Ibigkas!: The Iterative Development of a Mobile Collaborative Game for Building Phonemic Awareness and Vocabulary

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Abstract. Filipino learners' lack of English language proficiency is a major barrier to higher education opportunities and participation in high-value industries. Computer-based learning systems have the potential to increase educational quality, equity, and efficacy in the Global South. However, a key challenge is to design systems that are developmentally and socio-culturally appropriate and engaging for the target learners. In this paper, we describe the design, development, and preliminary testing of *Ibigkas!*, a collaborative, mobile phone-based game designed to provide phonemic awareness and vocabulary building support to Filipino learners aged 10-12.

Introduction

The use of English as a global language is well established and likely to continue barring major socio-political shifts (Chrystal, 2012). However, access to adequate language learning materials is not equally available to the learners who are most likely to benefit from acquiring English.

Learning applications for mobile devices (e.g., Traxler, 2005), which are often more affordable than computers, offer the potential to improve opportunities (Valk, Rashid, & Elder, 2010), but only if their designs match the pedagogical and social needs of the learners they are intended to help. Designers of mobile learning applications have often sought to exploit the ubiquity they afford, which allows for their use in both formal and informal educational settings (Kukulska-Hulme, 2012). Others have noted that characteristics of mobile devices, such as individualized interfaces, real-time access to information, instant communication and feedback, have the potential to enhance alternative, student-centered pedagogical approaches such as self-directed learning and inquiry learning (Sung, Chang, & Liu, 2016).

Research has shown that learners tend to be receptive to these applications (see reviews in Wu, Wu, Chen, Kao, Lin, & Huang, 2012), especially among younger learners (Sung, Chang, & Liu, 2016). Handheld devices such as mobile phones were associated with medium effect sizes, while laptops' effect sizes were low. However, there are concerns that studies with mobile applications tend to be shorter than those conducted on desktop computers, which could be creating a novelty effect that is skewing this research (Sung, Chang, & Liu, 2016).

Within the area of language learning, Mobile-Assisted Language Learning (MALL) has sought to support learners with a wide range of language-related skills such as vocabulary building, listening and reading comprehension, grammar, and pronunciation (Miangha & Nezarat, 2012). MALL applications vary in format. Learners may be asked to watch videos about English idioms (Thornton & Houser, 2005 in Stockwell, 2010). Short passages may be sent to mobile phones followed by comprehension questions (Uy & Rodrigo, 2017). Flash cards with pictorial representations of a new word can also be transmitted to help learners build vocabulary (Chen, Hsieh, & Kinshuk, 2008).

The outcomes from MALL initiatives have been mixed. While many studies report that mobile learning can be effective for second and foreign language learning (Bozdoğan, 2015), meta-analysts recommend caution when reading these results. In a review of 291 studies, Burston (2015) found only 15 that reliably reported unequivocally positive results, as most studies did not meet minimum durations and sample sizes, had serious experimental design problems, or showed no significant differences at all.

A number of factors inhibit the widespread use of mobile learning for language and other subject areas, or at least invite us to think of these technologies critically before we promote their adoption. Simply transferring pedagogy to a mobile application may not be effective; it could be poorly implemented or it could replicate pedagogy that was poorly designed to begin with (cf. Elaish, Shuib Ghani, Yadegaridehkordi, & Alaa, 2017; Burston, 2015). The use of game formats, for example, did not show significant effect sizes, possibly because the subject matter was not closely coupled with the game mechanics (Sung, Chang, & Liu, 2016).

Attitudes can also inhibit the adoption of mobile learning applications. Teachers sometimes discourage their use (Dashtestani, 2016), and some research shows that learners are unlikely to use them except when required as part of a class (Bozdoğan, 2015). These attitudes might be improved, however, if the content of the MALL were closely aligned to well-designed pedagogical strategies, and if the design of the application itself reflected the sociocultural preferences of its intended learners.

This study describes the design of *Ibigkas!*, a MALL application created for use in the developing world, namely the Philippines, where improved English skills offer significant opportunities for educational and economic advancement. We worked with elementary aged learners from underserved populations to investigate the feasibility of MALL intended to assist English Language Learners (ELLs) with basic reading skills like phonemic awareness and vocabulary acquisition.

The appeal of MALL for English Language Learners in the Philippine context. English-based education in the Philippines has a long-history rooted in the colonial era of the early 20th Century (see critical reviews in Bernardo, 2004; Bolton & Bautista, 2004). An English-only policy was initially adopted, with the assumption that it would improve educational outcomes among a linguistically diverse population; it did not (Benardo, 2004). The country has gone through several different approaches in the use of English in the education system since—including bilingual approaches and a return to instruction in native languages, with English taught as an auxiliary subject (Bolton & Bautista, 2004).

Multilingualism has generally been shown to improve opportunities. However, the Philippines is particularly motivated to train an English-literate population in order to supply the Business Process Outsourcing (BPO) industry—a US$23 billion sector that employs 1.15 million people—with linguistically-skilled employees. The BPO industry is the country's highest earner of foreign exchange, next to remittances from overseas contract workers (Lema, 2017), and the Philippines boasts the most number of call centers in the world.

The minimum requirements to qualify for BPO employment (at least two years of college education and excellent spoken and written English) are sometimes prohibitive to those from the poorest sectors of the economy. Of the over 100 million people in the Philippines (Philippine Statistics Authority, 2018), approximately 21.6% live below the poverty line (World Bank, 2018). The overall Philippine functional literacy rate is 90.3% (Philippine Statistics Authority, 2013), yet of those in the bottom 30% of the economic spectrum, functional literacy is measured at 78.8%. In contrast, functional literacy is 94.8% for those in the top 70% (Philippine Statistics Authority, 2013). Hence only 3% to 10% of applicants to BPO jobs are adequately skilled (Errighi, Bodwell, & Khatiwada, 2016), the rest of the population being already poor and acutely disenfranchised from accessing these and other high-value employment opportunities.

Mobile learning offers a means of reaching learners who are underserved. As in other countries, mobile phones permeate all social classes. In 2013, 82.1% of Filipino households owned a mobile phone, compared to 27.3% who own a personal computer (Philippine Statistics Authority, 2013).

This context represents an opportunity to design and develop mobile device-based technologies to help learners improve their English literacy skills. However, the design of such technologies must fit around learners' everyday contexts both in terms of learners' access to technology and in terms of its alignment with learners' interests to nurture and sustain their buy-in and engagement.

Design Process. In this paper, we describe the design evolution of *Ibigkas!*, a mobile game that supports the development of English literacy in children from 9 to 12 years old. We were interested in the perspectives of both teachers and learners, hence we elicited knowledge and design ideas from both these stakeholders, consulting and iterating multiple times using partial outputs from the previous stages. This allowed us to elicit feedback from both stakeholders, improving design ideas for each iteration.

Participants. Participants were recruited with the assistance of The Ateneo Center for Educational Development (ACED)-- an office within the Ateneo de Manila whose mandate is to provide state schools with assistance in improving teaching and learning, through teacher training, materials production, and student feeding programs. With ACED's assistance, we recruited teachers and students from two state elementary schools (Schools A and B)

from Quezon City in the Philippines. As of June 2017, School A had a total enrollment of 7,419 learners while School B had 6,377.

Our first goal was to understand the learners and their contexts in order to arrive at design considerations for the learning software. To do so, the project conducted interviews with teachers and administered a survey to students. Twelve English teachers (six per school) were invited, two per grade level for grades 4, 5, and 6, teaching sections with different ability levels. A final count of eight teachers participated in an interview held in August 2017 and seven (7) teachers participated in an interview held in October 2017. A total of 710 learners participated in the student survey. These learners were selected from the high-performing sections, average sections, and low-performing sections of Grades 4, 5, and 6. These grade levels corresponded with the ages of the intended users of the MALL application.

Defining Learner Characteristics

Teacher Interviews. Two structured group interviews with the teachers were conducted on school grounds, outside of the teachers' class schedules. For the first Interview, conducted in August 2017, we spoke to five teachers from each school. This process was repeated in October 2017 for Interview 2.

The goal of the first interview (***Interview 1; August 2017)*** was to determine the difficulty levels of the various learning competencies within the English curriculum. The teachers were shown lists of competencies for Grade 6 learners (i.e. Table 1) and asked:

- Which are most difficult to teach?
- Which are most difficult to learn?

Teachers were also asked follow up questions (i.e. Table 2) to enable them to qualify their responses to the list of competencies or point to possible causes of learners' difficulty.

Table 1. Grade 6 learning competencies

Listening Comprehension. After listening to a text, students should be able to:

- Analyze sound devices (onomatopoeia, alliteration, assonance, personification, irony and hyperbole)
- Analyze sound devices (personification)
- Analyze sound devices (irony and hyperbole)
- Infer the speaker's tone, mood and purpose
- Recall explicit details
- Note down implicit information
- Analyze aural information correctly
- Express and defend an opinion or point of view
- Restate portions of a text heard to clarify meaning
- Summarize the information

Vocabulary Development

- Infer meaning of idiomatic expressions using-context clues
- Infer meaning of idiomatic expression using-affixes
- Infer meaning of idiomatic expressions using-roots
- Infer meaning of figurative language using
    - context clues
    - affixes and roots
    - other strategies
- Clarify meaning of words using dictionaries, thesaurus
- Clarify meaning of words using online resources
- Use figurative language correctly in spoken and written discourse
- Infer meaning of borrowed words using:
    - context clues
    - affixes and roots
    - other strategies
- Use relevant synonyms in written or spoken language

Reading Comprehension

- Analyze sound devices (onomatopoeia, alliteration, assonance, consonance)
- Analyze poems with 4 or more stanzas in terms of its elements (rhymes, sound devices, imagery and figurative language)
- Determine tone, mood and purpose of the author
- Analyze figures of speech (simile, metaphor)
- Analyze figures of speech (hyperbole, irony)
- Analyze figures of speech (culture-based euphemism)
- Evaluate narratives based on how the author developed the elements:
    - Setting
    - Characters (Heroes and Villains)
- Evaluate narratives based on how the author developed the elements:
    - Plot (chronological-sequential, flashback)
- Respond appropriately to the messages of the different authentic texts
- Note significant details of informational texts
- Correctly summarize narratives and informational text
- Distinguish text-types according to purpose and language features
    - Enumeration
    - Time-order
    - Comparison and contrast
    - Cause and effect
    - Problem and solution
- Correctly interpret graphic organizers (charts, tables, diagrams) in printed text

Table 2. Follow up questions for teachers

1. What do you think makes it difficult/easy for learners to understand English text?
2. Do teachers have access to technologies that help them teach English?
3. Do learners have access to technologies that help them learn English?

The goal of the second interview (***Interview 2; October 2017)*** was to collect descriptive information about learners: their interests, their socio-economic circumstances, their aspirations. We showed the teachers drafts of student personas (Cooper, 2004), representing hypothetical, but nevertheless archetypal learners. These personas were constructed by the research team in order to elicit conversations with teachers about the learning and design considerations that would be important for their students.

Previous research using personas (e.g., Jones, Floy and Twidale, 2008; Nielsen, 2013) reports that persona differences are typically "perceived as axes in contrast" (Nielsen, 2013, p. 8). These studies have typically used anywhere from 2-6 personas, depending on the expected variation in the target population, but the more personas used, the more difficult it becomes for subjects to distinguish between them, so it is advisable to devise the minimum number required.

Personas do not need to be complete or fully accurate. Instead, they usually begin as reasonable approximations, often based on empirical or experiential evidence and, through a process of iterative refinement, eventually converge towards archetypically general user types. As Nielsen (2013) points out, the goal is not to develop user portraits, but instead to engage informants (in our case, teachers) in the design process by providing props that allow them to make concrete comparisons with their own experiences and needs.

For the purposes of this project, we settled on three broad brush base persona representing the three levels of learner attainment from high to low (see Table 3).: *Tala,* intended to portray the typical high performing learner, *Danisay,* intended to portray an average student, and *Jerome* intended to portray a low-performing student. These personas were provided as starting points for knowledge elicitation dialogues with teachers, allowing us to compare their traits with the key characteristics of our target population of learners. Thus, we were able to elicit discussions about potential barriers and design requirements for technology we were developing.

The personas provided the teachers with a comparative reference for answers to the following questions:

- Do these personas sound like learners in your class?
- What would be a better characterization of *Tala, Danisay,* and *Jerome*?

- What are his/her learning strengths and weaknesses? How does the student learn best? (e.g., independent study, collaborative work, class participation, etc.)
- What does the student like doing outside of class?
- What types of entertainment do they like—specific types of movies, tv, music, games--and in what languages?
- Who are the people they respect and admire?
- What are their typical aspirations? What do they want to own? What do they want to be when they get older?
- Describe the student's family background:
    - What would the parents' educational background be?
    - What types of work would they be doing?
    - How large are their families?
    - Are parents involved in their child's studies?
- Describe the student's access to, and proficiency in the use of computers, mobile phones, and other gadgets.

Table 3. Personas

Tala is a 12 year old who enjoys school. She is at the top of her class and quite competitive. Her favorite subjects are maths and science. At home she has access to a PC and knows how to use it to do research for homework. Her parents both studied at university and *Tala* is expected to do so as well. When she is not studying, she likes listening to music. She likes English pop music, Shawn Mendes and Justin Bieber in particular, as well as Filipino artists. She does her English language homework with diligence, learning the textbook vocabulary and even whole sentences by heart, as she believes this is the only way to learn a foreign language.

Danisay is one of her closest friends. Both of them love *Beauty and the Beast* though only *Tala* has watched it with the original voices. Danisay is aged 11 and though she sometimes enjoys school she is easily distracted. Art and music are her favorite subjects. English is something she finds boring but she knows it is important. As she is fond of saying to her friends, "*Sana matuto ako magbasa magtuto magbasa sana magka[ro]on ako sasa[k]yan."* (I want to learn how to read. I want to get my own car.). She is outgoing, lively and often makes Tala laugh. Although a bit of a joker, she can be responsible, particularly when helping to look after her younger siblings. Her parents are supportive of her education and are saving to buy her a PC.

Jerome is aged 12 and in the same class as Tala and Danisay. He finds school difficult and often talks to his friends rather than listen to the teacher. He is nervous about answering questions or talking during English lessons. Instead, he switches to Filipino whenever possible. Outside school, he loves watching action films, especially the Marvel universe. He also plays sports and, when he gets the opportunity, computer games. He would love an Xbox One, but for now he has to make do with going to his best friend's house to play. His dream is to one day star in an action film. Then he will be able to buy himself a car and an XBox One.

The feedback elicited from the teachers using these personas helped us to develop a more accurate understanding of our target audience in terms of their socio-economic circumstances, access to technology, and preferences. We also gained a better understanding of the differences among high, average, and low performers.

Results of Teacher Interviews

Learning Outcomes. Teachers observed that it was easier for learners to read and write English than to listen to it and speak it. As stated in Table 1, competencies fell under three broad headings: listening comprehension, reading comprehension, and vocabulary building. The hardest of these three was listening comprehension, followed by reading comprehension. Vocabulary building was the easiest. The most difficult listening comprehension skills were summarizing narratives, analyzing figures of speech, and responding appropriately to messages of different texts. Among the reading comprehension skills, the most difficult were time-order sequencing, analyzing figures of speech, and restating portions of text to clarify meaning. Figures of speech continued to be a source of difficulty for learners in the category of vocabulary building.

Teachers reported that their learners generally disliked reading in any language. They classified students as comprehension readers, word readers, syllable readers, and frustrated readers (with comprehension being the highest performing level) and reported that while 25% of students read at the proficiency expected for their grade-level, only 5% to 10% of students were in the highest proficiency category. At grades 4, 5, and 6, teachers still classified the majority of their students as syllable and word readers.

Teaching English in the Philippines posed its own challenges. Despite a Philippine Department of Education rule that only English should be used when teaching English, teachers said that they must often translate content to Filipino in order to be understood. Even among learners who can read aloud fairly proficiently, vocabulary difficulties often restrict comprehension, and many students are not proficient at this task. Teachers report that many learners skip harder words in order to avoid struggling with difficult pronunciations.

Resources can also be a challenge. Teachers and learners have access to paper-based learning materials provided by the Department of Education. Computers and the Internet (if available at all) are only available for computer classes, not for English. When teachers need laptops, projectors, and Internet access for their classes, they procure these at their own personal expense.

Socio-economic Circumstances. The school and home environment of the learners tended to be poor and, in some cases, quite rough. Learners from top sections, broadly represented by the *Tala* persona, usually came from supportive households that valued education. Parents of these high-performing students tended to hold university degrees and work at managerial-level positions. They were involved in their child's learning, (i.e. they checked homework and attended parent-teacher consultations).

On the other hand, parents of learners from lower sections usually did not hold university degrees, worked low-skilled jobs, and were less involved in their child's education. Many of these learners had to supplement their families' incomes, often working as street vendors before or after school. The use of personas, allowed us to elicit examples of students in this category, who broadly corresponding to the *Jerome* persona. One such *Jerome* was a student whose mother who was earning money through prostitution and whose father was dealing in drugs. On one occasion, the boy was abandoned in school for two days and no one looked for him. The school eventually had to find the support of government social services for him.

However, socio-economic conditions did not always dictate academic outcomes. Teachers participating in the interviews provided several examples of children, broadly corresponding to the *Tala* persona, who came from poorer conditions than others in her cohort. One such example involved a girl whose family lived in little more than a cubicle, occupied by one bunk bed. The family ate their meals in the same space. However, *Tala's* parents put a premium on her education, and she did very well at school. Tala worked at a local church after class in order to have pocket money. She aspired for a career in science and technology.

Access to Technology. Top learners from better economic circumstances, as represented by the *Tala* persona, were most likely to have computers at home. While most students across all achievement levels did not personally own cellular phones , they often had access to them through family and friends. They usually had televisions at home, but if they did not, they were able to gain ad-hoc access to a neighbor's or classmate's TV. They had access to the Internet through a chain of Internet cafes called Piso Net. These cafes charge P1.00 (approximately US$0.02) for three minutes of use.

Media Preferences. According to the teachers, students in our target population enjoyed a range of entertainment including Disney movies, Korean telenovellas (dubbed in Filipino), and Filipino comedies. Although they generally did not use English with their family or friends, they enjoyed English, as well as Filipino, Japanese, and Korean music. They loved to sing various popular songs in English. They could deliver song lyrics accurately, without necessarily understanding the meaning of the songs' words. Teachers also informed us that some learners were motivated to learn English as a gateway to online gaming, and the multiplayer game *Defense of the Ancients*, was reported to be particularly popular.

Student Survey . Information from the teacher interviews was supplemented by asking learners to complete a written questionnaire that surveyed their attitudes towards and usage of the English language (i.e. Table 4), their media preferences (i.e. Table 5), and their access to technology (i.e. Table 6). A total of 710 learners from Schools A and B participated in the student survey from the high-performing sections, average sections, and low-performing sections of Grades 4, 5, and 6.

Table 4. Learners were asked to indicate their level of agreement (Strongly Disagree, Disagree, Neutral, Agree, Strongly agree) with the following statements regarding their use of and attitudes towards English Statements had translations in Filipino.

1. I speak English at home.
2. I speak English with my friends.
3. I enjoy learning English.
4. I enjoy listening to English.
5. I enjoy reading in English.
6. I find English difficult to learn.
7. I feel nervous when I need to speak English in class.
8. I want to learn to speak and read in English.
9. Learning English is important.

Table 5. Learners were asked the following regarding their media preferences. Statements had translations in Filipino.

1. Give the titles of your 5 favorite English language songs.
2. Give the names of 5 of your favorite singers/bands who sing in English.
3. Give the names of 5 of your favorite singers / bands who DO NOT sing in English.
4. Give the titles of 5 of your favorite TV shows or movies in English.

Table 6. Learners were asked the following regarding their access to technology. Statements had translations in Filipino.

1. Do you use the Internet? If not, why?
2. What devices do you use to access the Internet (phone, computer, tablet, other)?
3. Who owns the device that you use to access the Internet?
4. How often do you use the following Internet-based applications (never, sometimes, often, always)
    a. Email
    b. Games
    c. Social media
    d. Educational activities
5. Name some of the apps you used within the last month.

Results of Student Survey

Attitudes Towards English. Contrary to the teachers' impressions, about 35% of learners claimed to speak some English at home (See Table 7). They generally did not use English when speaking to their friends (23%). The large majority said they enjoy learning English (87%) and reading in English (78%). They agreed that learning English is important (90%), and they expressed a desire to speak and read it (79%).

Table 7. Learner attitudes towards English.

	Strongly Disagree / Disagree	Strongly Agree / Agree
I speak English at home	40.09%	35.41%
I speak English with my friends	51.28%	23.72%
I enjoy learning English	4.39%	86.81%
I enjoy reading in English	7.37%	77.87%
I find English difficult to learn	49.93%	19.43%
I feel nervous when I need to speak English in class	33.38%	42.05%
I want to learn to speak and read in English	8.83%	79.06%
Learning English is important	3.56%	89.60%

Access to Technology. As Table 8 shows, about 73% of learners surveyed said they had access to the Internet. They also had access to cellular phones (63%), computers (54%), or tablets (36%). About 40% of learners owned the devices that they use while about 45% said that the devices were owned by a member of the family. Approximately 26% of learners made use of rented devices. When learners accessed the Internet, they did so principally to play games (50%) or to use social media such as Facebook (53.46%). Nearly 65% of learners said they use the Internet for educational activities.

Media Preferences. When asked to give five examples of English songs and five artists who sing in English, the children enumerated many popular songs and artists. However, many children were unable to spell the songs and artists correctly (e.g., the singer, *Justin Bieber*, was spelled "Justin Beber" [sic], "Justine bieber" [sic], and "Justine Bibier" [sic]; the song *Young, Dumb, and Broke* was cited as "Toung dumb and broke" [sic], "Yum dum and broke" [sic], and "Young dump" [sic]).

Design Guidelines. The findings from the teachers' interviews implied that students from the diverse socio-economic backgrounds understood the value of English language skills. With respect to the subject matter, teachers identified the need for the development of learning materials for listening and reading comprehension. However, the typically limited reading skills and vocabulary range of children (75% of learners) suggested that focusing on recognition and decoding of words is a primary need.

Surveys suggested that these students were interested in learning English, despite teachers' perceptions to the contrary. Their enjoyment of English-based media and English-based video games suggested that they may be receptive to an online game teaching English language skill development.

The use of technology, and especially a game format, seemed particularly suited for the diverse circumstances of these learners. This may be especially true for children from the lowest socio-economic backgrounds, as represented by the *Jerome* persona. These learners did not typically have the benefit of parental support or investment in their education. Therefore, an English lesson packaged in an engaging activity might be more likely to motivate *Jerome*, who would have to undertake this effort independently.

Table 8. Learner Use of the Internet.

	Never/Sometimes	Often/Always
Email	62.81%	18.17%
Web surfing	57.04%	28.59%
Games	27.08%	50.21%
Social media	33.85%	53.46%
Educational activities	23.13%	64.88%

Choice of platform must consider students' access to technology. While learners corresponding to the *Tala* persona might have home computers with Internet access, learners corresponding to the *Danisay* and *Jerome* personas must rely on an Internet café for computer access. Likewise, as discussed above, teachers often could not provide access to technology in the schools except specifically for computer classes. Therefore, learning materials that require computer-based Internet access might impose a barrier to adoption, both in home and in the school.

Given the easier access to and prevalence of mobile phone usage in the Philippines, learning material designed for the mobile platform seemed to afford the widest reach. Furthermore, it would allow students with mobile devices to access the material at any time (perhaps even during a commute), without relying on an Internet café.

The design specification presented here, also drew on a separate, but related study conducted by a subset of the authors, on a phonemic awareness activity with learners selected from this same population of children who participated in the survey (Bringula, Rodrigo, Ocumpaugh, Porayska-Pomsta, Olatunji, & Luckin, 2018). In this study, groups of six learners were asked to listen to popular songs. Under the supervision of facilitators (Ateneo researchers and specific class teachers), the learners were asked to identify pairs or groups of words that rhymed. Bringula and colleagues (2018) used a grounded theory approach (Charmaz & Belgrave, 2007) to classify the observations into six bins that represented common themes:

(i) *internal factors that increased participation* (learners were excited about the game, learners knew what rhymes were and were proud and confident of their work),
(ii) *internal factors that decreased participation* (some learners were bored; some were confused about the game rules),
(iii) *external factors that increased participation* (learners expressed strong preferences for game-based formats and cooperative learning),
(iv) *external factors that decreased participation* (the learners had to form the rhyming words using cards with letters printed on them; it was difficult for learners to find the card that they needed), team dynamics (learners took on different roles--leader, supporter, lurker),
(v) *game play strategies* (identifying the simplest rhymes first, inventing words).

The study's findings supported the case for a game-based format with user-controlled difficulty levels to accommodate different entry-level skills. The learners expressed a strong preference for cooperative learning activities, possibly with roles assigned to different players and with the option for individual play. Non-learning strategies such as guessing or nonsense responses were discouraged. Since the majority of the learners were syllable and single-word readers, and word recognition a primary need, it was decided that the objective of the game would be the decoding of single words through the identification of rhymes, synonyms and antonyms.

Ibigkas!

In this section, we discuss the design, testing, and revision of *Ibigkas!* (*Speak up!*) mobile game prototype for English language learning through rhymes. *Ibigkas!* is a collaborative, mobile phone-based, drill-and-practice style game that helps learners develop fluency in identifying rhymes, synonyms, and antonyms or opposites.

Design 1. A team game, all players must have mobile phones connected to a network (not necessarily the Internet). At the start of the game, the game host selects the target content--rhymes, synonyms, or antonyms. When a game round begins, a random player from the team receives a target word (in Figure 2a, the target word is *SIT*). All players receive lists of words (Figure 1a, b, and c), only one of which is the correct answer, i.e. the rhyme, synonym or antonym of the target word (in this example, the correct target word is *HIT*, in Figure 2b). The player presented with the target word must say it aloud so that the other players can hear it. All other players then check their list of words to see if they have the correct answer. The player with the correct answer should say the target word aloud and then tap it. Once the correct answer is tapped, the round is over and a new round begins.

(a) (b) (c)

Figure 1. Sample of a rhyming task. (a) Player 1 with target word "SIT" (b) Player 2's screen with the correct answer "HIT" (c) Player 3's screen

User test 1. We tested the game with 17 learners and 5 teachers from School A, with 36 learners from School B, and with 22 teachers from a provincial school division that was about 150 kilometers northeast of Manila. Because the game required the use of cellular phones and the development team had a limited number of devices, we divided the test participants into smaller groups of 3 to 4 members. The School A group was asked to play the game for 20 minutes, or until they had finished all the levels. The School B and Provincial groups were asked to play for about 10 minutes. After the game was played by children, the facilitators conducted structured group interviews with teachers and students. The teachers were asked to describe what learning goals the game supported, to identify what the learners might find easy or difficult about the game, what they think the learners would enjoy or not enjoy about the game, and about how they envisage the game could be made more effective as a tool for learning English and more fun for the children.

The learners were first asked to describe the game and their task within the game. They were also asked whether they knew what they were supposed to learn, what they found easy or difficult, what they liked or disliked, and how the game could be made more enjoyable.

The teachers from both School A and the Provincial group seemed to enjoy the game very much. They were lively and enthusiastic during the game play, often demonstrating excitement and laughing. During the interview,

they said that learners would most likely have difficulty with antonyms. Rhymes and synonyms were not likely to be as difficult. They anticipated that the learners would enjoy the game and quickly comprehend its mechanics.

The teachers saw the potential of the game for developing word recognition. They said that their learners would enjoy it very much because it was gadget-based and because it required collaboration and social interaction. They also made several suggestions to increase the educational value of the game and to make it more visually attractive and motivating. They suggested placing words in the contexts of sentences, as well as using more colors and colorful graphics. Adding levels to enable users to control speed and level of difficulty was also deemed important. The teachers thought that the target word was not visually distinct enough from the choices, so there was a tendency for users to tap on the target word. Using Filipino words or having a module on Filipino would be a plus. To make the game more fun, they wanted to see more "sparkle", e.g. cute characters, colorful interfaces, encouraging feedback like "good job!", and congratulatory graphics like smiley faces when learners are correct.

Learners' feedback was consistent with that of the teachers. Some learners struggled in the beginning to understand the game mechanics, but they were subsequently able to play without any problems as soon as they understood what they had to do.

The learners liked learning the meanings of words. They also liked the fact that the game was multiplayer. They said that this multiplayer feature encouraged cooperation among team members requiring everyone to stay alert and to think fast. An important observation by the learner was that the game provided a psychological buffer or safety zone, where "no one has to be blamed for incorrect answers." From the point of view of boosting and maintaining learner confidence, this was a particularly welcome comment.

The learners also made several suggestions to improve game play, content, and the aesthetics of the game. In terms of game play, the version of the game that we tested ended as soon as the players made a mistake. Learners found this to be quite harsh. Instead, they suggested having "lives" to allow players to have the possibility to get a number of wrong answers before losing. They suggested having a single-player mode so that they could practice on their own in preparation for the multiplayer version. They also thought that the content of the game could be improved if the game provided translations of the words in Filipino to ease the initial understanding of the words. Providing pictures could also help convey meanings of words. For the interface design, they suggested using more color, changing backgrounds, emojis, cute characters, music, and some voice to say the word and its meaning.

Design 2. *Ibigkas!* was data-driven in that the program drew words from a text-based corpus that was easy to maintain or replace. Hence, the user feedback that had to do with adding graphics or pictures for every word was not actionable without major software redesign. However, there were many suggestions that we were able to implement to improve both game play, contents, and aesthetics.

Game play. To provide users with help in our absence, we created a tutorial module that walked users through both the single- and multi-player modes. We adjusted the game play so that it was timed. Every correct answer resulted in a time bonus, every wrong answer resulted in a time penalty. We also introduced a pause button for the players to leave the game voluntarily, as we found that players who were proficient in English could hypothetically play "forever". We also created levels so that users could control the speed of the game (untimed, very slow, slow, medium, fast, very fast) and level of difficulty of the words (very easy, easy, medium, hard, very hard). We had initially thought of classifying words by the grade level at which learners were expected to know them. However, because teachers had said that most learners were reading below their expected levels, we reverted to the content descriptions mentioned below.

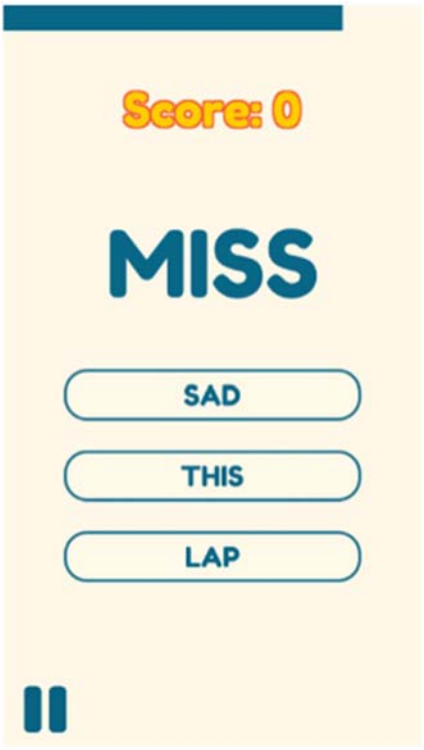

Figure 3. Player screen with a target word **Figure 4. New color palette**

Contents. In relation to the difficulty levels of the game, a long list of words was screened and categorized into five difficulty ratings. The very easy words would be Consonant-Vowel-Consonant words such as *cab, bad, cap, leg, kit,* and so on. Medium difficulty words would have more letters or were still commonly used, e.g. *drum, light, geek, soon, command*. Very hard words would be multisyllabic words (e.g. *ubiquitous, solicitous*), words not commonly used (e.g., *joule, neigh*), or words whose spellings were less transparent (e.g., those with silent letters like *wrought, plough*). We provided a glossary that gave users access to the list of words used in the game.

Visual Aesthetics and Audio. We revised the color palette to look younger, brighter, and more energetic (See Figure 2). We enlarged the target word so it was more distinguishable from the options (See Figure 3). We provided visual cues for correct answers (background flashes green) and wrong answers (background flashes red) We also employed the services of a sound designer to select the auditory effects for option selection, and correct and wrong answers.

User test 2. We tested the game with 9 students from School B, three from grades 4, 5, and 6. We asked the students to play with the game for about 10 minutes and then asked them to complete a questionnaire (Table 9; questions were translated to Filipino).

Students said that they would like to play the game again (4.11). They also tended to agree that the game was easy to play and easy to learn. They tended to disagree that the game was cumbersome or complex.

Conclusions and Ongoing Work

Our attempt to design an educational application for state school learners in the Philippines could not have been accomplished in a vacuum. Although time-consuming and expensive, these repeated consultations enabled us to identify important contextual considerations as well as those related to content and look-and-feel of the game. Both teachers and learners contributed to the conceptualization, drafting, and redesign of the game's content, game game-mechanics, and aesthetics.

Table 9. User test results. 5 = Strongly agree; 3 = Neutral; 1 = Strongly disagree

Statement	Mean	SD
I think that I would like to play this game again.	4.11	0.93
I found the game unnecessarily complex.	2.78	0.97
I thought the game was easy to play.	3.22	1.20
I think that I would need the support of a technical person to be able to play this game.	3.33	0.87
I found the various functions in this game were well integrated.	3.44	1.24
I thought there was too much inconsistency in this game.	2.44	0.73
I would imagine that most people would learn to play this game very quickly.	3.78	1.20
I found the game very cumbersome to play.	2.44	1.13
I felt very confident playing the game.	3.78	1.09
I needed to learn a lot of things before I could get going with this game.	3.22	1.09

Two design features that emerged from our iterative design process reflect the needs of the underserved young learners who *Ibigkas!* is intended to teach: (1) the use of a mobile app (and a corresponding card game) that does not require Internet access, and (2) the level of instruction. That is, this app targets students are unlikely to have regular access to computers or the Internet. Similarly, this app targets ESL students in grades 4-6, who are still struggling with English vocabulary. In principle, however, the game would be useful to any student interested in learning about rhymes, synonyms, and antonyms, regardless of their socio-economic circumstances.

The new version of *Ibigkas!*, which consolidates the findings presented in this paper, is already scheduled for testing in School B and with the Provincial division. We are also planning a dissemination workshop in Manila and in the Provincial division in early 2019 to raise teachers' awareness of the software's existence and of how to use it. We intend to monitor the usage of the software to determine its impact on classroom practice, investigating student learning and engagement, and we shall be reporting these findings in due course.

We are in conversations with ACED and other groups to try to develop corpora for other subject areas such as Math and Filipino. In the meantime, the current version of *Ibigkas!* is already available free of charge on both Google Play and on the Apple Store.

Acknowledgements

We thank the Ateneo de Manila University, specifically the Ateneo Center for Educational Development, Areté, and the Department of Information Systems and Computer Science. We thank the principals, teachers, and learners of our partner public schools for their participation. We thank our support staff composed of Marika Fernandez, Juaneo Fernando, Ma. Rosario Madjos, Jose Carlo Sanchez, Japtheth Samaco, Francesco Amante, John Carlo Ariola, and Jon Ray Favorito. Finally, we thank the Commission on Higher Education and the British Council for the grant entitled *Jokes Online to improve Literacy and Learning digital skills amongst Young people from disadvantaged backgrounds*.

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