goals, and standards into their own personal motivations (Bernardo, 2008). Additionally, ethnographic research suggests that the values of cooperation and compliant behavior become internalized by children in East Asian cultures, leading them to emphasize social obligation, group orientation, harmony, and close family ties

(see Eisenberg et al., 2006; Farver et al., 1995). These differences may lead Filipino students to be more reluctant to go off-task than students from the United States.

These same values may explain why Filipino students disengaged in another fashion, gaming the system, in study 1. Whereas off-task behavior typically draws attention, gaming the system presents a surface appearance of being on-task. To a teacher or fellow classmate, a gaming student appears to be actively engaging with the software. In a culture which emphasizes the value of group dynamics and self-control, gaming behavior may be a way that a student can disengage without incurring the costs of overt off-task behavior.

Another difference between the USA and East and Southeast Asia is in terms of the value given to academic effort (Stevenson & Lee, 1990; Stevenson, Chen, & Lee, 1993); this difference could potentially explain the lower off-task behavior seen in the Philippines, but would not explain the relatively higher frequency of gaming the system within study 1.

Alternatively, these same cultural differences may have caused observer effects to function differently in the two countries. Despite our attempts to make the observations non-intrusive, the students in the Philippines might have regarded the observers in the room as authority figures. As mentioned earlier, Bernardo (2008) found evidence that Filipino students tend to blend their authority figures' wishes, expectations, goals and standards into their own personal motivations. Students might therefore have made an additional effort to remain on-task. Students in the United States, on the other hand, may not have been influenced to the same degree by the observers, given their greater individualism and propensity for self-expression. However, as with valuation of academic effort, this explanation does not account for the prevalence of gaming the system in the Philippines within the first study.

It is worth noting, however, that similar problems exist for alternative methods for assessing off-task behavior. For instance, survey items might produce different demand effects between cultures, and video cameras might produce different observer effects between cultures. Weisz et al. (1995) argues that cultural differences are a more serious problem for survey measures of off-task behavior than for observational measures, as there can be very strong self-presentation or demand effects with surveys. Automated software-based detectors of off-task behavior (see Baker, 2007) may be a future possibility for a method that avoids these problems (as they are completely non-obtrusive), but these detectors need to be validated to be accurate across cultures, and such validation has typically relied upon field observation data (cf. Baker, 2007; Cetintas et al., 2009).

Another possible explanation for the rarity of off-task behavior in these studies is that intelligent tutor software – and educational software in general – is more novel in the Philippines than in the US. Computers themselves are rarer in Philippine schools than in the USA, and when students utilize computers it is predominantly in the context of courses on computer literacy or programming, as opposed to language arts, math, or science (Rodrigo, 2004). Within our studies in the Philippines, all students were using the Cognitive Tutor, Aplusix, Ecolab, and M-Ecolab for the first time. The students in the United States, on the other hand, had been using intelligent tutor software as part of their regular classroom routine all year (though they had not previously seen the specific intelligent tutor studied). Given this discrepancy, the lower off-task behavior seen in the Philippines might be primarily due to the novelty of using an intelligent tutor for math or science. While this might be viewed as a confounding “novelty effect,” it can also be seen as a genuine difference between students in the two countries. Finding middle school students in the USA who are completely unfamiliar with educational software would require

finding schools that serve populations well outside of the norm for American students. At the same time, it is worth noting that this study replicates past studies in other parts of East and Southeast Asia that found that off-task behavior was rare when using traditional curricula of a type commonly seen (cf. Abiko & George, 1986; Bennett, 1987; Winter, 1991; Weisz et al., 1995). By contrast, field observations of engagement in the earlier years of intelligent tutor usage in the United States did not replicate the behavior patterns seen here (see Schofield, 1995). Hence, it seems relatively unlikely that a novelty effect could explain all of the differences in off-task behavior between the USA and East and Southeast Asia. Furthermore, it is unclear why intelligent tutors are so much more common in US classrooms than in other countries – cultural differences may in fact be one of the factors explaining this difference.

Overall, understanding the relative roles of cultural factors and past experiences with adaptive educational technology in student off-task behavior is an important area of future work. One potential way to follow up the research presented here would be to replicate this study in additional countries. Comparing two nations inherently produces a confounded comparison. Hence, it would be of value to replicate the first study in this paper in a set of countries that vary systematically in terms of cultural variables and exposure to educational technology. For example, we could address the dimension of individualism/collectivism from (Welzel, 2006; Inglehart, 2009; Hofstede et al., 2010), one of the factors hypothesized above to explain the differences in off-task behavior between the USA and Philippines. The USA is a country characterized by high individualism and high exposure to educational technology. The Philippines is characterized by low individualism and low exposure to educational technology. Japan, to give one of many examples, is characterized by low individualism and high exposure to educational technology. Interestingly, there are relatively few countries that are high in

individualism and low in exposure to educational technology – Zimbabwe is one of the few countries meeting that profile. The study could also include a pre-test that measures the extent to which the study participants exhibit individualism/collectivism. This pre-test would help establish whether the participants selected from each country indeed exhibit the cultural characteristics attributed to their respective countries.

One other factor that is worthy of future study is the increase in gaming the system seen within the Cognitive Tutor in the Philippines in the first study. Though there was relatively little gaming seen in studies two and three, this finding is nonetheless worth investigating further.

In particular, if students in the Philippines are disengaged a similar total amount of the time as American students for a given learning system, but manifest their disengagement differently, it may be necessary to reinterpret the meaning of the differences in off-task behavior repeatedly seen between countries. In specific, past theoretical accounts have suggested that American students are at a disadvantage compared with Asian students because American students spend more time off-task (e.g., Abiko & George, 1986; Weisz et al., 1995). However, if students spend comparable amounts of time disengaged but spend their disengaged time differently, the differences in learning between the two populations of students might be minimal. In fact, there may even be a moderate learning advantage for American students, as gaming the system appears to be more strongly associated with poor learning than off-task behavior (Baker, Corbett, Koedinger, & Wagner, 2004; Cocea, HersHKovitz, & Baker, 2009). In order to confirm (or disconfirm) this interpretation, it will be necessary to analyze whether gaming the system correlates to learning in the same fashion (and under the same conditions) in the Philippines as it does in the USA. Analyzing gaming behavior at this grain-size is facilitated through the development of automated detectors of gaming the system, which can infer the exact moments

when gaming behavior occurs in student log files (Baker, Corbett, & Koedinger, 2004; Baker & de Carvalho, 2008; Cocea et al., 2009). Hence, it would be necessary to develop and validate detectors of this behavior to study this interpretation in full depth. It is also worth looking at how gaming changes among students in the Philippines over time. Gaming the system has been shown to increase in the United States as students become more familiar with a specific type of educational software (see Beck, 2005). If this is the case in the Philippines as well, then gaming the system may turn out to be a significant problem for the use of educational software in the Philippines.

Over recent decades, there have been several calls to look at classrooms in East Asia and Southeast Asia as inspirations for behavior and classroom management in the United States and Europe (Abiko & George, 1986; Bennett, 1987; Chase & Mueller, 1989; Winter, 1991; Weisz et al., 1995). Though the research presented here carefully controls for curricular confounds, multiple possible explanations still remain for the differences in off-task behavior between the United States and Philippines found in this paper. As proposed by Abiko & George (1986), Winter, (1991), and Weisz et al. (1995), these findings may reflect genuine differences in engagement stemming from cultural differences. However, further research is needed to determine whether these findings are instead due to differences in observer effects, or to disengagement manifesting differently (for instance, manifesting as gaming the system rather than off-task behavior) – though these differences are themselves likely to be cultural in nature. One way to reduce observer effects would be to develop and validate automated detectors of off-task behavior and gaming the system in log files (see Baker, 2007; Baker & de Carvalho, 2008), as discussed earlier in this section. These detectors could then be used to confirm (or disconfirm) the findings seen here. Furthermore, these detectors could be applied to data from larger numbers

of students in the Philippines to study the exact situations in which gaming occurs, towards understanding if the two behaviors occur in the same situations in the Philippines (in the United States, the two behaviors occur in different situations – Baker, Corbett, & Koedinger, 2004; Baker, 2007). As such, further work is needed to understand the causes and implications of international differences in the prevalence of off-task behavior.

In the long-term, a better understanding of how disengagement manifests itself in the United States, the Philippines, and other countries as well – and how specific cultural factors drive the manifestation of disengagement – may support the design of better education worldwide. Different countries appear to produce students who disengage in different amounts and in different ways, and these differences are apparently not due to differences in curricular design (at least in the case of off-task behavior in the USA and Philippines). Understanding these differences will be key for developing culturally appropriate practices that reduce disengagement and improve learning in every country.

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Table Captions

Table 1. Study 1 average incidence of off-task behavior. Parentheses indicate standard deviation.

Table 2. Study 2-3 average incidence of off-task behavior. Parentheses indicate standard deviation.

Tables

Table 1.

	% Off-Task	% Gaming the System
Cognitive Tutor: USA	19.7% (17.8%)	5.3% (9.9%)
Philippines	2.7% (5.2%)	10.7% (15.3%)

Table 2.

	% Off-Task	% Gaming
Aplusix	0.8% (2.2%)	3.3% (12.9%)
Ecolab	4.5% (10.5%)	0.6% (3.5%)
M-Ecolab	2.7% (7.4%)	<0.1% (1.0%)