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Differences Between Japanese and U.S. Children's Performance on "Zoo U": A Game-Based Social Skills Assessment

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Abstract

Objective: The purpose of this study was to test whether and how performance on a digital game-based social skills assessment tool, ''Zoo U'' (3C Institute, Durham, NC), differed for children in the United States and Japan across six core social skills.
Materials and Methods: ''Zoo U'' was administered to 497 third and fourth grade children from the United States and Japan (46 percent Japanese) by teachers and researchers, respectively. U.S. children received the original version of ''Zoo U,'' and Japanese children received a fully translated Japanese version of the program. Scoring of each of the six social skills is built into the ''Zoo U'' software, with specific scoring algorithms for each grade level that provide both a continuous scale score and cutoffs for three distinct performance categories: high, average, and low.
Results: A multivariate analysis of variance (MANOVA) was conducted to assess differences by cultural group on each of the six continuous social skill scores, controlling for gender and grade level. Results revealed significant differences on four of the six skills in expected directions. Chi-squared and odds ratios analyses were then conducted on the assignment of children into each of the performance categories by cultural group, revealing additional nuance to the cultural differences identified in the MANOVA consistent with existing literature.
Conclusions: We were able to replicate known cultural differences between U.S. and Japanese children with a simple direct translation of a Web-based social skills assessment game, ''Zoo U.'' Our results provide preliminary support for the potential of game-based assessment methods to provide efficient and valid social skill assessments to children around the world.

Introduction

Decades of research have demonstrated how poor social skills such as communication, cooperation, and impulse control contribute to a variety of peer problems, including bullying, teasing, and social isolation.[1–3] These peer problems place children at risk of serious negative outcomes in adolescence, including substance abuse, educational underachievement, and dropping out of school,[4–6] particularly when these peer problems occur during late elementary school when academic and social challenges intensify significantly.[2,3] Therefore, targeting social skills intervention to late elementary school provides a rich opportunity for timely and effective intervention. However, in order to provide effective social skills intervention, educators, clinicians, and parents must first have access to effective social skills assessment.

Traditionally, social skills assessments have been administered in one of four ways: teacher- or parent-completed behavior rating scales, behavioral observations of the child, interviews with the child, or peer nominations.[7] These traditional assessment methods, however, are limited in several ways, particularly with regard to efficiency—both time and cost.[8] To overcome these barriers, 3C Institute (Durham, NC) developed ''Zoo U'' (www.ZooUgame.com), a game-based social skills assessment system disguised as a single-player point-and-click Web-based strategy game in which players engage in a virtual school for zookeepers. ''Zoo U'' assesses children's social problem solving strategies and aptitudes across six domains: emotion regulation, impulse control, communication, empathy, cooperation, and social initiation (we define each of these skills below). The second author and other subject matter experts drew on their expertise in social–emotional development to develop six

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social scenes tailored to assess these six social skills, and research to date supports ''Zoo U'' as a valid and efficient social skills assessment tool with children in the United States.[9,10] The performance scores for ''Zoo U'' have been found to be commensurate with teacher reports of children's social skill levels,[10,11] as well as predictive of teacher-reported child outcomes such as incidents of bullying behaviors and office discipline referrals.[12] Table 1 provides more information about the ''Zoo U'' software, and Table 2 describes each of the six social scenes in greater detail.

Of course, social behaviors are not objective, isolated actions that can be assessed independently of the context in which they occur; the degree to which a social act is adaptive or appropriate (e.g., acceptable levels of activity, formality of speech, appropriate engagement with others) varies based on the structures and social norms of the particular context,[13–16] especially one's culture. For example, in more collectivistic cultures such as Japan—as opposed to more individualistic cultures such as the United States—social competence is more closely tied to the ability to cooperate

Table 1. Characteristics of a Videogame for Health: ''Zoo U''

Characteristic	*Description*
Health topic	Social skills
Targeted age groups	Third/fourth graders (7–11 years)
Other targeted group characteristics	''Zoo U'' is a universal social skills assessment for children ages 7–11 years; however, completing ''Zoo U'' assumes the child is not visually or hearing impaired and has the motor skills necessary to use a mouse or other pointing device.
Short description of game idea	''Zoo U'' is a virtual school-like world where children learn how to be zookeepers by completing novel social problem solving tasks to care for the animals.
Target player	☑ Individual ☐ Dyad ☐ Small group ☐ MMOG
Guiding knowledge or behavior change theory(ies), model, or conceptual framework(s)	Social skills training, cognitive–behavioral therapy
Intended health behavior changes and knowledge element(s) to be learned	The ''Zoo U'' assessment game is not intended to facilitate behavior change on its own; rather, it identifies children who would benefit from social skills interventions. The companion game, ''Zoo U'' Skill Builder (www.zoougame.com), is designed to improve children's social behavior in six domains: impulse control, communication, cooperation, social initiation, empathy, and emotion regulation.
Behavior change procedure(s) or therapeutic procedure(s) used	NA (see above)
Clinical or parental support needed?	''Zoo U'' is a social skills assessment tool to assist teachers, clinicians, or parents in determining appropriate interventions for children; thus, clinical or parental involvement is necessary.
Data shared with parent or clinician	☑ Yes ☐ No
Type of game	☐ Active ☐ Action ☐ Adventure ☐ Role-playing ☐ Simulation ☑ Strategy ☐ Sports ☐ Casual ☑ Educational
Game components	
Player's game goal/objective(s)	To solve social problem solving scenarios with peer, teacher, and animal NPCs
Game mechanic(s)	Click to move, hover over preview menus
Virtual environment	
Setting	School for zookeepers
Avatar	
Characteristics	Players can choose from either a male or female avatar and select from a number of hairstyles/colors and colors of their shirts, shorts, and shirts.
Abilities	NA
Game platform(s) needed to play the game	☐ Smartphone ☐ Tablet ☐ Kinect Xbox ☐ Wii ☐ PlayStation ☑ Computer ☐ Hand-held device
Sensors used	NA
Estimated play time	45–60 minutes

MMOG, massively multiplayer online game; NA, not applicable; NPC, nonplayer character.

Table 2. Summary of "Zoo U" Game Content

Skill	*Objective*	*Task*
Scene 1: Emotion regulation	Degree to which the child can control what he or she does and says in an emotionally charged situation	Bullies in the hall are trying to force the child to pay a toll before allowing him or her to go to class. The child can choose to be passive, aggressive, or assertive in interactions with the bullies.
Scene 2: Impulse control	Degree to which the child can stay focused and on-task while problem solving	The teacher instructs the child to feed the elephant before the class can go to recess. The child must gather information from the clipboard (which provides feeding instructions) and the teacher in order to accomplish this task.
Scene 3: Communication	Degree to which the child is able to communicate clearly and respectfully, as well as listen accurately in conversation with another character	A note on the door indicates the child's class will return at 2:30. The bell rings, and the hall monitor informs the child that he or she must get to class. The child must communicate with the hall monitor to find out where his or her class is and get a hall pass to go and find them.
Scene 4: Empathy	Degree to which the child demonstrates caring for and understanding of another character	The child is playing 4-square on the playground, and there's a boy on the sidelines clearly upset. The child needs to understand what is upsetting this boy in a caring and thoughtful way.
Scene 5: Cooperation	Degree to which the child demonstrates team work with another child in order to solve a problem	The child needs to figure out how to catch the parrot flying around the classroom. In order to be successful, the child must work cooperatively with another character.
Scene 6: Social initiation	Degree to which the child initiates social play appropriately with other characters	The child is on the playground and can select to interact with the giraffe or join a 4-square game with three other characters.

Adapted from the Summary of SPS Tasks for Each Zoo U Scene table in DeRosier.[9]

with others for the collective good and on social skills that foster interdependence.[17–19] Japanese children are more likely to be socialized to attend to and fit in with others in order to increase social cohesion. As a result, in Japanese culture greater emphasis is placed on social skills that result in reduced social friction and confrontation (such as deference to parents and authority figures, social responsibility, modesty, cooperation, and pride in one's social group) than there is on personal achievements. Even seemingly innocuous everyday social behaviors may send very different messages, depending on the cultural context. Avoidance of eye contact, for example, may signal respect or deference in Japanese culture, whereas such behavior in the United States suggests inattention, rudeness, or shyness.

The purpose of this study was to test whether and how performance on "Zoo U" differed for children in the United States and Japan, and whether these differences would be commensurate with the existing literature on cross-cultural differences in children's social skills. Below we provide a brief review of this literature for each of the targeted social skills in "Zoo U" and our hypotheses for the current study.

Emotion regulation

We define emotion regulation in "Zoo U" as managing and adjusting one's emotional reactions to achieve particular goals, either personal or interpersonal, via a child's ability to control his or her emotional reactions (e.g., aggression, hostility, anxiety) in a bullying situation. Cultures that tend to value group harmony over one's personal fulfillment, such as Japan, tend to value high levels of self-regulation, particularly suppression of emotions. Cultures with greater egalitarian and individualistic values, such as the United States, tend to encourage assertiveness and place less emphasis on self-regulation. For example, existing studies suggest that for both adults and children, the display rules (cultural norms) in Japan allow for less expression of powerful emotions (e.g., anger, contempt) compared with their North American counterparts, who are more likely to see powerful emotions as having instrumental value.[20,21] Therefore, we expected that Japanese children would receive higher emotion regulation scores in "Zoo U" compared with their U.S. counterparts.

Impulse control

Impulse control is defined as the ability to control one's behaviors in service of meeting a goal. In "Zoo U," children's impulse control is assessed via their ability to attend to their environment, minimize perseveration on incorrect choices, and stay on task when communicating with children and teacher characters while trying to figure out how to feed the classroom elephant. Individuals with impulse control issues are generally less able to focus attention on relevant

features of their environment or disengage their attention from things in which they have strong interest. Although some differences between children in the United States and Japan have been reported in the literature (U.S. children tend to focus their attention on people and things central to their visual field, whereas Japanese children are more likely to focus their attention to the contextual nuances of their environment[22]), there is little evidence of practical differences between Japanese and American children in impulse control.[23] Thus, we predicted that children in Japan and the United States would score similarly on assessment of impulse control in ''Zoo U.''

Communication

Effective communication in ''Zoo U'' is assessed via menu choices that clearly and directly convey the player's thoughts and feelings to a hall monitor in an appropriate and polite manner (e.g., tone of voice). This kind of direct communication style has been classified as low context by communication researchers and is hypothesized to be more prevalent in individualistic cultures.[24] Individuals and cultures with more collectivistic values tend to use high-context communication styles that rely more heavily on the delivery of indirect messages in which meanings are embedded within knowledge of the person and/or the social–emotional context. As a result, we hypothesized that children in the United States would demonstrate higher performance on assessment of effective communication in ''Zoo U'' than Japanese children.

Empathy

In general, we see children's responses to others' distress take three forms: empathic concern, personal distress, and unawareness/disinterest, with high empathic concern linked to better peer relations.[25] In ''Zoo U,'' empathy is assessed via the child's style of (and speed in) approaching a student character who is sitting alone while other student characters are playing—higher scores are given for choices that reflect empathic concern. Given the value of group harmony often cited as prevalent among the Japanese,[18] we predicted that Japanese children would score higher than U.S. children on assessment of empathy in ''Zoo U.''

Cooperation

Cooperation is defined as the ability to work with others to meet a goal, and in ''Zoo U'' we assess cooperation via a child's ability to work with a student character to catch the class parrot; the player must request help appropriately and respond honestly when the nonplaying character makes suggestions for ways the player could try to complete the task on his or her own. It is surprising that there is little research on the distinction between U.S. and Japanese children regarding cooperation, despite a heavy emphasis in the literature on individualistic versus collectivistic values. However, research looking at Asian cultures more broadly suggests that children in the United States are more likely to show responses to peers that emphasize individualism and competition compared with their Asian counterparts, who are more likely to show responses that favor equality and group enhancement[26]; thus, we predicted Japanese children would score higher on assessment of cooperation in ''Zoo U'' than children in the United States.

Social initiation

Social initiation is defined as the inclination and ability to start and maintain social interactions. In ''Zoo U,'' social initiation is assessed via children's speed to and style of approaching a group of child characters already engaged in a group activity. In Western cultures, social initiation, and assertiveness in particular, is considered a strong indicator of positive social skills.[27] In East Asian cultures, however, a high degree of social assertiveness may be seen as detrimental to the maintenance of group harmony; this is reflected in the fact that social assertiveness is not related to social acceptance in the literature.[28] Indeed, evidence suggests that children from Western cultures, such as the United States and Canada, show more active engagement with their peers, whereas children from Eastern cultures are more likely to engage in solitary and parallel play.[29] In keeping with this evidence, we hypothesized that children in the United States would score higher on assessment of social initiation in ''Zoo U'' compared with children in Japan.

Materials and Methods

Participants

Participants were 497 third and fourth grade children from the United States ($n = 270$) and Japan ($n = 227$). The U.S. sample consisted of 25 classrooms with an average of 11 participating children per classroom (range, 1–21); the Japanese sample consisted of seven classrooms with an average of 31 participating children per classroom (range, 28–33). Across the entire sample and separately by group, female and male children were evenly distributed ($\text{female}_{\text{full sample}} = 47.7$ percent; $\text{female}_{\text{Japan}} = 46.7$ percent; $\text{female}_{\text{United States}} = 43.0$ percent). The race/ethnic makeup of the Japanese sample was homogeneous; the U.S. sample was relatively diverse (23.3 percent African American, 4.8 percent American Indian, 3.3 percent Asian, 55.6 percent European American, and 12.9 percent other). Precautions were taken to ensure ethical protection of participants in this research study. The study protocols were approved by institutional review boards in both the United States and Japan.

Measures

''Zoo U'' was originally developed in English for deployment in schools across the United States.[14,17] For the current study, we created an ''exact equivalent'' for Japanese children (www.3cisd.com/zoouJapan/demo). To accomplish this, the original English version of ''Zoo U'' was fully back-translated over multiple iterations for both in-game text and in-game audio, including pronunciation, tone of voice, and consideration for gendered language. All other game components and scoring were kept the same across both versions. Visuals of the English and Japanese-translation of ''Zoo U'' are shown in Figure 1.

For both the English and Japanese versions of ''Zoo U,'' thresholds of performance (low, average, high) were established by grade. To accomplish this, gameplay was captured, logging the times and locations of every player click event. We parsed these logs and aggregated the data that were then used to calculate a composite performance index by grade (algorithm) for each of the six scenes. The resulting performance indices consist of variables derived from the

FIG. 1. Screenshots from the U.S. and Japanese versions of "Zoo U." (Color graphics available at www.liebertonline.com/g4h)

aggregate log data, such as how many times a player clicked on a particular in-scene object, average response time when making a dialog choice, and the sequence of problem solving choices. Previous research provides evidence of the construct validity of performance scores in "Zoo U."[11,12] Because scoring algorithms in "Zoo U" are tailored for each scene and grade, the scale and range of possible scores vary for each scene and grade; thus, for the purposes of the current study all scene scores were standardized (mean [standard deviation] = 0.0 [1.0]) to aid in the interpretation of analyses across each of the six social skills.

Procedure

Children were asked to complete all six scenes of "Zoo U" in one sitting. Teachers and/or researchers assisted children in accessing the game but provided no additional support for children's gameplay behaviors or in-game

choices. As described above, scoring in ''Zoo U'' is fully automated by the Web-based software, thus eliminating administrator-related errors. For the purposes of the current study, we asked teachers to provide us with each child's gender, grade, and race/ethnicity; these data were matched to children' gameplay data via a participant ID number to ensure anonymity of child data. All children completed ''Zoo U'' individually on separate computers. Teachers and researchers in the United States and Japan, respectively, were given the same instructions to read to children. Specifically, children were told:

> Today we are going to work on the computer for 20 to 30 minutes. You will have six scenes to work through. These scenes take place at a make believe school called ''Zoo U.'' In each scene there will be a problem, such as you can't find your class or there are bullies who are bothering you. I want you to try your very best to solve these problems, just like you would if they happened here at school. It is very important that you try your very best.

United States. As part of a larger study, third and fourth grade teachers and school counselors were recruited via listservs and message boards to participate in validating and refining the scoring algorithms and cutoffs for ''Zoo U'' with a nationally representative sample. Teachers entered student information into the online implementation center for ''Zoo U'' and were asked to complete questionnaires unrelated to the current study about 10 randomly selected students; teachers could then choose to complete questionnaires on additional students if they wanted (teachers were compensated based on the number of student questionnaires completed). Once teachers had completed at least 10 student questionnaires, they were given access to ''Zoo U'' for all students in their classroom. Using the online implementation center for ''Zoo U,'' teachers deployed ''Zoo U'' with their students with no additional researcher involvement. Based on game log data, children completed all six ''Zoo U'' scenes in an average of 16.38 minutes (standard deviation = 7.13 minutes).

Japan. Participants were recruited from three elementary schools in and around Tokyo via the third author's connections with school principals. Teachers were given a small gift as a thank you for their cooperation, but no incentive was promised to encourage participation. Using a translated version of the online implementation center for ''Zoo U,'' researchers administered ''Zoo U'' during school hours in a computer lab. Teachers were available to provide support to researchers as needed. All children in the Japanese sample were drawn from fourth grade classrooms in order to gather a developmentally equivalent sample to that of the United States. Based on game log data, children completed all six ''Zoo U'' scenes in an average of 18.65 minutes (standard deviation = 3.86 minutes).

Results

Preliminary analyses

Given the impact of age and gender on children's social skills, we used multivariate analyses of variance (MANOVAs) to explore whether children's ''Zoo U'' social skills scores varied along with either of the following child characteristics.

Gender. Analyses revealed a significant multivariate effect for gender ($F_{1,\ 433} = 3.86$, $P < 0.0001$), and follow-up univariate analyses specified gender differences on both the Empathy ($F_{1,\ 433} = 4.67$, $P = 0.030$) and Cooperation ($F_{1,\ 433} = 9.81$, $P = 0.002$) scenes. Specifically, female children (mean [standard error] = 0.12 [0.07]) scored higher on empathy than male children (mean [standard error] = −0.09 [0.07]), with a reverse pattern for cooperation such that male children (mean [standard error] = 0.12 [0.06]) scored higher than female children (mean [standard error] = −0.18 [0.94]).

Grade. Even though ''Zoo U'' accounts for grade-level differences via grade-specific scoring algorithms and cutoffs, we wanted to be sure that no differences remained between third and fourth grade children in this sample. Again, analyses revealed a significant multivariate effect ($F_{1,\ 433} = 5.53$, $P < 0.001$), and follow-up univariate analyses specified grade-level differences for both the Emotion Regulation ($F_{1,\ 433} = 16.44$, $P < 0.001$) and Impulse Control ($F_{1,\ 433} = 8.91$, $P = 0.003$) scenes. Specifically, third grade children (mean [standard error] = −0.29 [0.09]) scored lower on emotion regulation than fourth graders (mean [standard error] = 0.14 [0.05]), with a reverse pattern for impulse control such that fourth graders (mean [standard error] = −0.09 [0.06]) scored lower than third graders (mean [standard error] = 0.23 [0.09]). Thus, both gender and grade were entered as covariates in all subsequent analyses.

Continuous score differences

A MANOVA was conducted to explore the cultural differences in ''Zoo U'' performance across the six continuous social skill scores. As expected, there were numerous differences. Japanese children scored significantly higher than children in the United States on both emotion regulation and cooperation, whereas the U.S. children scored significantly higher on both empathy and social initiation compared with their Japanese counterparts. Of particular note is that cultural group explained more than 16 percent of the variance (represented in Table 3 as η^2) in social initiation scores. As hypothesized, there was no significant difference by group for impulse control. Contrary to our hypothesis, there was no significant difference by cultural group on communication. However, it is notable that we found a trend-level difference in the hypothesized direction, with U.S. children scoring higher on communication than those in Japan. All relevant statistics are shown in Table 3.

Categorical differences

In addition to using continuous scale scores, ''Zoo U'' categorizes children based on their performance into one of three categories: high, average, and low performance. Therefore, we were also interested in the possible differences between children in the United States and Japan regarding the likelihood that their in-game behaviors would be classified into one of these three categories for each social skill. To explore this possibility, we applied the ''Zoo U'' cutoff criteria to each child's scores (cutoff scores were determined based on a large pool of child data [$n > 1000$] not included in the current study[10,11]). Percentile scores were calculated for each scene separately for third and fourth grade children, with the score best approximating the threshold for the 15th

Table 3. Descriptive and Multivariate Analysis of Variance Statistics

	Descriptive statistics				*MANOVA*		
Skill, group	n	*Mean*	*SE*	*Range*	F	P	η^2
Emotion regulation[a]							
Japan[b]	195	0.298	0.078	−1.99 to 1.55	12.85	<0.001	0.027
United States	266	−0.219	0.065	−1.99 to 1.55			
Impulse control							
Japan	227	−0.007	0.074	−1.81 to 2.93	1.24	0.265	0.003
United States	260	0.006	0.069	−2.31 to 3.38			
Communication							
Japan	226	−0.040	0.075	−7.82 to 1.66	3.07	0.081	0.006
United States	266	0.040	0.068	−5.27 to 1.66			
Empathy[a]							
Japan	227	−0.117	0.073	−2.59 to 2.23	18.84	<0.001	0.037
United States[b]	264	0.100	0.067	−2.59 to 2.23			
Cooperation[a]							
Japan[b]	227	0.173	0.072	−1.99 to 2.36	26.22	<0.001	0.052
United States	259	−0.151	0.067	−1.99 to 2.36			
Social initiation[a]							
Japan	227	−0.302	0.069	−3.54 to 1.30	95.37	<0.001	0.162
United States[b]	270	0.254	0.062	−2.99 to 2.91			

[a]Indicates a significant *F* value.
[b]Indicates the higher of the two means.
MANOVA, multivariate analysis of variance; SE, standard error.

and 85th percentile establishing the *low* and *high* cutoffs, respectively (*average* is thus determined by being neither *low* nor *high*).

We conducted chi-squared analyses to determine differences in the assignment of *low* and *high* based on cultural group. In keeping with the MANOVA analyses presented in Table 3, there were consistent differences in the number of children categorized as *low* and *high* for emotion regulation, empathy, cooperation, and social initiation. Specifically, for emotion regulation and cooperation, Japanese children were more likely to be categorized as *high*, and U.S. children were more likely to be categorized as *low*; this pattern was reversed for empathy and social initiation. Despite not finding significant cultural differences in communication skills when considering the continuous score, when exploring the categorical differences, U.S. children's performance was categorized more often as *high* compared with children in Japan. In keeping with our hypotheses and the results from the continuous score MANOVA described above, no difference was revealed for impulse control for either the *low* or *high* categories.

We then calculated odds ratios to better understand the magnitude of difference in classifications between the two groups. Specifically, we were interested in how much more likely one group of children (United States or Japan) was to be classified as *low* or *high* compared with the other group. Of particular note is the effect for social initiation; there was a strikingly high odds ratio statistic representing a 145 times increased likelihood that U.S. children were classified as *high* social initiators compared with Japanese children (a function

Table 4. Number of Children Classified as Low and High, Chi-Squared Statistics, and Odds Ratios

	Low					*High*				
Skill	*Group*	n	*Chi-squared*	P	*Odds ratio*	*Group*	n	*Chi-squared*	P	*Odds ratio*
Emotion regulation[a]	Japan	34	14.32	<0.001	1.95	Japan[b]	60	15.40	<0.001	2.49
	United States[b]	79				United States	34			
Impulse control	Japan	21	2.74	0.098	1.61	Japan	34	0.53	0.465	1.96
	United States	38				United States	47			
Communication[a]	Japan	44	1.83	0.176	1.38	Japan	8	18.87	<0.001	4.90
	United States	40				United States[b]	41			
Empathy[a]	Japan[b]	73	14.65	<0.001	2.25	Japan	23	5.39	0.020	1.87
	United States	47				United States[b]	47			
Cooperation[a]	Japan	6	30.12	<0.001	7.43	Japan[b]	128	89.46	<0.001	6.83
	United States[b]	49				United States	43			
Social initiation[a]	Japan[b]	137	97.55	<0.001	7.22	Japan	0	62.87	<0.001	145.02
	United States	47				United States[b]	65			

[a]Indicates a significant chi-squared value for either the Low or High category.
[b]Indicates the larger group and gives direction about how to interpret the odds ratio.

of the fact that no children in Japan were classified as high initiators). Table 4 provides information about the numbers of children classified as *low* and *high*, chi-squared analyses, and odds ratios for each of the six social skills.

Discussion

The goal of the current study was to explore the ability of a game-based social skills assessment tool, ''Zoo U,'' to identify similarities and differences between children in the United States and Japan across six specific social skills. In keeping with existing literature regarding cultural variations in children's social skills, ''Zoo U'' identified several expected and a few unexpected cultural differences. As predicted, children in Japan demonstrated better performance on emotion regulation than those in the United States, as evidenced by both a higher average score and a greater number of children falling into the *high* category and fewer children falling into the *low* category. For impulse control, there was no significant difference between U.S. and Japanese children's performance, echoing previous research demonstrating relative equivalence between the two cultural groups with regard to attention and hyperactivity.[23] Although the assessment of cooperation in ''Zoo U'' is not fine-grained enough to draw the conclusion that children in the United States are more competitive compared with Japanese children as is indicated in the existing literature,[26] our results do support the notion that Japanese students may make choices that are more favorable to successful cooperation with peers (as seen by their higher mean scores and their nearly seven times increased likelihood of being labeled as a highly skilled cooperator).

Our results revealed interesting cross-cultural differences in the area of communication. Although children's overall communication scores showed no differences by culture, when we looked at the differences in the number of children in the *high* and *low* categories, we found significantly more U.S. children were classified as *high* relative to children in Japan. In fact, U.S. children were five times more likely to be classified as high on communication. U.S. children may have had an advantage, however, because the scoring algorithm in ''Zoo U'' assigns more credit to responses that are direct about one's needs and responses to others' questions than those that are more subtle (a style of communication that is more adaptive and appropriate in Japan).[24]

Established cultural differences in social initiation were very much reflected in assessment by ''Zoo U'' of this social skill. In fact, cultural group explained more than 16 percent of the variance between Japanese and U.S. children's social initiation scores. Even more striking were the assignments of children into the *high* and *low* categories of ''Zoo U.'' Sixty percent of Japanese children were assigned to the low category compared with only 17 percent of U.S. children—resulting in an odds ratio of more than 7 times. Whereas 24 percent of U.S. children were classified as high initiators, not one Japanese child was classified as such—equating to a staggering odds ratio of 145.

Finally, contrary to our predictions, we were surprised at first that U.S. students performed better on assessment by ''Zoo U'' of empathy, both at the mean level and with regard to assignment into the *low* and *high* categories. However, evidence suggests that throughout childhood, children from Western cultures experience a greater degree of empathic concern compared with Asian children and adolescents who are more likely to experience personal distress when confronted with the distress of others.[30,31] The increased distress experienced by Japanese children may be a result of anticipating the feeling of shame if their attempts to help others fail, which, coupled with their relative reluctance for initiation, may result in Japanese children being less likely to approach their peers directly when they show signs of distress relative to children in the United States.

Limitations and future directions

A notable limitation of the current study was the lack of a validated Japanese social skills assessment measure by which to establish construct validity of the Japanese version of ''Zoo U.'' However, the pattern of differences in ''Zoo U'' scores across cultures reflects what would be expected based on well-documented social skills differences between U.S. and Japanese children in the existing literature. These preliminary findings suggest that ''Zoo U'' is likely to be an effective social skills assessment tool for teachers, clinicians, and parents in Japan, and across the globe more generally. This study provides ample justification for future research to establish a fully culturally valid version of ''Zoo U-Japan,'' including Japanese-specific updates to the scoring algorithms.

An additional limitation of the current study is the inclusion of only fourth graders in the Japanese sample, whereas our U.S. sample included both third and fourth graders. This difference was a function of variations in the academic calendars of U.S. and Japanese schools; schools in the United States typically begin in early fall, whereas schools in Japan begin in early spring. Thus, despite these two samples being composed of different grade-level compositions, the children were approximately equivalent in terms of age. Furthermore, because ''Zoo U'' adjusts its scoring and category assignment (i.e., high, average, low) based on grade level, we believe these sampling effects did not affect our results in meaningful ways, and to be sure, we controlled for grade level in all analyses.

In addition to establishing culturally relevant construct validity for ''Zoo U-Japan'' as described above, future research is needed to make modifications to the graphic design and content (e.g., adjusting menu options to be culturally relevant) to ensure optimal utility for Japanese children. This research will enable us to fully update ''Zoo U'' to be a culturally relevant, ecologically valid game-based social skills assessment specifically for Japanese children.

Conclusions

To our knowledge, this is the first study of its kind to explore cross-cultural variations in children's social skills via a digital game-based social skills assessment platform. That we were able to show clear cultural differences commensurate with our existing knowledge of expectations and norms for social behavior in Japan and the United States with a simple direct translation of the in-game text and audio suggests that using game-based assessments across cultures has significant potential. Given the efficiency and implementation advantages of computerized assessment technologies, as well as the growing acceptance of computerized

assessment methods in school settings, we believe game-based social skills assessment will provide a much-needed service to schools and parents around the world. If effective social skills assessment can be made affordable, easy to use, and broadly accessible through games, children who experience social skills problems will be more likely to be identified for—and then benefit from—social skills interventions. In effect, game-based social skills assessment could provide an effective way to address peer problems of bullying and social isolation that plague children across the globe.

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Author Disclosure Statement

A.B.C. and M.E.D are employees of 3C Institute, which conducted the study. The English version of this software is commercially available. Y.W. declares no competing financial interests exist.

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