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Introduction of Phonological Concepts in an Initial Teacher Education Literacy Unit

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Abstract: Pre-service teachers (PSTs) need sound Knowledge About Language (KAL), both for their own professional communication and for their teaching practice. In the longer term, enhanced KAL will benefit our graduates in their implementation of the Australian Curriculum. This paper reports on work with First Year PSTs at one Australian university. We present an analysis of students' response to an intervention designed to develop their KAL, focusing on Phonological Awareness (PA) and phonics. While the designed resources were introduced and discussed in class, students mainly accessed them online afterwards. Student achievement was measured by online testing, and attitudes were obtained from unit evaluation instruments and a survey. We present results documenting their knowledge before and after the intervention, and their attitude toward the content. Most students demonstrated improved confidence and increased knowledge in particular areas post intervention. Nevertheless, their ability to apply their knowledge lagged behind their ability to give definitions.

Introduction

It is crucial that our pre-service teachers (PSTs) have a sound Knowledge About Language (KAL), both for their own professional communication skills, including writing of university assignments, and as a knowledge base for their teaching of English in schools (Sangster et al., 2013). In the short term, improved KAL is likely to mean that student teachers perform better in their degrees. In the longer term, enhanced KAL will benefit our graduates in their implementation of the Australian Curriculum English (ACE). KAL underpins all literacy teaching. In order to teach children how to write, teachers need good knowledge about how language works at the text, paragraph, sentence, clause, group and word level. Students need to understand word classes (parts of speech) and how they carry and expand the topic in different learning areas. They need to appreciate how different types of sentences and clauses create relationships with the audience. To teach children how to read, they need to know about semantics (from the text to the word level), sentence structure and word classes, as well as phonemic awareness (being able to recognize the individual sounds in words) and phonics (the relationships between letters and sounds). Further, they need to understand the differences between speaking and writing so that they can move children from talking into written discourse. The understanding of the PA concepts (covered in our initial Language and Literacy unit, which we will call LAN1) underpins all these other aspects of English language structure. All of these aspects are explicitly mentioned in the

ACE, especially in the Language strand, and are developed in later core LAN units that follow LAN1.

National accreditation bodies in Australia require Higher Education providers to prepare pre-service teachers to graduate with a set of high professional standards. As such, from 2017 all enrolling PSTs have been required to sit a national Literacy (and Numeracy) test, known as LANTITE, in order to register as teachers. In terms of the focus of this paper, it is vitally important that PSTs have a sound knowledge of the KAL needed for teaching children to read in particular; this has been an ongoing area of concern in the Australian education system.

Knowledge About Language, or KAL, has been defined by Harper and Rennie (2009) as:

... a concept that relates to all aspects of linguistic form. It relates to knowledge about the sounds of a language, such as knowledge about the phonological and phonemic systems and how these systems relate to print (graphophonics), as well as to knowledge about the words of a language, word meanings (semantics) and the origins of words (etymologies). A major aspect of KAL ... is knowledge about grammar ... A further, but related, aspect of KAL is sociolinguistic knowledge, or knowledge about the different language varieties used in a speech community and their contexts of their use. (p. 23)

While Harper and Rennie have offered a broad definition of KAL, many educational researchers are much narrower in their focus. For example, Purvis et al. (2016, p. 57) claim that, “many pre-service teachers in Australia have deficits in areas of literacy”, referring to a lack of what they term ‘metalinguistic knowledge’ but which they in fact limit to “phonological awareness, morphological awareness and orthographic knowledge” (p. 55). Alternatively, as Honan et al. (2013) would argue, this very statement could present a deficit approach, failing to take into account pre-service teachers’ sociolinguistic understandings and their vast knowledge of multiliteracies and digital literacies. Perhaps the answer lies somewhere in between these extremes. Whether a broad or a narrow view of KAL is adopted, there is no doubt among many educators and researchers that explicit understandings about language are necessary for PSTs, both for their own literacy development and in order to effectively teach their students.

There appears to be some evidence that shows that the metalinguistic knowledge of pre-service teachers (PSTs) in regard to language structure is generally low (e.g., Coltheart & Prior, 2007; Fielding-Barnsley, 2010). Coltheart and Prior (2007, p. 6) refer to “spelling and grammar”, as well as phonemic awareness and phonics. However, some of this literature, especially that from a Learning Difficulties perspective, needs to be read with caution as it takes a very narrow view of what KAL is, that is, the authors do not state that it is only looking at part of KAL.

Research by Fielding-Barnsley (2010) makes it clear from its title that it is only concerned with phonemic awareness and phonics. However, for other writers the limitations of scope are not so obvious. For example, Bos et al. (2001) use “language structure” to mean PA and phonics only; Mahar and Richdale (2008) use it to mean phonology only, and they use the terms “linguistic knowledge” and “metalinguistic knowledge” to refer to phonics only, in spite of their paper being entitled, “Primary teachers’ linguistic knowledge...”. Another example of unusual lexis is “structured language terminology” (Mather et al., 2001, p. 476), which, again, refers to phonology and graphophonics only. Bostock and Boon (2012) mention “Pre-service teachers’ ... literacy competence” in their title but acknowledge that they assess, “a small subset of literacy skills” (p. 19). Tetley and Jones (2014) use the general terms “language concepts” and “knowledge about language” for what on closer examination is revealed to be limited to PA and phonics knowledge. Purvis et al. (2016) use “language

structure” and “the constructs of the English language” to refer to PA, phonics and morphology only; and Washburn et al. (2016), citing Joshi et al. (2009), use the term “basic linguistic constructs” to refer to phonology and morphology only.

Keeping in mind that these studies focus on particular, low-level aspects of KAL (at the word level and below), the findings can be generalized to state the PSTs and teachers are usually found to be lacking in this knowledge. However, to conclude that they are lacking in “literacy competence” is arguably an over-generalisation and an indication that the findings of such studies should be treated with caution.

Studies investigating Australian pre-service teachers using a broader definition of KAL have found that the participants’ knowledge was “fragmented and lacked depth”, and most “did not feel adequately prepared to use their knowledge in future teaching” (Harper & Rennie, 2009, p. 22), as well as finding that beginning teachers and their senior colleagues identify a need for stronger preparation of personal literacy for new graduates (Louden et al., 2005). Moon (2014) finds that the personal literacy skills of PSTs who are preparing to be secondary teachers are gravely inadequate, in terms of their ability to spell and write grammatically correct sentences. While it is certainly possible to write well without having explicit KAL, in student teachers the lack of KAL is a concern, as they will need to help develop their own students’ writing and will need a metalanguage to do so.

In a recent overview of the field, Stephenson (2018) presents a systematic review of the research on the knowledge and skills of PSTs in Australia, which includes KAL. Of the fifteen peer-reviewed journal articles related to literacy, ten found PSTs’ knowledge to be lacking in some way. In investigating students’ perceptions of, or confidence in, their own knowledge and skills, Stephenson (2018, p. 131) examined 15 studies across a range of topics, including literacy. Only one study showed that PSTs underestimated their knowledge, while six reported that they over-estimated it. Five studies found higher confidence to be associated with more knowledge. Thus, it could be that the Dunning-Kruger effect (Kruger & Dunning, 1999) is in operation here: that PSTs “do not know what they don’t know.”

As well as PSTs, there is evidence that in-service teachers are lacking in KAL. Stark et al. (2016) take a broader view of language than many articles in the *Annals of Dyslexia*; their work investigates knowledge at the sentence and discourse levels, as well as PA, phonics and morphology, concluding that “teachers’ content knowledge of basic linguistic constructs is limited and highly variable” (p. 39). Their questions on sentence structure and discourse, however, appear somewhat randomly selected and lacking in context. Similar to the studies of pre-service teachers, many studies, such as Carroll et al. (2012), are limited to looking at phonology and paint a negative picture. However, Tetley and Jones (2014) found that, overall, PSTs had better PA and phonics knowledge than subjects in some earlier studies of both in-service and pre-service teachers, indicating that there may be a change in progress, possibly influenced by recent changes in teacher education.

In the UK, Myhill et al. (2013), focusing on middle school teachers and the teaching of writing, demonstrated that teachers’ implicit KAL is more developed than their knowledge of language as object. That is, teachers may not do well on decontextualized tests of KAL but are able to use the knowledge that they have in their practice. Myhill et al. (2013) argue for explicit knowledge about language, but stress that it needs to be able to be applied in context to discuss how texts make meaning. This has implications for the design of studies investigating teacher KAL. In order to investigate the depth of teacher understanding, it may be preferable to look at ‘transference’ of knowledge, as Fenwick et al. (2014) do in their study of primary PSTs at one Australian university; they found that, following a carefully designed program, students were able to transfer their knowledge of linguistics into tasks such as writing lesson plans. Joshi et al. (2009) claim that teacher educators in the USA lack

KAL; however, literature on the topic of teacher educator KAL appears to be scant, and this would probably be a fruitful area for further investigation.

Some researchers have used problematic items in their tests of PA and phonics (Mahar & Richdale, 2008; Mather et al., 2001; Meehan & Hammond, 2006; Moats, 2009; Sayeski et al., 2017; Stark et al., 2016). Readers should take into account these problems when interpreting the reported results. Problematic areas include the authors' knowledge of dialect differences (Moats, 2009), diphthongs (Mahar & Richdale, 2008; Mather et al., 2001; Meehan & Hammond, 2006), schwa (Moats, 2009), spelling (Mahar & Richdale, 2008; Mather et al., 2001; Sayeski et al., 2017) and sentence structure (Stark et al., 2016). Some of these problems relate to issues with using instruments not designed for Australian English speakers. See Appendix 1 for details.

Background

The project reported here arose out of concerns that the PSTs in our Primary program did not have the KAL necessary to prepare them for their future occupations as teachers. The project was part of a wider study, "Student Literacy Needs and Support in the B.Ed. Primary" (2016-2020), approved by the University's Ethics Committee. The aim of the project was to investigate the needs of our students in terms of both their academic writing and their KAL for teaching, as well as trialling means of supporting these areas. It began in 2016 as a pilot study (Thwaite, 2016). In this small study one cohort of our First Year B.Ed. (Primary) students was surveyed about their views of their own KAL and whether they thought that they needed support in this area. Most students expressed confidence that their skills were sufficient for their university studies and did not consider that they needed help. A group of self-selected students who did indicate that they would like support was invited to take part in a short intervention where they participated in hands-on grammar activities. Feedback was positive but the numbers were too small to obtain any significant results.

Beginning in 2017, we commenced tracking students in a pilot study that surveyed and tested one cohort of students (Thwaite et al., 2017). This indicated that, in general, students who had strong KAL displayed a realistic perception of their own abilities; however, those with weaker KAL tended to be over-confident. As part of this project, we produced resources to support student KAL in the first three Language and Literacy units in the program, Yvonne Urquhart acting as our research assistant. Resources consisted of powerpoints and podcasts about various aspects of language, with associated quizzes. After the 2017 pilot, we refined our resources and instruments for the next iteration of the unit in 2018, reported upon here.

LAN1 is the first of four units focused on the teaching of English in Primary School. The unit examines spoken language and its importance as a foundation for both learning and teaching, as well as its vital role in stimulating the development of essential communication and thinking skills. Unit content covers aspects of spoken language, including language variation, register, the mode continuum, active listening, and phonological and phonemic awareness. In the unit PSTs are encouraged to consider the backgrounds of the students when selecting from a range of teaching and learning strategies to promote learning and thinking across the curriculum. On completion of this unit, PSTs progress to LAN2, which focuses on teaching English in the early years, followed by LAN3: Teaching English in the middle years and LAN4, which focusses on supporting children from EALD (English as an Additional Language or Dialect) backgrounds.

Historically, PSTs have found the first unit, LAN1, to be challenging and, in particular, have grappled with the understandings of KAL and the metalanguage of literacy

and language learning. Student unit evaluations over several years showed a pattern of dissatisfaction and a perception of the unit as being irrelevant and confusing. This was part of the impetus for this project.

The current study aims to investigate the knowledge about, skills in and attitudes to KAL of one cohort of pre-service teachers. These students are in the first year of their degree and are undertaking the unit LAN1. The KAL project was implemented to address the gap in understanding of KAL and associated student dissatisfaction identified in previous versions of LAN1. Our primary research question was: "What was the effect of the inclusion of a KAL component in the LAN1 unit in 2018, in terms of the students' knowledge of, and attitudes to, basic phonological concepts?"

Methods

Research Design

We present this as an observational case study of a particular cohort, including both qualitative and quantitative components. As the study took place as part of the ongoing running of a unit, the educational context could be seen as limiting what we were able to do; for example, an experimental design was certainly out of the question, and all designed-in experiences were conceived of as potentially beneficial to the students.

Participants

A unit licence was obtained and ethics approval granted to use deidentified data. In addition, all students were invited to participate in a follow-up survey and were recruited through invitation. All students enrolled in the unit were first sent an email advising them of the study and referring them to a podcast provided on the unit Blackboard site (the Learning Management System or LMS), entitled "KAL Information Video", which outlined the project and their involvement. Students were informed that the KAL component of the unit functioned as a support for them (as a diagnostic test so they could determine their own level of KAL knowledge on topics that would be covered in the unit, weekly podcasts and practice quizzes), and that the overall KAL knowledge from the unit would be assessed in a summative test at the end of the unit.

There was also a note in the Unit Plan and a Frequently Asked Questions (FAQs) sheet in the Assignment folder in the LMS, as well as a heading on the Discussion Board. The invitation was then repeated and extended in the first lecture and an information letter and consent form was provided; students were invited to sign and submit this. Online students were invited by email and through a live online session.

Individual student background data were not collected due to the limitations of the Ethics licence; nevertheless, we are able to say that typically our undergraduate cohorts contain approximately 15% bilingual students. These students may have had a greater underlying KAL than the monolingual students; however, the purpose of this paper is not to explore such differences but to focus on the cohort as a whole.

Procedures

Recruitment and Participation

Consent forms were made available in lectures and tutorials for on campus students who were interested in participating to sign. Off campus students were recruited through the

LMS and those interested were emailed the consent form. The Coordinator of Primary Programs gave us permission to email the students through the LMS, and this was approved by the Ethics committee. Our survey was distributed by email and the university-wide survey (the Unit Teaching and Evaluation Instrument or UTEI) was distributed by the usual channels, that is, the university emailed all the students in the unit with a link to the survey. The smaller sample who did the final survey were a sample of convenience recruited from Helen Adam’s class; they consisted of the students in the class who had originally signed the consent form for the project.

Teaching Content and Delivery

LAN1 was offered both on and off campus. Weekly topics consisted of Introduction, Language development, Children’s speech, Talk across the curriculum, Language and Literacy, Selecting literature, Application to practice, Spoken language, Phonics and Unit review. Support for students’ KAL learning was offered in the form of non-compulsory weekly podcasts and quizzes to test their understanding of the topics. The number of minutes for each podcast and the number of weekly quiz questions is shown in Table 1, while Table 2 focuses on Phonological Awareness in the First-Year unit, giving details of the main topics.

Week	Podcast (Minutes)	No. Weekly Quiz Questions	Topic
1	9	10	Language variation in speaking and listening (Register) (Derewianka & Jones, 2016, p. 5f)
2	11	2 (14 items / 13 items)	Active listening: before, during and after listening (not in the 2018 Final Test)
3	15	13	Phonological Awareness (predominantly phonemic awareness)
4	-	-	-
5	-	-	-
6	16	10	Moving from spoken to written language (including decoding and encoding phonemes to graphemes)
7	5	1 (24 items)	Within word (including blends, digraphs, trigraphs)
8	6	15	Apostrophes in contractions (some note of pronouns/contractions)
9	9	20	Apostrophes/possession
10	-	-	Online Exam: Final Test: a random selection of topics from the KAL component

Table 1: Podcasts and quizzes used in the first-year unit

Week	Topic
3	Phonological Awareness (predominantly phonemic awareness)
6	Moving from spoken to written language (including decoding and encoding phonemes to graphemes)
7	Within word (including blends, digraphs, trigraphs)
10	On-line Exam: Final Test- a random selection of topics from the KAL

Table 2: LAN1260 KAL topics

Instruments and Measures

Weekly Quizzes

There were six weekly quizzes which students could do online in their own time. The quizzes were automatically marked online but the marks were solely to provide formative feedback to the students and did not contribute to their final grade.

Diagnostic and Summative Assessments

Students were informed about the assessments in class, in their Unit Plans and on the LMS. While for the students we used the terms, 'Pretest' and 'Final Test', these were, in fact, a simple diagnostic assessment and a more complex summative assessment, both completed online in the students' own time. The diagnostic assessment was to be taken at the beginning of the unit, was optional and did not attract any marks; it had 29 questions, of which 21 related to PA. The summative assessment was in Week 10 of the unit and was worth 10% of the students' total marks. For this assessment, there was a bank of 41 questions out of which each student had to answer 10. The summative assessment had to be attempted in one sitting and students were asked to complete it "on your own as if you were sitting in an exam room - by undertaking the **online** test you are acknowledging that it is your own individual work" (Announcement on the LMS). Questions were selected randomly from a question bank so that if students did sit together they would be unlikely to encounter the same items.

For these two online assessments the questions covered the same topics, with, in general, several questions for each topic. However, although the diagnostic test was virtually identical in scope to the summative test, the questions were in a simpler format (i.e., more dichotomous questions, in the form of true/false statements), whereas the summative assessment was made up of questions that required students to show their understanding (e.g., "How many syllables in [this word]?", multiple choice to define terms). For example:

- The diagnostic test included many true/false questions, which the summative one did not.
- The summative test asked for definitions of terms and application of knowledge.
- For the graphophonics topic two of the questions asked the students to identify all the consonants and all the vowels but these were not asked for in the summative test. (These questions that focused on simply identifying the consonants and vowels were set in the diagnostic test to alert the students to this information and not really considered to be of high enough value to need to be tested again.)

This structure was chosen as the diagnostic test was predominantly to make the students aware of the topics (to set a mindset to begin considering the topics that would be addressed in the KAL component of the unit for the semester). The justification for the simpler questions in the diagnostic test, as compared to the summative one, was based on a concern to not overwhelm the students with their lack of knowledge before they had been taught the topics; i.e., the diagnostic test was set as more of a 'taster' for the topics that would be covered in the weekly KAL podcasts and quizzes. We were conscious that we did not want these first-year students faced with a sense of failure from this first assessment. The summative assessment was to ascertain the depth of their knowledge and learning based on the podcasts and quizzes throughout the unit. Therefore, the diagnostic and summative assessments covered the same concepts/topics, but the difficulty of question types did not equate.

Another reason for not including exactly the same questions in the diagnostic and summative assessments was that we did not want the students to simply remember the

answers and regurgitate them: we wanted them to have deeper understanding of the concepts of PA and phonics. Furthermore, immediately after completing the diagnostic assessment the students were given the answers (to give an indication of aspects of the topics that would form the foundation for their learning). The fact that students had been provided with the answers, and that the summative test was completed online (with students potentially having their notes available) was a further reason for not duplicating the questions.

Our analysis examined the results for both the diagnostic and the summative tests. Attempts for all weekly quizzes were also compared to the summative test, firstly with all students (including those who withdrew and did not attempt the final test), then with only students who attempted the final test. The average diagnostic test scores that related to the PA topics were added. The diagnostic and final test marks were compared as percentages. The final test was compared question by question as percentage correct. Where students did less well on the final test than the diagnostic their results were analysed again to identify possible explanations for this. In interpreting our analysis we kept in mind that the summative test was more difficult than the diagnostic one, which clearly would affect the results. Due to this fact and because our study was not an experiment pre- and post-test design, we clearly cannot perform quantitative measures such as tests of statistical significance on our data. Table 6 gives a list of questions for the summative test, along with overall results for each question.

University-wide Surveys

We compared student satisfaction as evaluated by the UTEI from previous years and those subsequent to the introduction of the KAL component. The UTEI is a university wide instrument that measures student satisfaction through eight items related to unit content and organisation. A Likert scale is used for student input on each item. A subsequent section allows for students to provide text responses on the following two questions: *What were the best aspects of the unit?* and *What changes would you suggest for this unit?* The eighth item, which measures the students' overall satisfaction for the unit: *"I am satisfied with this unit (the unit met my expectations in most ways)"*, is used to generate an overall satisfaction score which is compared with average scores from across the university. This study utilized the data from the overall satisfaction scores and from the two questions in the text response section.

First, overall unit satisfaction scores were considered for the three years prior to the introduction of the KAL component and for the two years in which the KAL component had been included. This allowed us to identify any changes following the inclusion of KAL. Second, the text responses from the year before the inclusion of the KAL component (2016) and the year of inclusion of the KAL component (2017) were analysed to identify the percentage of comments specifically related to KAL in both pre- and post KAL inclusion. The text responses were analysed by Helen Adam and Yvonne Urquhart using an inductive approach in which "frequent, dominant or significant themes inherent in raw data emerge from the application of a systematic analytical process" (Thomas, 2006, p. 238). Using Braun and Clarke's (2006) five stages of thematic analysis, the text responses were read and re-read, initial codes generated and emergent themes established. Through an interrater conference, the themes were reviewed and checked for fidelity; this revealed 100% agreement on the nature of the themes. Finally, each theme was carefully defined and named. In line with the framework of sociocultural theory, in which participants interpret and make sense of their experiences to capture their version of reality (Denzin & Lincoln, 2005), direct quotation of student comments was utilised with a goal of building "an in-depth picture of participants'

understandings and responses” (Buchori & Dobinson, 2015, p. 73) and thus to authenticate the analysis.

To mitigate potential uncertainty about whether changes could be attributed to other reasons such as quality of teaching or unit content, the teaching team and the unit content and assessments remained the same across this project, with the addition of the KAL the only modification. All members of the teaching team had over ten years’ experience in teaching undergraduate pre-service teachers.

Follow-up Survey

A group of students who had initially indicated their interest were given a follow-up survey to reflect on their learning. They provided written feedback about their attitudes and perceptions of the benefits of the KAL program. This was undertaken in 2019, after they had completed two further literacy education units. Please see Appendix 2 for a list of the survey questions. As this was a sample of convenience, based on the students Helen Adam could access in her class, only a very small number of students (five in total) responded. Due to the very low response rate, the results of the survey will not be presented here.

Findings

Data were obtained from 423 students enrolled in the unit in 2018: 76 off-campus (online) and 347 on-campus students. For the LAN1 unit much of the focus was on the students’ understanding of Phonological Awareness (PA); therefore, we look at the data especially related to topics under this umbrella term. These include syllables, onset-rhyme, phonemes (consonants, vowels and diphthongs), as well as the process of manipulating phonemes. Test scores for the parts of the diagnostic test and summative tests that focussed on PA are discussed. We first deal with student attitudes and then with their achievement.

Student Attitudes

Overall Attitudes to the Unit

This section will provide results and identify findings relating to the student satisfaction scores and comments relating to KAL. The evidence from this study shows that following the addition of the KAL component of the course, student attitudes showed strong approval of and satisfaction with the KAL learning and increased overall satisfaction with the unit as a whole. Unit evaluations suggest that the KAL component is strengthening confidence and understanding of linguistic concepts. Table 3 shows the unit satisfaction scores for LAN1 from 2014 – 2018. The university average satisfaction scores are also shown; this score is a weighted mean with a potential maximum of 100 – the weighting takes into account the number of students in the unit. This evidence shows that prior to the introduction of the KAL component in 2017, the unit scored a maximum of only 35% of the university average. Following the inclusion of KAL, the change was considerable, with the score being 84% of the university average in 2017 and 94% in 2018.

	Year				
	2014	2015	2016	2017	2018
Unit score	17	11	17	41	47
University average	48	49	51	49	50
% of University average	35	22	33	84	94
No. of student responses	81	119	145	84	115
Participation rate	18%	28%	37%	28%	32%

Table 3: Unit evaluation scores in relation to the University average

While the improvements against university scores are encouraging, the most important result shown through the comparison in Table 3 is that the unit satisfaction score rose dramatically by 24% in the first year of the inclusion of KAL (2017), and a further 6%, giving an overall increase of 30%, in the second year of KAL (2018), though it is important to note that based on student feedback from 2017, minor changes were made to quiz scoring processes for partially correct answers and this could have contributed to this increase.

Three themes emerged from the 2016 UTEI comments: confusion over concepts/language; overwhelmed; and lack of feedback. Another three, strongly contrasting, themes emerged from 2018: Practical application; KAL was enjoyable; KAL reinforced learning. The thematic analysis from the comments section of the UTEIs supports the finding that the increase in the satisfaction score is likely to have been due to the inclusion of the KAL component. These themes and typical student comments illustrating them are shown in Table 4. This evidence shows that the addition of the KAL component to the unit led to a noticeable improvement in student satisfaction with the unit and that this satisfaction was tied to the expressed belief by students that their learning was enriched and supported by the KAL component.

Theme	2016		2018	
	Illustrating comment	Theme	Illustrating comment	Theme
Confusions over concepts / language	I felt confused throughout this unit. Slow it down, explain it, I've never heard of many of the things introduced in this unit before, therefore I need to learn it and relate to it.	Practical application	The online KAL quizzes also helped improve my knowledge which was extremely valuable for our PRAC unit where I had to apply spoken language understandings daily.	
Overwhelmed	I fully understand the pressure of covering so much content but I am exhausted decoding the information. I Feel like an ESL student who still needs to think about the meaning of the words said.	KAL was enjoyable	<u>Question:</u> What were the best aspects of the unit? <u>Answer:</u> Watching the KAL videos and learning more about sounds and letters.	
Lack of feedback	I had no idea how I was going with this unit through the semester, even just a weekly quiz assessing knowledge would have really helped to focus my study	KAL reinforced learning	Scaffolding understanding of complex content. I really enjoyed the KAL quizzes as they helped me have a better understanding of phonics for example and they showed the areas you needed to work on in your spoken language.	

Table 4: Themes and illustrating comments from UTEI evaluations before and after introduction of KAL

Student Achievement

Weekly Quizzes

Although it did not count towards their final mark, students’ participation rates in the six weekly quizzes are shown here. The most common number of quizzes attempted, for both on- (38% of students) and off campus students (47%), was five. The majority of on campus students (51%) completed between three and five quizzes. The majority of off-campus students (58%) completed between three and five quizzes. Of the on campus students, 244/347 (70%) completed at least one quiz. For the off campus students, the figure was 55/76 (72%).

Diagnostic and Summative Assessments

Results of the initial diagnostic test and the summative test in the unit LAN1 (on and off campus) are shown in Table 5. 293 students completed the diagnostic assessment and 352 completed the summative assessment. For the diagnostic assessment, the participation rate was 244/347 (70%) for on campus students and 49/76 (64%) for off campus students. For the summative assessment, which contributed to the final mark, the rate was 298/347 (86%) on campus and 54/76 (71%) off campus. In total, 79% of students achieved a higher final test score than diagnostic score. Although the tests were not identical, the average score for each topic gives an indication of where student knowledge may have improved.

Table 5 shows data for the main topics included in the tests; in general, there were several questions for each topic. Results show that, generally, there was improvement from the diagnostic to the summative test, with some topics showing marked improvement. Examining the results for PA topics only, it can be seen that the students improved their average marks from the first to the last test. Additionally, in the Final Test students generally achieved better marks in identifying the definitions for the PA and phonics terminology than they did in the application of these understandings. This can be seen in:

- Rhyme, where for the definition the average was 10/10 but application was 9.5/10;
- Phonemes, where the average for the definition was 8.7/10 but the application average 5.9/10;
- Digraphs, where the definitions scored an average of 8.8/10 but the application scored an average of 3.2/10;
- Trigraphs, where the definition was an average of 10/10 but the application resulted in 5.5/10;
- Adjacent Consonants (Blends), where the average for the definition was 6.6/10 but the application 4.9/10.

Topic	Average score	
	Pre-test (/10)	Final test (/10)
Phonological Awareness	4.5	6.9
Rhyme	9.7	9.4
Syllables	8.9	9.8
Onset-rime	4.1	8.1
Phonemes	5.9	6.6
Graphophonics	8.2	7

Table 5: Results (average scores) for the phonological awareness and graphophonics tests

The only anomaly to this was in Syllables, where the definition scored an average of 9.6/10 but the application scored an average of 9.9/10. When choosing overall definitions for PA, Phonics, Phonemic Awareness and Alphabetic Principle, the students had an average of 7.4/10 correct. For Word Awareness, the definition was 7.5/10 but application was 2.4/10. Overall, results show that, apart from Syllables, which are hard to define but easy to identify, students still struggled in applying their KAL.

Table 6 shows student results for each of the final test questions, ranked from lowest to highest percentage of correct answers. Note that in some of the questions students were able to listen to the relevant items. Question stems only are presented here. The number of students answering each question differs, as questions were randomly allocated.

Question	Total students (N)	Answered correctly (N)	Answered correctly (%)
1. Choose all examples of vowel/ consonant digraphs.	131	20	15.3
2. Using phoneme manipulation what is the new word?	132	26	19.7
3. Using phoneme manipulation what is the new word?	132	29	22.0
4. Listen to the sentence and give the answer based on your	142	36	25.4
5. Choose all examples of vowel digraphs.	136	45	33.1
6. Choose all examples of adjacent consonants.	137	53	38.7
7. Choose all examples of consonant digraphs.	149	58	38.9
8. Children have an understanding of alphabetic principle when they:	138	54	39.1
9. How many phonemes in this word? (elephant)	128	52	40.6
10. How many phonemes in this word? (enormous)	145	72	49.7
11. Choose all examples of trigraphs.	136	74	54.4
12. Choose the correct example of apostrophe use.	128	70	54.7
13. Adjacent consonants are:	140	82	58.6
14. Choose the example where the apostrophe is used correctly.	128	78	60.9
15. The register in a spoken text is:	129	87	67.4
16. Word Awareness is:	131	94	71.8
17. Phonics is:	130	96	73.8
18. Spelling is part of:	141	105	74.5
19. Based on onset-rime which part of the word “zip” is the rime:	141	107	75.9
20. Phoneme Blending is:	126	102	81.0
21. Orally playing matching games with words like fox /socks and high/fly would help children focus on:	125	103	82.4
22. Children with word awareness can:	135	113	83.7
23. A vowel digraph is:	142	120	84.5
24. Encoding is:	137	116	84.7
25. Which word has the same initial phoneme?	132	112	84.8
26. The tenor in a spoken text is:	123	106	86.2
27. Which word has the same middle phoneme?	140	121	86.4
28. Decoding is:	135	118	87.4
29. Phonological awareness is:	137	120	87.6
30. A consonant digraph is:	132	116	87.9
31. Phonemic awareness is:	152	134	88.2
32. Children have an understanding of graphophonic knowledge when they:	146	129	88.4
33. A grapheme is:	146	130	89.0
34. A phoneme is:	142	127	89.4
35. Which word has the same final phoneme?	146	131	89.7

Question	Total students (N)	Answered correctly (N)	Answered correctly (%)
36. A vowel/consonant digraph is:	129	116	89.9
37. Based on onset-rime which part of the word “ban” is the onset:	125	114	91.2
38. A contraction uses an apostrophe because:	139	127	91.4
39. The mode in a spoken text is:	142	131	92.3
40. What is the new word?	133	124	93.2
41. Phoneme segmenting is:	138	130	94.2
42. How many syllables in this word? (nonsensical)	121	116	95.9
43. Match these rhyming words	132	127	96.2
44. A syllable is:	131	126	96.2
45. The field in a spoken text is:	130	126	96.9
46. Write the correct contraction for will not.	152	148	97.4
47. Match what you hear with the correct term	127	125	98.4
48. Write the correct contraction for you are.	127	125	98.4
49. A trigraph is:	138	136	98.6
50. How many syllables in this word? (multifunctional)	148	146	98.6
51. What two words make the contraction didn't.	125	124	99.2
52. Rhyme is:	153	152	99.3
Range	121 - 153	20 - 152	15.3 – 99.3%

Table 6: Results for each question in the final test

The diagnostic test was easier overall than the final test because, as explained above, many of the diagnostic questions were true/false, whereas the final test asked for definitions of terms and application of knowledge. However, while this difference needs to be acknowledged, in all the areas where the students were tested in both the diagnostic and final test there is improvement in the final test in their performance on the phonology and phonics topics.

Discussion

Student Attitudes

The increase in student satisfaction for the unit can likely be attributed to the KAL inclusion. The consistency of using the same teaching team and unit content other than KAL leads us to this conclusion. Following the completion of the diagnostic test, it was clear that PSTs were in fact lacking in several areas of literacy and metalinguistic knowledge, as also found by Purvis et al. (2016) and by others (e.g., Coltheart & Prior, 2007; Fielding-Barnsley, 2010). We need to keep in mind the narrow focus of our study, which excluded multiliteracies and digital literacies, and also that, as was stressed to the students, they were not expected to know this content on arrival at university. Practice quizzes each week served as a form of formative assessment which, as argued by Yorke (2003), “is vitally important to student learning” (p. 477).

Student Achievement

While we share the concerns of Moon (2014) about the KAL of pre-service teachers and keeping in mind that this was not an experimental study with a pre- and post-test so the results need to be interpreted with caution, our work shows that a small-scale intervention can

improve student KAL in the areas of PA and phonic knowledge. This result was consistent for both on- and off-campus students in 2018. It was also consistent with our previous study of the KAL of a similar cohort of students (Thwaite, 2008). However, it does contradict the findings of Moats (2009, 2014, 2019), who advocates a much more teacher-centered and lengthy exposure to these topics, rather than the contextualized approach described here. Moats (2019) claims that teachers need at least 16 hours' instruction in these topics:

Teachers ... need at least six to ten hours of instruction and practice to learn the English phonemes, to accurately segment English words, and to understand more advanced ideas such as co-articulation and allophonic variation. We need at least another ten hours of coursework to educate teachers about English orthography and how to teach it. (p. 57)

The length of the intervention is a very important consideration as, while the knowledge focused upon here is crucial for PSTs, it is necessary but not sufficient for them in their development as literacy teachers. The phonological knowledge discussed here is only one of the Four Resources needed for effective reading (Luke & Freebody, 1999), which our PSTs need to be familiar with before they exit our program at graduate level.

While the figures indicate that 21% of the students did less well in the summative test than the diagnostic, there were patterns that indicated other factors may have contributed to this. First, some did not attempt the weekly quizzes to support their KAL learning; some had lower than average time spent overall on Blackboard for this unit; and several of these students did not complete all assessments in the unit and thus did not complete all unit requirements. These factors seem to suggest a drop off in participation of these students in unit learning as the unit progressed. So, for the proportion of students whose performance deteriorated between the diagnostic and summative tests, in general we can offer a reasonable explanation for this negative result.

Our findings suggested that students seemed to be better at defining rather than applying the phonological concepts. This is of concern, as PSTs will be largely making use of application rather than definition in their teaching practice; they need to understand what the concepts are but, more importantly, they need to use them meaningfully in their work as teachers. As Fenwick et al. (2014) state, "Teacher education is effective when pre-service teachers are able to transfer knowledge from content areas to practice" (p. 82). Our finding that PSTs appeared better at definition than application contradicts that of Myhill et al. (2013), who showed that teachers did not do well on decontextualized tests of KAL but were able to use their implicit knowledge in their teaching practice. Thwaite (2015) also showed that a cohort of PSTs similar to the ones we examined here were able to link their emerging KAL to their practice. The difference in the findings may be due to the different characteristics and contexts of the various cohorts. The nature of the online testing situation also needs to be taken into account as a limitation of our study, as it is possible that students could have referred to their notes during testing, even though they were instructed not to do so.

Relationship between Student Confidence and Achievement

Overall, this study found that the KAL component appeared to not only improve PSTs' confidence and understanding towards KAL itself but also had a flow on effect to the unit as a whole. PSTs clearly believed that the knowledge gained about KAL was applicable to their work as teachers and this extended to wider confidence in literacy teaching and learning. This finding supports evidence from the Australian Survey of Student Engagement (AUSSE) (Coates, 2010), which found that "when students achieve positive outcomes in the

first year (of university study), this is likely to reinforce their commitment to university” (p. 11). In addition, our results support another AUSSE finding, i.e., to improve retention of first year university students it is important to pay more attention to supporting their basic study skills and to simultaneously challenge them intellectually. It could be argued that the KAL component has had both these benefits for the cohort studied.

Conclusions

We carried out this study investigating the phonological KAL of one cohort of B.Ed. Primary students as we were concerned that our PSTs may not have sufficient KAL to implement the Australian Curriculum English, in particular the Language component. We wanted to help them develop their KAL in a way that was compatible with the larger aims of their first year Language and Literacy unit. We also wished to examine how effective our intervention might be, while keeping in mind that all activities with the students needed to be pedagogically sound; we were concerned to avoid drilling and excessive testing.

Our study showed that it is possible that a small-scale intervention can lead to improved attitudes and higher confidence about KAL for PSTs. It further demonstrates that PSTs can see the value of this type of knowledge for their own academic capacity, their future teaching and the learning outcomes of their future students. Of importance is that these participants overwhelmingly considered the KAL to be an essential component of their learning and success in the unit and, later still, in the whole course. We also showed that the PSTs appeared to gain in their understanding of what the phonological components were, although they were not necessarily able to apply this knowledge successfully.

This was a small-scale study within one institution and was subject to the limitations of the context. As Stephenson (2018, p. 131) rightly points out, there is a need for more, larger-scale studies of this kind across Australian universities. Another limitation is that the scope of the study in terms of KAL was quite restricted, with a focus only on PA and phonics. We did not examine PSTs’ knowledge of grammar, let alone their wide grasp of multiliteracies and digital literacies (Honan et al., 2013), which we know from experience exists. We also acknowledge that the intervention described in the study was part of a teaching-learning experience, where students’ involvement in engaging learning activities was at the top of our agenda; it was not an experimental study with a pre- and post-test.

In future we would like to pay more attention to systematically building up KAL over our whole program, giving students many opportunities to apply their KAL in context. However, it is encouraging that an intervention such as the one reported here can be seen as showing positive results in terms of both student achievement and attitude, and we are committed to continuing our efforts in this area, contextualizing KAL in our wider literacy programs so that it is relevant and meaningful to our students.

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Appendices

Appendix 1: Examples of Concerns with Previous Tests

- The *Teacher Knowledge Assessment: Structure of Language* (Mather et al., 2001, p. 479), *Teacher Knowledge of Language Structure* (Meehan & Hammond, 2006, p. 24) and *Linguistic Knowledge Assessment* (Mahar & Richdale, 2008, p. 36) each include questions about diphthongs and voiced consonants where more than one answer is correct - despite the claim that there is only one right answer. (See example (a) below for details.)
- The vowel sound schwa is another area where there appears to be confusion. The *Teacher Knowledge Survey* used by Moats (2009, p. 395) would have no less than four right answers to the question about schwa if administered to Australian English speakers. (See example (b) below.)
- Some of the literature referred to in this article also contains incorrect spellings of technical terms in phonology. (See example (c) below.)
- At the level of sentence structure, the test used by Stark et al. (2016) has an error in the question about types of clauses (p. 51). (See example (d) for details.)

Asterisks indicate answers that would be correct for Australian English speakers.

- (a) Mather et al. Question 7 = Mahar & Richdale Question 3 and Meehan & Hammond Question 3:
A diphthong is found in the word:
(a) coat* (b) boy* (c) battle (d) sing (e) been?*. Only one answer is supposed to be correct but the words we have starred both contain diphthongs.
Mather et al. Question 8 = Mahar & Richdale Question 4 and Meehan & Hammond Question 4:
A voiced consonant digraph is in the word:
(a) think (b) ship (c) whip* (d) the* (e) photo
Only one answer is supposed to be correct but we have starred two words with voiced consonant digraphs.
- (b) Moats (2009) Question 15:
Which word has a schwa?
(a) eagerly* (b) prevent* (c) definition* (d) formulate* (e) story
- For Australian English speakers, all starred words would be pronounced with at least one schwa. It would be actually be preferable to reformulate the question as, “Which word **does not have** a schwa?” This indicates the importance of paying attention to dialect differences.

- (c) Some of the literature referred to also contains incorrect spellings of the words ‘digraph’ (Sayeski et al., 2017, p. 30), ‘diphthong’ (Mahar & Richdale, 2008, p. 30; Mather et al., 2001, p. 479) and ‘schwa’ (Mahar & Richdale, 2008, p. 30).
- (d) Moats (2009) Question 44:
Which sample has one dependent clause?
Answer given as E: “Tom drank the milk and ate the apple.” (This is incorrect, as the sentence consists of two **independent** clauses)

Appendix 2: KAL Follow-up Survey

- Do you believe the KAL components of your LAN units have supported your learning of KAL?
- How much knowledge about language do you believe you had before you started this course?
- How do you feel the KAL has supported your overall learning in the LAN units?
- How do you think this will impact on your future teaching?
- What have you found most/least valuable about the KAL components?
- Do you have any suggestions for improvements or modification to the KAL components?
- Has the KAL knowledge been useful to you on prac and/or in your academic writing. If so, in what way/s?
- Do you have any other comments, suggestions or feedback relating to the KAL?