Science fluency in primary school: Student transition from Filipino to English language learning

Maribel D. Ganeb and Marie Paz E. Morales
Philippine Normal University, Philippines

This study critically explored Filipino third graders' fluency in science to determine their readiness to comprehend and understand fourth level science, which is taught in English. This mixed design case research purposively sampled 30 third graders from a government-owned elementary school. An oral reading technique using a pre-selected science text passage determined the participants' fluency in science in terms of word recognition and decoding, reading speed, and reading prosody. The results show that our third graders registered low ratings in all the three components of reading fluency. They are categorised as instructional readers of common terms, but are frustrated readers of science terms. They have very low reading speed and based on their reading prosody, more than half of these learners are labelled as non-fluent readers. This resulting dysfluency may be sourced from non-congruence of the complex morpheme and phonemes of English medium compared to the home language of the learners (Filipino). The home language of learners in the Philippines depends on ethno-linguistics grouping, thus a comparative study may be done to extract more information on how to align and help our learners be ready to accommodate level 4 science.

Introduction

Global indices such as poverty reduction index and economic growth and development index influence the nation's quest for knowledge-based society (Morales, 2017). Apparently, strategies to achieve a knowledge-based society serve as a gateway to a better standard of life for citizens, improved sustainability of resources, and economic progress of a country. This implies that a knowledge-based society has the capacity to enhance individuals' globally competitive skills and eventually provide the nation with strong human capital, which can be termed as "scientifically qualified workforce," (Xanthoudaki, 2010, p.8). However, attaining a knowledge-based society will require an extended effort to acquire appropriate skills, for which high quality education is necessary.

In response to this global demand, developing countries like the Philippines greatly invest in education. Significant government initiatives include the curricular reform known as *Republic Act 10533* (Official Gazette, 2013) adopting the K to 12 curricular paradigms, which basically shifts the educational system from a 10-year to a 12-year program. The science curriculum commits to provide Filipino learners with a "repertoire of competencies essential in the world of work and in a knowledge-based society" (Science Curriculum Guide, 2016, p. 2). Significantly, Symaco (2013) saw this curricular shift as the country's defined path for Filipinos to bring them to a globally competitive level workforce, with scientific skills and knowledge to become productive in the current and future economies. Thus, educational institutions must emphasise quality science education to hone the scientific knowledge and skills of the learners (Imam, Mastura, Jamil & Ismail, 2014; Kaptan & Timurlenk, 2012; Loney 2014).

As science education is vital in a country's economic growth and development (Kaptan et al., 2012; NSTA, 2011; Perera, Bomhoff & Lee, 2014; Science Curriculum Guide, 2016; Science Education Institute, Department of Science and Technology, undated; UP NISMED, undated), science educators must be committed to quality science education (Kaptan & Timurkenk, 2012), and provide the country with a scientifically, technologically, and environmentally literate citizenry (Anderson, Hiebert, Scott & Wilkinson, 1985). Locally, science education in the Philippine education system:

> ... aims to develop scientific literacy among learners that will prepare them to be informed and participative citizens who are able to make judgments and decisions regarding applications of scientific knowledge that may have social, health, or environmental impacts. (Science Curriculum Guide, 2016, p.2).

The guiding principles of this framework acknowledge the proactive relationship between science and society and the aspiration to inculcate scientific literacy to every student. School science must insure that students leave school with a level of understanding and high scientific literacy (Imam et al., 2014; Science Curriculum Guide, 2016) — an output of science learning which must be given a high priority by science teachers, specialists, and stakeholders.

Science learning

Learning science is a multifaceted endeavour of developing positive science-related attitudes, emotions and identities, practices, appreciating the social and historical context of science, and understanding scientific explanations of the natural world (Xanthoudaki, 2010). As a prerequisite for this sequence of processes, language plays a vital role in knowledge acquisition.

Tracing back, Vygotsky (1962) emphasised that experience must be coupled with language to develop the learners' thinking. For example, science concepts expressed through words clarify thinking, and provide means for symbolising thoughts, thereby forming an integral part of concept formation. Science concepts are often presented in a text format, using words that convey meanings that may help in concept formation and conceptual change among learners, depending on their reading literacy. The hierarchy in the learning pattern, where understanding of a science concept is sourced from understanding and decoding texts and words, makes science a difficult subject to learn (Vosniadou, 2013). This complexity of the subject leads science learners to struggle with misconceptions (Sadler & Sonnert, 2013), which is aggravated by reading science content. In fact, even students from English speaking countries still consider reading science text as reading a foreign language. Similarly, Filipino learners encounter the same difficulty brought about by their lack of automaticity (Estrada, 2016; TeAchnology, undated), defined by Quizlet (2018) as the development of strong orthographic representations, which allows fast and accurate identification of whole words made up of specific letter patterns found in reading science language. Their low reading level leads also to lower gains in other subjects, though they may have expended much effort in decoding the meaning of printed texts. This situation affects the way they understand text and deduce knowledge from a text, thus impeding their achievements in science.

Science achievement and scientific literacy are considered as major outcomes from science learning (Bybee, McCrae & Laurie, 2009). But national and international student assessments have revealed that students' achievement in science may give a dismal perception of the quality of science education in a country, causing educational leaders to decide not to participate in such assessments (Anderson et al., 1985). Some organisations have pointed out that Filipino students have performed poorly in science, despite having high literacy rate. In fact, the UNDP (United Nations Development Program) reported in 2009 that the 2008 literacy rate of Filipinos fell to 93.4%. The rate increased in 2010 to 97.5% (Philippines Statistics Authority, 2013), despite many decades of poor performance in science and mathematics, as rated locally (Tubeza, 2009) and internationally (Imam, 2009; *The Manila Times*, 2014).

In terms of reading literacy, region-based Filipino learners are tagged as "frustrated" readers, and "instructional" readers (Marual-Gillaco, 2014; Imam, 2009). This result is concerning, because understanding the text is significantly and positively correlated with their performance in science (Imam et al, 2014; Imam, 2009). Internationally, Scammacca, Roberts, Cho, Williams, Roberts, Vaughn and Carroll (2016) reported that student proficiency in comprehending the subject-matter text has remained a significant educational problem in grades 4-12 (levels where reading to learn the concepts is especially important).

Science fluency

Science fluent citizens understand the nature of science, the concepts, and how these concepts can be applied in one's daily life (Lederman, 2009; Xanthoudaki, 2010); understand the concepts written in words and what the teacher is conveying to students; learn science with understanding of its knowledge, theories and its application — all of which are characteristics of science literacy (Century, Rudnick & Freeman, 2008). Science fluency vis-a-vis science literacy of foundational (primary) learners may later motivate the more mature ones to learn science in higher education years, leading to the envisioned knowledge-based society. This outcome may be realised through curricular emphasis on foundational levels by exploiting reader-friendly, well-organised, and clear texts, for better text comprehension (Floyd, Meisinger, Gregg & Keith, 2016).

Reading researchers and specialists recognise that reading fluency is a necessary skill for proficient reading (Kuhn, Schwanenflugel & Meisinger, 2010). Reading fluency dictates understanding of the reading text and is critical to reading success and comprehension (Kuhn et al., 2010). Struggling readers experience slow and effortful reading that leads to difficulty in accessing the word meaning sourced from non-recognition and non-decoding of words (Pappas, 2011). Decoding skills are the building blocks of successful reading (Marual-Gillaco, 2014). Proficient readers can read words in a text speedier and read words in lists quicker than struggling readers can. Proficient readers tend to group words into phrases and read with pitch, stress, duration, and loudness. This reading characteristic known as prosody (the way the reader says words and phrases beyond their phonemic and lexical qualities) means "reading with expression" and is one aspect of oral reading competence. Learners who are able to read text with expression, and understand what the text means compared to reading texts haltingly and into broken strings of words, have high prosody and become competent readers (Pappas, 2011). Good reading fluency by mainstream primary learners allows them to understand science concepts in text leading to better progress in national and international assessments. For struggling readers, encryption of concepts hardly happens because of their poor reading performance, consequently affecting their ratings in both national and international assessments (Imam et al., 2014; Imam, 2009). In fact, the Programme for International Student Assessment (PISA, 2018) survey emphasises that students who are below the standard reading level struggle to perform many everyday reading tasks, and are unlikely to become lifelong learners or do well in the labour market.

The Philippine K to 12 curriculum features three-level learning: foundational level (K to 3), junior level (Grade 4 to 10), and senior level (Grade 11 to 12). In this curriculum, students encounter a significant transition from the primary or foundational level to junior level, namely the medium of instruction transition from a student's home language, Filipino, to English. They also need to transition from the view of *learning to read* to a paradigm of *reading to learn* science concepts. This large shift in the medium of instruction and learning paradigm from primary level to junior level, specifically from level 3 to level 4 presents significant challenges to science fluency and scientific literacy. Relatively little local research has focused on this aspect of language and learning, thus, this study explores the primary students' language transition from Filipino to English with particular reference to science fluency (word recognition, reading speed, and prosody).

Purposes of the research

The study explored the third graders' (taught in Filipino medium of instruction) fluency in science text to determine their readiness to transition to level 4 science (taught in English). Specifically, this study sought answers to the following objectives:

1. Identify the word recognition level of level three students (third graders).
2. Determine the reading speed of level three students (third graders).
3. Describe the prosody of selected grade three students.

Framework of the study

Reading science text is one of the scaffolds of science learning as the text unfolds knowledge for the learners (Van Den Broek, 2010). The ideas, theories, and principles in informational texts need to be understood so that knowledge can be transformed into meaning. It requires reading with a fluent understanding of the text to be able to create mental representations, make meaning, and formulate correct concepts (Helder, 2014; Wright, 2011).

Figure 1 presents our crafted visual to show how we contextualised the theories in reading fluency, which includes word recognition, reading speed and prosody (Seabra, Dias, Mecca & Macedo, 2017). Fluency (ability to read with sufficient ease and accuracy) includes accuracy in word decoding, which will lead to recognition and word expression or correct pronunciation known as prosody, and reading speed. Each facet of fluency is strongly linked to text understanding (Hudson, Pullen, Lane & Torgesen, 2008). Difficulty in word recognition significantly affect the readers' ability to understand the text (Han, 2015). Challenges encountered in word recognition lower attention in reading, reduce reading speed, and trigger rereading just to acquire the meaning of the text (Beech, 2010). Anything that impedes the mapping of print to language, disrupts reading for understanding.

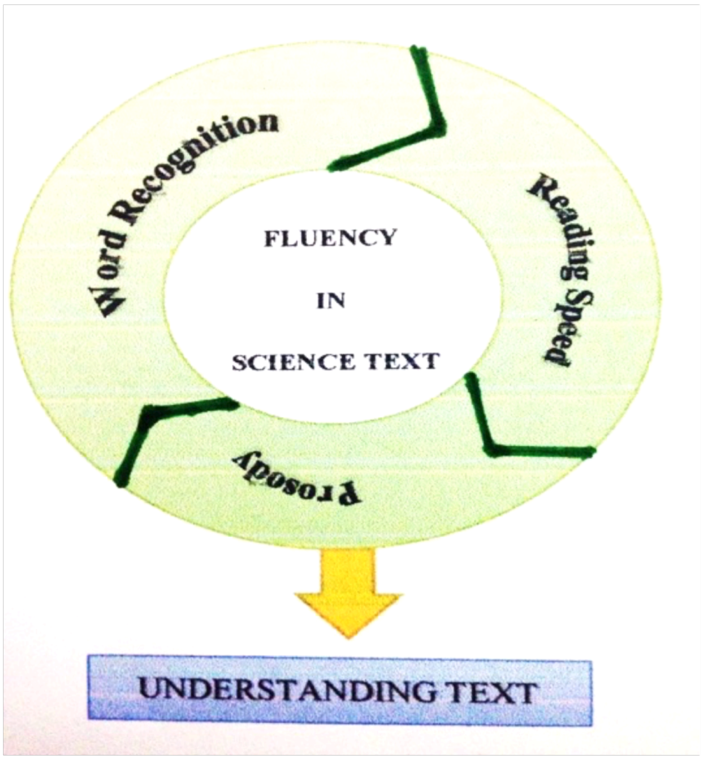

Figure 1: Framework of the study.

The most common causes of reading dysfluency are word recognition difficulties that occur when learners encounter particular words or if they lack word recognition automaticity. Readers may misinterpret the usage or meaning of a word, lose the thread of a sentence, or fail to identify the contextual significance of other words in the passage when they encounter unfamiliar vocabulary. Reading fluency is most commonly assessed by listening to children as they read aloud. When young readers lack fluency, their oral reading sounds choppy or hesitant, lacking accuracy, rhythm, and flow that indicates low confidence in understanding of the text. This manifestation describes the prosody of the reader in reading the text, which may or may not enable the reader to express his or her feelings and thus make meaning out of it depending on the readers' prosody rating (Scientific Learning Corporation, 2017). Additionally, prosody provides evidence that the reader understands what is being read (Paige, Rasinski, Magpuri-Lavell & Smith, 2014), central to interpreting text, and guides listeners and readers to interpret using context (Erekson, 2010). A reader who recognises words in text with good reading speed and good prosody understands the entire text. Thus, this study explored the third graders' (taught in Filipino medium of instruction) fluency in science text to determine their readiness to transition to level 4 science (taught in English) and provide paths to improved science text understanding in the succeeding years, thereby motivating these students to learn science.

Method

The study implemented a mixed methods research design to investigate Filipino third graders' fluency status in science text reading. We chose to explore science fluency to determine the readiness of our third graders (taught in Filipino language) to understand and comprehend science text for level 4 (written and taught in English language). Science fluency identifies the root cause of low student achievement which is significantly correlated with reading comprehension (Chege, 2012; Imam et al., 2014).

Participants

Purposive sampling identified 30 third grade students in a government-owned elementary school in the Philippines' capital city as study participants. Purposive selection of the grade level emphasises the learners' current transitioning status (from learning science in Filipino language in level 3 to learning science in English in level 4). Filipino serves as the medium of instruction in level three in all subjects except in English, which transitions to English language medium of instruction in all subjects in level 4 except in Filipino language subject. The reading states of these learners are within the transition phase from learning reading skills and reading Filipino text, to reading to learn science concepts in English. Ages of the participants ranged from 8.5 to 9.5 years and all had a good record of class attendance.

Instruments

We used four instruments: a reading selection, aide memoire, voice recordings, and transcripts. The *Reading selection* is an adapted text from the Philippine Standard K-12 curriculum learner's level 4 module (Department of Education, 2015, p.80), titled *The kidney function*. This selection is part of the 2nd quarter texts thematically categorised as *Living things in their environment*. We based the choice for this reading selection on the fact that it is the only passage or text with a sufficient number of words for determining the reading standard per minute (Hasbrouck & Tindal, 2017). The selection has four paragraphs with 129 words, composed of 25 scientific terms and 104 general terms. The selection is found on the "remember" section of the module and is supported with an image of the kidney (p. 79) (Department of Education, 2015). Table 1 presents the list of

25 scientific terms from the passage sourcing six terms categorised as common terms but new to learners.

Table 1: Scientific terms in the text selection from *The kidney function*

Scientific terms				Common terms (but may be new to learners)
Balance	Hormone	Nitrogenous	System	* Form
Blood	Kidney	Organs	Urea	* Formation
Body	Liquid	Produce	Urinary	* Function
Cells	Liver	Salts	Urine	* Produce
Filter	Metabolic	Stable	Water	* Stable
Formation	Nephrons	Substances	Waste	* Slightly
Function				
25 terms				6 terms

Aide memoire is a half sheet of paper containing the name, age, teacher, and grade level of every participant, which served as a simple questionnaire for the participant's personal profile prior to the conduct of the oral reading. The *Voice record* refers to the recorded voice from each reader-participant. We used these records as our primary source of information on how each reader read, pronounced every word, and chunked each phrase or sentence. Thirty voice records were saved in an *i-Phone 5* mobile, dated 23 March 2017. The transcribed voice records served as the researchers' transcript. *Transcript* is the last instrument in our list. The transcript included 30 files of transcribed voice records.

Data collection and analysis

The collection of data included four phases: profiling, voice recording of the reading session, transcribing of the voice records, and determining the three fluency indicators. Data gathering took place a week before the end of the 2016-2017 school year. We sought parental consent before the conduct of the study, and debriefing was also ensured before and after the reading sessions. In the profiling phase, we asked the participants to fill in the aide memoire by indicating their name, age, and date of birth. We assisted them to complete this form and provide all the required information. In the reading sessions, we briefly instructed each participant on the flow of the reading session, with the verbal instructions given in Filipino (their home language). We asked them to read the reading selection (written in English) one after the other while ensuring silence during the reading session. Each reader was isolated in a separate room to achieve clear recordings. We sat beside each reader to record the entire reading session (using an *i-Phone* as a mobile recorder), to observe their facial expressions, and to record the reading duration. In transcribing the voice records, we used headsets, listened, and encoded how the participants read and pronounced every word. Our invited validators listened to the voice records from electronic files and descriptively noted the correctness and accuracy of our transcriptions through earmarks and side notes.

Transcript analysis included identifying participants' word recognition by counting the number of words that were correctly decoded, read, and pronounced. We took the ratio of the number of words read and the total number of words to get the percentage of recognised words. Based on the *Philippine Informal Reading Inventory* (Flojo, 2009), word recognition is computed as:

WR = (Number of mispronounced) ÷ (Total number of words) × 100

We determined the reading speed (RS) by getting the duration of text reading and the total number of words in the text. We also took the ratio of the total number of words and the time spent in minutes by the reader:

RS = (No of words in the passage) ÷ (Reading time)

Finally, we determined prosody by listening to each voice record and noted if the reader stopped. We marked every chunk in every phrase or sentence on the transcript. We rated separately, and then compared our ratings for descriptive inter-rater agreement. We took audio recordings of oral reading and reviewed the sections where we did not attain agreement and adapted the *National Assessment of Educational Progress Fluency Scale* (NAEPFS) of Hasbrouck (2006) to describe the prosody of the participants.

Results and discussion

We present this section in three parts: word recognition level, reading speed, and reading prosody of Filipino third graders.

Word recognition level

Word recognition is vital to reading fluency for the reader to recognise written words correctly. Every learner in the foundational years must possess this basic skill to understand the translational English medium of instruction when reading science text. In fact, automatic word recognition is the most common cognitive process that takes place in reading. Table 2 shows the third graders' word recognition of all the words and the science terms in the text.

We note that a large percentage of the participant-readers (77% of 30 readers) are labelled as instructional readers. These are readers who can recognise all the words in the text with the help of a teacher (Philippine Informal Reading Inventory, 2009; Flojo, 2009). Consequently, 26 out of 30 readers (86%) can barely recognise science terms from all the words in the pre-selected text. They are termed as frustrated readers of science texts and are described as those who show withdrawal from reading situations by refusing to read. This finding may be sourced from the complexity and non-familiarity (six common but new terms, Table 1) of English words and science terms (25 terms out of 129 words) compared to their home language from which they are transitioning. This condition is aggravated by the reading paradigm shift ("learning to read" to "reading to learn") while

Table 2: Word recognition level of 3rd graders (N=30) reading the text selection from *The kidney function* (four paragraphs containing 129 words

Percentage of words recognised	Level of word recognition	Description	No. who recognised all words	No. who recognised all science terms
100%	Independent	Pupil can read independently and with ease, without the help of others	5	2
75-99%	Instructional	Pupil can profit from instruction	23	2
39-74%	Frustrated	Pupil who shows withdrawal from reading situation by refusing to read	2	26
0-38%	Non-reader	Pupil who is unable to recognise sounds and sound out letters	0	0

learners transition in medium of instruction from Filipino to English language. Though none among our foundational learners are categorised as non-readers, the large percentage of frustrated readers of science text implies that most of them hardly recognise science terms in the text, that they tend to refuse reading these science terms, which significantly affects their comprehension and derivation of meaning from the text. Consequently, our observations may impact science performance in the fourth level, in which word recognition is a necessary skill to understand in the English medium of instruction and read text in the same language.

Although we observed in Table 2 that the majority (23 out of 30) of the learners are instructional readers (Marual-Gillaco, 2014), who are able to read with the aid of instruction, most of these learners are frustrated readers of science terms, which may indicate difficulty in extracting the scientific and correct meaning of science terms that may affect their learning outcome. If these readers misread the word or group of words, they may lose access to the author's deliberate meaning and misinterpret the meaning of the text (Hudson, Pullen, Lane & Torgesen, 2008). This disability may also affect the learners' assessment performance. Readers who quickly decode words because they correctly recognise them can focus on thinking of the concepts and not on how to recognise, decode, and efficiently read or pronounce the words to understand their meaning (Kuhn et al., 2010).

Reading speed

In the reading fluency components, reading speed refers to the ratio of the number of words read in the passage or reading selection and the reading time. It is highly influenced by word recognition and decoding (Nascimento, de Carvalho, de Souza Batista Kida & de Avila, 2011). The reader is labeled as a fast reader when the reader is able to recognise and read about 120 words in a minute. We confirm our assessment of the participant readers' low word recognition and decoding by presenting the results in Table 3.

Table 3: Reading speed level of 3rd graders

Reading speed based on Phil. IRRI Grade 3 standard			Oral reading rate of Grade 3 based on International Standard		
No. of words per minute	Speed	Number of participants	Correct words per minute	No. of participants	Classification
Below 90	Slow	15	Below 119	28	Not standard
91-119	Average	13	Above 124	2	Standard
120	Fast	2			

We assessed that the oral reading rate (28 out of 30; 93.3%) of most third graders based on international metric (NAEP, 2002) is below the standard (119 words per minute and below). In fact, Philippine Informal Reading Inventory (Phil IRI) (2009) rated 50% (15 out of 30) of our third grade participant-readers as slow readers who can recognise only about 90 words or fewer per minute. Furthermore, both standards (Phil IRI and international standards by NAEP) are attained by only two readers among the 30 participants to be within the respective metric standards. Evidently, voice records suggest that most of these readers rated as slow, stopping momentarily when reading science words, which affects their reading speed. The readers' pacing may result in non-completion of assigned schoolwork (Kelly, 2014), consequently putting pressure on the student, eventually leading to a loss of interest both in reading and understanding the content, thus significantly affecting how they assimilate the content (Xanthoudaki, 2010). Strong correlation is evident between reading rate and higher comprehension in average and poor readers (Rasinski, 2014), thus, the results of our observations may mean that our third graders may need further assistance to bring their reading fluency to the standard and help them make meaning in science classrooms when reading by sustaining good word recognition, and decoding to accelerate their reading speed and their motivation to learn science content.

However, Rasinski and Hamman (2010) believed that more important than speed in reading is active awareness and thought about the language, which may attain certain levels of text understanding through appropriate and meaningful phrasing. Accordingly, this skill is termed as prosody, the third component of reading fluency.

Reading prosody

Prosody is a foundational reading skill that students must develop from 1st to the 5th grade. Inappropriate or meaningless groupings of words or unsuitable applications of expression may result to poor prosody and eventually confusion. In Table 4 we present the reading prosody assessment of the participants and the corresponding rating with reference to the components of reading prosody: expression and volume, phrasing, smoothness, and pacing.

Based on our assessment, more than half (57%, 17 out of 30) of our Filipino third graders are considered as non-fluent in their level of prosody, and they may require significant intervention to develop a level of fluency enabling them make meaning of science text and

Table 4: Level of prosody and over-all rating of in each component of reading prosody

Prosody level	Description	Prosody component	Prosody component ratings	Description	No. of participants
Fluent	Has good prosody	Expression and volume	3.07	Sounds like natural language throughout the better part of the passage. Occasionally slips into expressionless reading. Voice volume is generally appropriate throughout the text.	13
		Phrasing	2.7	Mixture of run-ons, mid-sentence pauses for breath, and possibly some choppiness; reasonable stress/intonation.	
		Smoothness	3.3	Several "rough spots" in the text where extended pauses, hesitations, etc., are more frequent and disruptive.	
		Pacing	3.15	Uneven mixture of fast and slow reading.	
		Over-all	12.22	Manifest prosody.	
Non-fluent	Needs intervention to develop fluency	Expression and volume	1.4	Reads with little expression or enthusiasm in voice. Read words as if simply to get them out. Little sense of trying to make text sound like natural language. Tends to read in a quiet voice.	17
		Phrasing	1.5	Frequent two and three word phrases giving the impression of choppy reading; improper stress and intonation that fail to mark ends of sentences and clauses.	
		Smoothness	1.8	Several "rough spots" in the text where extended pauses, hesitations, etc., are more frequent and disruptive.	
		Pacing	1.8	Moderately slow.	
		Over-all	6.5	Do not manifest prosody.	

understand text. We noted that our Filipino third graders lack skills in all components of prosody, but their insufficiency is more pronounced in expression, volume, and phrasing, though they also exhibit quite low ratings in smoothness and pacing. Most of these readers read the words that they don't really recognise and decode in a soft voice, which denote a low confidence that they understand what they read (Reading Rockets, 2018). Low confidence can also be sensed in the way they perform in smoothness of reading. They tend to exhibit prolonged pauses, hesitation and poor intonation (Miller et al, 2008), and are often disrupted in the reading process. Additionally, we observed that these readers phrased words in groups of three (the maximum) that they render choppy reading. This grouping of words in a phrase provides a short and probably meaningless phrase rendered by the text when read by non-fluent readers, consequently affecting text comprehension, and reading achievement (Miller & Schwanenflugel, 2008) that significantly influences text understanding and meaning making. Inaccurate meaning making from the text may even result to misconceptions of science ideas and information.

Conclusion and recommendations

Reading is an essential and an effective mental process to transfer information into knowledge (Reading Soft, 2017). In fact, reading is considered as a fundamental building block for gaining knowledge as needed for a knowledge-based society (Marual-Gillaco, 2014). Our study explored Filipino third graders' (Filipino language medium of instruction) fluency in reading a science text in terms of word recognition, reading speed, and prosody, to determine their readiness to transition to fourth level science based upon English as the medium of instruction.

We found that our Filipino third graders registered low ratings in all the components of reading fluency. The majority of these participants are categorised as instructional readers of a selected science text. Worse, they are rated as frustrated readers of science terms. They barely recognise and decode common words and they encounter great difficulty in decoding and recognising science terms, significantly implying low automaticity and reading speed. As confirmed, more than half registered low prosody indicating non-fluent readers in terms of expression and volume, phrasing, smoothness, and pacing. These results imply that our third graders (Filipino [L1] medium of instruction) may encounter struggles in their fourth level science, unless we provide concrete assistance while they transition from L1 to L2, to bring them to the level of readiness for fourth level science (English [L2] medium of instruction). The displayed reading dysfluency by our learners may not be able to awaken the pre-conception of learners during reading or teacher instruction. Helder (2014) believed in the capability of students' preconception to help them integrate new information into their knowledge system, which directs them to text formation and helps them organise and process a given text. However, dysfluency may not extract these preconceptions in classroom discussion, which may lead to non-accommodation of new information, eventually resulting to accumulation and formation of alternative science conceptions or misconceptions.

Dysfluency among Filipino third graders may arise from the great differences between the English (L2) medium and their home language (L1) (Morales, 2014). We treat words in our home language differently compared to English. Filipino words are spelt as they are pronounced, while English words do have complex morpheme and phonemes (Dimaculangan, 2017). Since our learners are accustomed to learning in their home language as prescribed by the inclusion of the mother-tongue based learning in the foundational or primary levels (Kindergarten to Level 3), they encounter difficulty in recognising English terms due to the aforementioned difference. Our learners are not accustomed to hear the different phonemes in English language, so they don't register automaticity in English as compared to their home language. Furthermore, our learners tend to develop Filipino-influenced English (Dimaculangan, 2017) that further complicates matters on learning the English language (L2), resulting to non-recognition and non-decoding of English words in a science text. This situation renders dysfluency, which leads to non-comprehension of text impeding understanding of the text, meaning making from the text, and ultimately deviation of the student from the author's intended meaning of the text. This could lead to science misconceptions which may impede scientific literacy.

We have a promisingly significant result that may inform foundational or primary education policies, language theories for English for second language speakers, and practices of foundational or primary education. However, the study only focused on exploring science fluency of Filipino third graders in terms of word recognition, reading speed, and prosody to describe Filipino students' L1 to L2 transition. We have covered only a section of the whole transition process and have not described how motivation to read, derived from concrete, confidence building and engaging science training, can improve science fluency. Further studies may explore the entire transition process by investigations of classroom experiments and active learning experiences of learners in developing science fluency. Likewise, prosody construct in this study concentrated on data obtained from participants' read aloud sessions. We have not considered in our data collection procedure the possibility that the nature of participants' previous experiences with reading aloud to an audience may be an influential factor in poor reading performance. Future studies may examine how teacher-student ratio impacts upon achieving more student-centred classrooms, in which there may be more opportunities for practising reading aloud skills.

Finally, this study was conducted with Filipino learners who speak Filipino as their home language. This means that results obtained in our study may represent only learners speaking the same home language. A replicated study could be undertaken to determine the readiness of students with other home languages for fourth level science education. Also, comparative analyses of the performances of children from different home language groups, from different parts of the country, and in different countries such as those in engaged in PISA, taking into account class size, teachers' pay and disciplinary climate (PISA, 2018) could be valuable. Such further studies will help to develop the best possible framework for language training in the foundational years, which is needed to deliver improved performance in science and other subjects, eventually building strong human capital for the envisioned knowledge-based society.

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Maribel D. Ganeb is a Master Teacher II at Andres Bonifacio Integrated School, Division of Mandaluyong. She is a postgraduate student in the Philippine Normal University undertaking a PhD in Science Education through a state scholarship program. Her interests include research and publication in ICT integration and its effect on integrated science process skills and perception in science.
Email: maribel.ganeb@deped.gov.ph

Dr Marie Paz E. Morales is a Full Professor in the College of Graduate Studies and Teacher Education Research at the Philippine Normal University. Currently, she holds the directorship of the Publications Office of the Philippine Normal University, managing three journals. Her research interests are in science education, cultural studies in science education, indigenous knowledge, STEAM education, and gender education.
Email: morales.mpe@pnu.edu.ph

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