

An Exploration of the Use of Musical Activities to Promote Foundational Literacy Competencies for Children Aged 3 to 5 Years

Maria Kay, University of Aberdeen, United Kingdom

The European Conference on Education 2026
Official Conference Proceedings

Abstract

Reports from the USA and the UK suggest that they are facing a literacy crisis. Whilst much research focuses upon the teaching of the alphabetic principle as a starting point for literacy success, more important are the foundational competencies, which children bring to their formal literacy learning. It is these that determine a child's ease of entry to the educational system. Research to date suggests a strong relationship between music and language and that musical activities are advantageous to literacy learning, yet music cannot teach reading. Through a pragmatic, sociocultural lens, this research used a micro-ethnographic, action research study of nine children, aged three to five years, daily, over a ten-week period, to explore how a literacy-focused musical programme can be designed and delivered to promote foundational literacy competencies and experiences. Data from video recordings were analysed through hybrid coding. The findings revealed that when engaging musical activities which promote auditory, motor, cognitive, language and timing skills, with elements of dialogic teaching are integrated in a Literacy-through-Music programme, focusing on explicit literacy outcomes such as language, and phonological and prosodic awareness, children develop skills which will support literacy learning. Observation of the activities also offered the presenter a panoptic view to possibly identify children at risk of reading failure. Highlighting the features of an integrated Literacy-through-Music programme provides a unique contribution to current literature and shows how such a programme can obviate the need for transfer from musical to literacy skills.

Keywords: skills gap, early literacy, literacy foundations, preschool literacy, music and literacy

iafor

The International Academic Forum
www.iafor.org

Introduction

Literacy, the ability to understand and use spoken language and to read and write at a level which enables a person to engage fully in the functions of daily life, is a necessity; but the Annual Literacy Survey in the UK (NLT, 2026) reported that just over a third of children said that they enjoyed reading in their spare time, whilst only 1 in 4 enjoyed writing. Cabrera et al. (2024) reported that 25% of Year 7 pupils (age 11–12) had a reading age below 11, 1 in 5 primary pupils are failing to meet expected reading standards and that 5.1 million adults in England are functionally illiterate. In America the NAEP (National Assessment of Educational Progress) (U.S. Department of Education et al., 2025) reported that only 43% of 4th graders were at a proficient or above, level of reading. Those most at risk included students of colour, from low-income backgrounds, multi-lingual learners and those with disabilities. Roughly a third of twelfth-grade students in 2024 (U.S. Department of Education et al., 2025) were below basic (able to identify relevant details in a text for literal comprehension); a third were at basic level and a third were proficient (connect details across texts and draw complex inferences about author’s purpose, tone, word choice and related ideas) or above.

Despite changing methods of teaching over time, some children to continue to struggle with literacy learning. Literacy models such as those of Scarborough’s “Reading Rope” (2001) and the Active View of Reading (Duke and Cartwright (2021) evolved from the Simple View of Reading, proposed by Gough and Tunmer (1986), the “Writing Rope”, (Sedita, 2019) and the Not-so-Simple View of Writing (Berninger & Winn, 2006,) which evolved from the Simple View of Writing (Berninger et al., 2002), serve to guide literacy instruction.

The reading and writing “ropes” identify the knowledge and skills which contribute to literacy success and provide metaphorical illustrations of how knowledge and skills must be woven together.

Figure 1

Strands of Early Literacy Development (Scarborough, 2001)

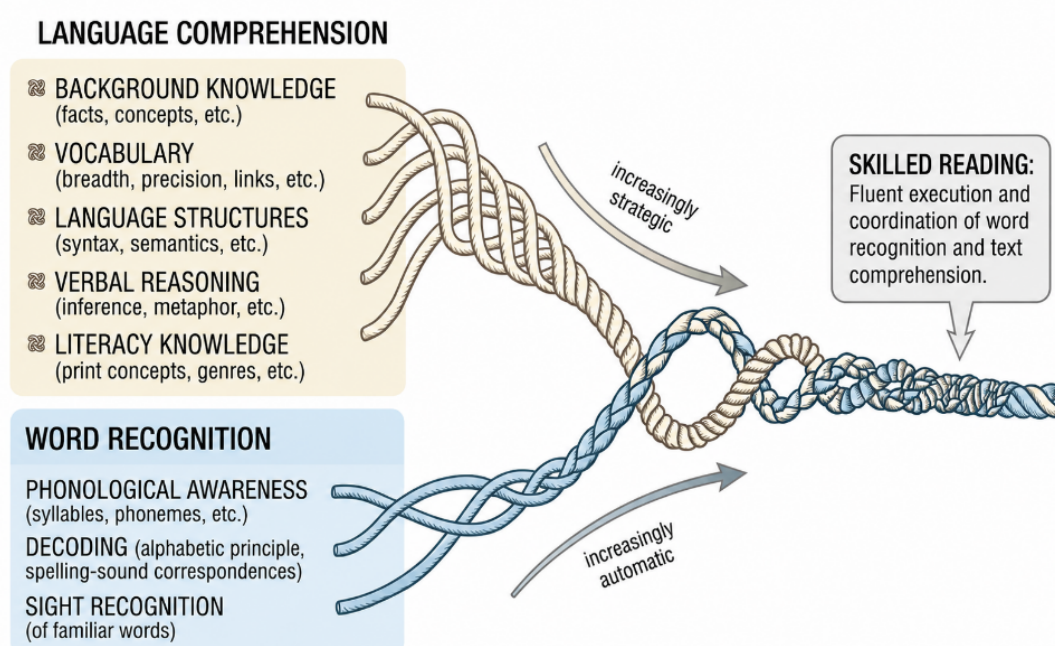
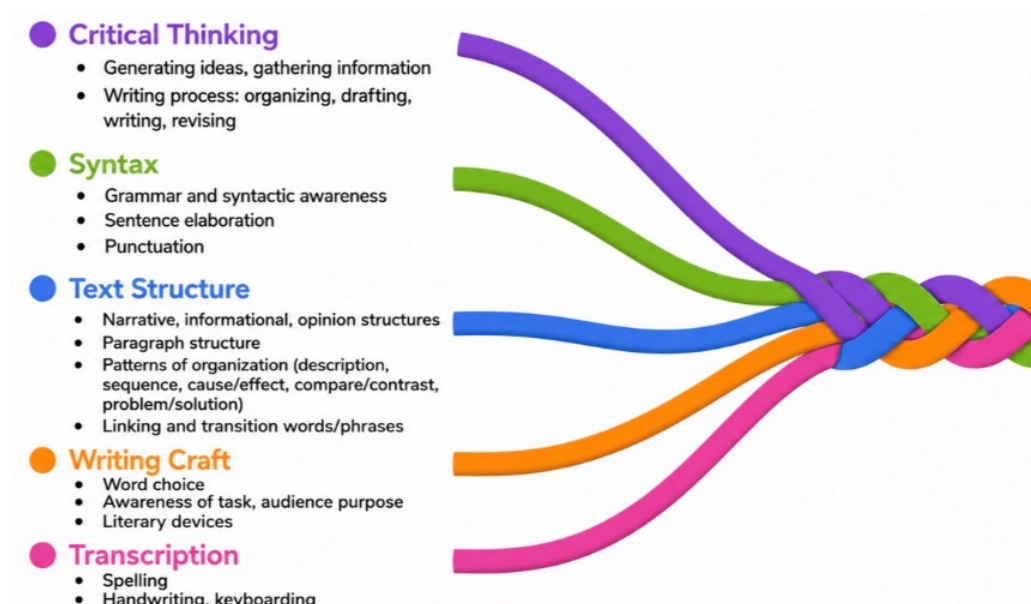


Figure 2*The Strands That Are Woven Into Skilled Writing (Sedita, 2019)*

The Active View of Reading recognises the importance of additional skills of active self-regulation and also the impact of the demands of the text, the purpose of reading and the reader's sociocultural background, as these influence how well the reader will comprehend the text.

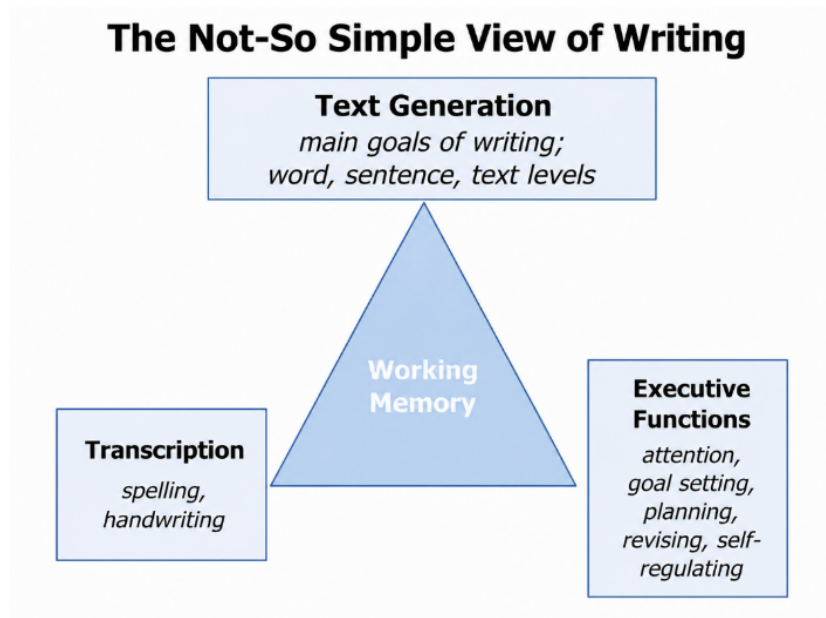
Figure 3*The Active View of Reading (Duke & Cartwright, 2021)*

Whilst much research focuses upon the skill of reading, reading and writing are complementary skills and the learning of each, supports the learning of the other. As can be seen in Figure 2, the productive task of writing, necessitates the conflation of a great many skills. The Not-so-

Simple View of Writing (Figure 4) acknowledges that composition and transcription are underpinned by executive functions and working memory.

Figure 4

The Not-So-Simple View of Writing (Berninger & Winn, 2006)

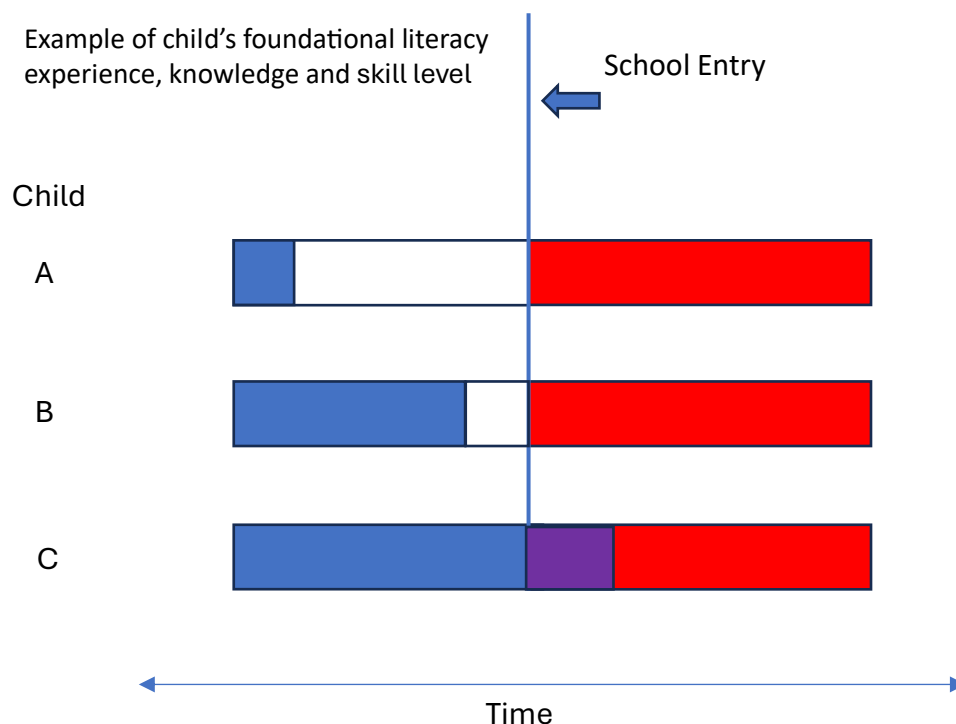


For early years' practitioners there is little to guide foundational instruction, and little qualitative research in this area. Mirhosseini (2017) stated that qualitative research continues to be of lower visibility in the area of language and of literacy education than quantitative research. This research aims to address both identified gaps.

Prior to school entry children acquire knowledge, skills and experience which they will bring to later literacy learning. Rohde (2015) suggested that the informal preschool literacy learning should move seamlessly into formal school literacy learning but this is not the case as children arrive at school with varying competencies. Whilst some children are "ready" to learn to read and write, others are not. For some children the home learning environment can be a rich source of foundational literacy learning (Zhakim, 2024), but for others it is not. Additionally, some children attend preschool settings and others do not. Corriveau et al. (2010) found that children who entered school with little pre-reading skills, phonological awareness and poor receptive vocabulary, were disadvantaged.

Figure 5

Gaps in Early Literacy Learning: Possible Variance in Foundational Literacy Competencies Upon School Entry (Kay, 2026a)



Note. Blue = Foundational literacy experience, knowledge and skills; Red = The teaching of formal literacy skills – phonics; Purple = The teaching of formal literacy skills to a child who already has some of these skills; White = Foundational literacy experience, knowledge and skills gap

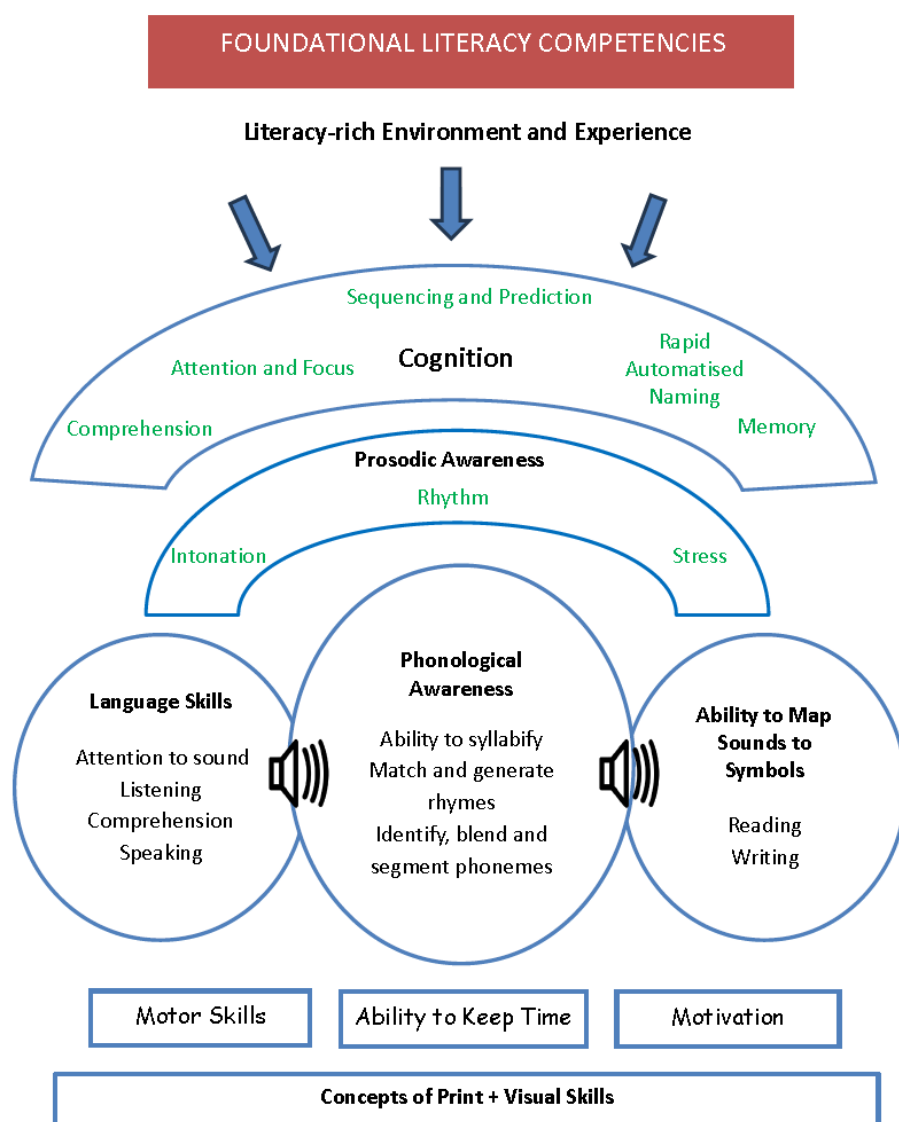
As is evident from Figure 5, the gap, identified in white, illustrates the extent to which some children may not have sufficient literacy experience, knowledge or skills to enable them to be successful upon school entry. Other children may be already reading and writing to some extent.

Literature Review

Rohde (2015) suggested that when children enter pre-school provision, there is often little understanding of what children require in order to facilitate literacy success and a knowledge of letters is often viewed as the starting point.

A review of the literature revealed the experiences, skills and knowledge upon which literacy success is dependent and which are in place prior to formal literacy learning for those who appear to easily master what is required and which are lacking in those who struggle (Kay, 2026a). These are identified in Figure 6.

Figure 6
Foundational Literacy Competencies (Kay, 2026a)



When children have been exposed to a literacy-rich environment and have acquired competency in a range of the identified skills, there is a greater chance of literacy success for them than for children without such experiences.

The importance of cognitive skills is often overlooked, when these are important contributors to literacy proficiency. Stothard and Hulme (1992) proposed that comprehension skills are required, Dice and Schwanenflugel (2012) emphasised the importance of being able to focus and pay attention to what is being taught, Stein (2022), purported that being able to sequence and predict what is to follow, supports reading acquisition, and being able to remember both visually and auditorily, what is being taught is essential. McWeeny et al., (2022) found that random automatised naming is predictive of reading ability and thus is also a contributor to literacy proficiency.

Facility with spoken language is imperative to literacy, as written language is predicated upon it. It is important to be able to comprehend and use language and that vocabulary is built over time, as at two years of age, language development is predictive of future literacy performance

(Roulstone et al., 2011). A lack of language skills is a preventative barrier to literacy learning. Visual skills are also acknowledged as important to the recognition and formation of text and it is important to be able to differentiate letter shapes for correct identification.

The ability to identify prosody in language; the stress and intonation placed upon syllables, supports language comprehension and children with dyslexia show poor processing of these stresses (Goswami, 2022). It is imperative that children are able to tune in to and discriminate language sounds in for them to ultimately map them to alphabetic characters. This awareness of sounds within language is termed “phonological awareness” (PA), of which there are three levels—syllable, rhyme and phoneme. Martin et al. (2024) state that PA is the undisputed major predictor of literacy success and that phonemic awareness (awareness of the smallest sound elements within language—phonemes) being the strongest predictor. This ability to recognise phonemes, facilitates their blending and segmenting in order to code and encode written script.

There is a strong positive relationship between motor proficiency and pre-reading skills (Milne et al., 2018). Movement stimulates the brain, thus impacting learning, and gesture supports language learning (Novack & Goldin-Meadow, 2015). Macrine and Fugate (2021, p. 3) refer to the fact that “Our current educational delivery systems and approaches can be traced back to ‘disembodied views’ of human thinking”. This alludes to the general gap between what is known about how children learn – that learning should be active, and the often observation of classroom practice, where they are often observed to be immobile. Macrine and Fugate (2022) advocate for a holistic approach to learning and teaching and assert that embodied learning, where movement supports learning, can promote vocabulary acquisition, language development and comprehension, and handwriting proficiency.

The ability to keep time by entrainment to a beat, encourages fluency of auditory-motor timing, a skill required for reading and writing fluency (Tierney & Kraus, 2014) and as with prosody, there is a strong link between difficulties with rhythm perception and dyslexia. Polyanskaya et al. (2019, p. 1) describe rhythm in speech as “the structure that determines how the signal is organised and develops over time”. The reason for the link between reading ability and rhythm memory is elucidated by Tierney et al. (2021) who determined that they rely on shared cognitive processes (such as those used to process abstract concepts, thoughts and memories) and the ability to perceive the temporal structure of sound.

When words are mispronounced, due to ineffective speech processing, it becomes very difficult to match the sounds within the words to corresponding graphemes. As speech rhythm patterns are fundamental to linguistic processing it behoves parents and educators to include infant-directed speech, lullabies and rhymes to enhance language development (Goswami, 2022).

The benefits of participation in musical activities are far-reaching, yet much undervalued (Collins et al., 2020) and include brain stimulation (Schlaug et al., 1995), speech processing (Patel, 2014), assistance with memory recall (Parbery-Clark et al., 2009), encouragement of movement (Toyka & Freund, 2007), enhanced detection of “speech-in-noise” (Slater et al., 2015) and support of the ability to entrain to a beat by engaging auditory-motor systems (Corriveau et al., 2010; Slater et al., 2013). Tierney and Kraus (2013a, p. 228) stated that “one of the reasons musical training can be such a powerful educational tool is that music is inherently rewarding, emotion-inducing and attention grabbing”.

In order to learn to read and write, children must be motivated to do so. Rhythm processing and reward have been linked by Fiveash et al. (2023), thus showing how the pleasure gained

through participation in musical activities can be harnessed for learning. Music stimulates emotional areas of the brain and can facilitate memory recall. Where music is integral to learning, the wealth of benefits derived from music alone serve to support learning in other areas and specifically in literacy where music and language share multitudinous commonalities, not least, neural pathways in the brain (Meyer et al., 2014).

Whilst there is a wealth of literature attesting to the correlation between various musical experiences and literacy outcomes, there is no causal evidence to prove that early participation in musical activities results in later literacy success. Reasons for the transfer of skills between music and literacy are suggested by The OPERA hypothesis (Patel, 2011) and the PAT hypothesis, (Tierney & Kraus, 2014), but this cannot be assumed and is not automatic. However, a causal relationship does exist between informal music activities and auditory discrimination (Putkinen et al., 2012) and it is firmly established that auditory discrimination is foundational to phonemic awareness.

The integration of music and literacy activities to promote literacy outcomes would therefore obviate the need for transfer and this has been suggested by Frasher (2014) and Verney (2011), for example. Rautenberg (2015) called for further research in this area. Bolduc and Lefebvre (2012) and Bostelman (2008) suggested that integrating music with literacy learning to promote literacy outcomes have been the most efficacious. The seminal work of Standley and Hughes in 1997, offers one such study and this was replicated by Register in 2001. The results from their study demonstrated that “the more focused the music activities were on a specific skill, the more effective they were in teaching print conventions and writing skills as intended” (Standley & Hughes, 1997, p. 5).

Method

The micro-ethnographic study was conducted through the analysis of child participant vocalisations and behaviours which were video recorded in their own preschool setting for 30-40-minute periods over six weeks. A setting was chosen in an area of social deprivation, based upon findings from Sosu and Ellis (2014) that children in such areas are at risk of low language abilities which impact upon literacy. There were nine participants, five male and four female, aged between three and five years of age. The participants were chosen randomly by the Centre Head.

A literacy intervention was designed using the “embedded-explicit model” of Justice and Kaderavek (2004), a preventative framework for conceptualising the delivery of emergent literacy interventions for young children who were at risk of later reading difficulties. Literacy outcomes were embedded in the musical activities and were explicitly promoted by the presenter who was a literacy specialist. The study sought to examine how literacy competencies could be promoted through a purpose-designed, integrated literacy-through-music (LtM) intervention.

Activities and props were selected which would stimulate imagination and be engaging for the participants. Music was recorded with introductory and ending sections to help the children to focus upon the musical sounds which indicated when singing should begin and the activity would finish. These sections also allowed participants to anticipate and prepare to sing or perform actions and to anticipate when an activity was coming to an end. The recorded music was syllabic with notes corresponding to the syllables in the lyrics. Whilst the activities, songs, rhymes and movement to music, were musical, their focus was literacy oriented. Initially, focus

was placed upon variations in musical sounds, concordant with a musical program, such as the recognition of rhythm, duration, tempo, dynamics, pitch and timbre. As the program progressed the presenter began to focus on literacy outcomes as identified in Figure 6. Unlike a musical program, the LtM program used books as props to promote bibliographic knowledge, response to visual stimuli, language comprehension and the purpose of text. Dialogic teaching was applied to elicit feedback on literacy outcomes and to promote focus and attention. Towards the end of the program, the presenter used an alphabet book with songs to promote phonemic awareness and the relationship between language sounds (phonemes) and alphabetic symbols (graphemes). All activities were age-appropriate, and letters were presented in a context that would help to embed learning.

Data Collection and Analysis

The research was conducted according to SERA ethical guidelines (SERA, 2005). Permission slips were obtained from parents and guardians for participation of the children. The children were asked if they wanted to participate and were advised daily that they could leave at any point by asking a member of their staff. At least two centre staff accompanied every session. To ensure the comfort of participants, the sessions were video recorded by volunteer school pupils from the adjoining school. The recordings from twenty-two sessions were suitable for review.

Footage was selected from six full sessions between the beginning to the end of the intervention. These showed the most activities and number of participants. This footage was transcribed. A priori deductive coding was initially used to analyse the transcription and inductive coding was later applied to enable themes to be identified.

Findings

The data collected provided a wealth of information with regards to foundational literacy skill acquisition through the integrated LtM activities. This enabled a LtM model to be developed. Analysis of the data highlighted the similarities and differences between a musical program and a LtM program in terms of design and delivery. It also enabled specific activities to be identified which could be used to best promote literacy outcomes and highlighted the way in which the presenter was able to do this. The findings revealed how such an intervention could be used as a diagnostic tool to identify strengths and weaknesses in foundational literacy skills.

It also showed how literacy competencies were acquired and positively compounded throughout the program. Six underlying mechanisms were able to be identified to explain how and why the LtM intervention was successful.

At the beginning of the sessions, participants followed actions very easily and were eager to join in. The activities were simple and repetitive, encouraging participation. Music, lyrics and actions were presented simultaneously. Actions were followed more easily than melody or lyrics. Over time, the number and frequency of actions increased, and the length of songs and rhymes increased. Participation then varied between the children as strengths and weaknesses become increasingly visible, the rate of progression and improvement in skill areas differed. However, all participants improved in skill building over time, as was expected. Engagement with the activities was high. Memory retention and recall was demonstrated as participants began to learn melodies and lyrics in addition to actions. Speed of prediction varied between participants. Dialogic teaching was used to assess the comprehension of storylines with

questions being posed and discussion encouraged. For example, the book, “My Cat Ben” (Kay, 2026b) was used and the participants sang the song about a greedy cat, as the music was played, and the pages turned of the book with each verse. As the children became familiar with the book, they were able to remember the order of the verses and to describe the cat and the events in the story. They related these to their own experiences and enjoyed interjecting with their own stories. From the transcription and observation of the video footage, it was possible to observe motivation and demonstration of cognitive and language skills. Awareness and use of prosody was demonstrated. The children were highly engaged and keen to proffer answers to questions posed. Verbal participation increased with confidence over time. Some participants used gesture to support their speech and two used gestures instead of speech on occasions. Using gestures in place of speech indicated immaturity in language development. One participant had a speech impediment, yet a high level of engagement with the activities and frequent contributions and one demonstrated weakness in memory recall.

Participants were shown how to tap out syllables. In one song, the word “alligator” was elongated with the musical notes changing for each syllable. This, along with scaffolding by the presenter, supported all participants to be able to syllabify this word and many others. Children were also able to choose and syllabify words on a theme, themselves, which they all managed successfully by the end of the program.

Participants became adept at matching and generating rhyming words. The strategy of cloze was used by the presenter to encourage the interposing of rhyming words. Attention was drawn to similar sounding patterns at the end of words. One participant was seen to be saying “*cheesey wheezy*” to herself when the presenter spoke about a rhyme with a mouse eating cheese. Although this was not part of the program, her behaviour demonstrated her awareness of and ability to generate rhymes.

Six of the nine participants were notably moving their bodies in time to the music subconsciously. Whilst the perception of beat is said to be innate (Winkler et al., 2009) the ability to synchronise to a beat is not. Carr et al. (2014) have correlated inability to synchronise to a beat with poor literacy skills. Improvement in synchronising to a beat was noted over time in all participants, as was improvement in motor skills.

As knowledge indicators, participants were asked to identify written numbers, name colours and to identify left and right sides of their bodies. Those with weak knowledge were found to have overall weaknesses in all areas. Participants who showed strengths, showed them in all areas.

An unexpected finding was that of volitional rehearsal. Children were reported by staff and parents to be performing some of the activities from the program at other times, other than the scheduled sessions. This also took place within the session, unrequested; for example, one participant was reading aloud printed numbers to himself, which were displayed on the wall. As part of an activity the children had been asked to read aloud the numbers but in this instance the boy was performing of his own accord. Such rehearsal would undoubtedly serve to further embed learning.

When a child was observed to be struggling, scaffolding was implemented by the presenter. The taking of immediate and avertive action could mitigate the risk of future failures in competency assimilation.

Underlying Mechanisms

Inductive codes were generated to identify the underlying mechanisms for the acquisition of foundational literacy skills. Some activities were observed to be more popular than others. This was due to observed higher levels of participation, they evoked more positive body language (laughing and smiling) and had the greater number of requests for performance or repetition. One particular activity, where children stood at imaginary bus stops and boarded an imaginary bus when their name was sung, was particularly popular. These activities were also the ones for which most skills were demonstrated. Ultimately six possible underlying mechanisms were identified:

- Engagement – the activities held the participants’ attention
- Attention drawn to sound and specifically language sounds
- Focus upon literacy outcomes
- Entrainment to a beat – tapping performance is linked to reading attainment (Tierney & Kraus 2013b; Tierney et al., 2021) as children must be able to process the temporal structure of sound in order to be aware of the sound structures in language (PA).
- Motivation and enjoyment – participants engaged readily with the activities and demonstrated enjoyment
- Integration – the activities promoted the ability of the participants to integrate their knowledge and skills and apply them to tasks set.

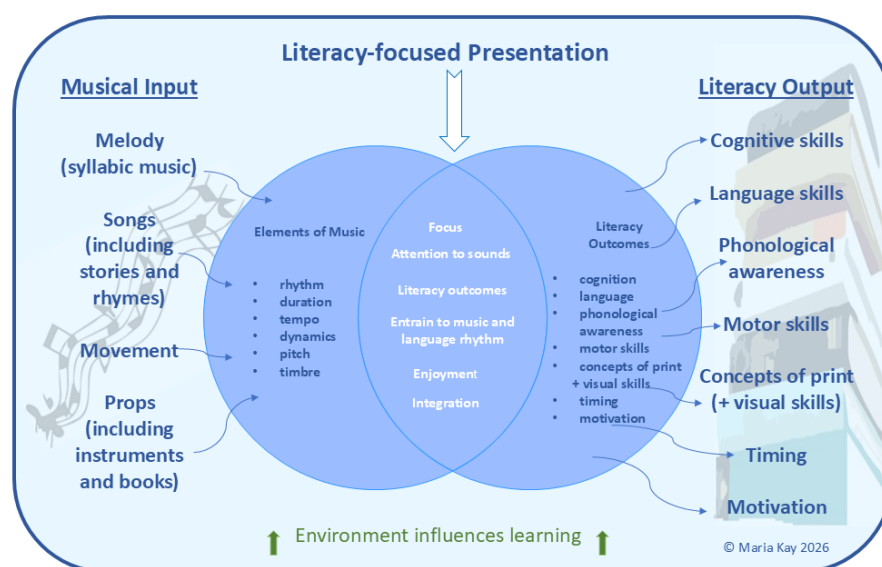
It is possible that other factors were also contributory to the popularity of activities, such as relevance to the children (boarding a bus in this example), ease of performance (the children had only to listen for their name and find a place on the “bus”).

Discussion

The data collected enabled the formulation of a LtM model (Figure 7 from Kay, 2026a) to explain how musical activities can be integrated with literacy learning to promote foundational literacy outcomes.

Figure 7

Literacy-Through-Music Model (Kay, 2026a)



Whilst the inputs are musical—the nature of which have been described in the intervention method—the outputs are foundational literacy outcomes. The underlying mechanisms that facilitated the successful promotion of these outcomes are central to the model.

The engaging nature of the activities and their suitability for children of this age, in terms of content and ease of participation facilitated the children's willingness to undertake the activities and focused their attention on the activities, the presenter and their performance. Children's attention was also focused upon discrimination of both musical and language sounds; the ability to discriminate language sounds being pivotal to literacy success.

The findings highlighted the importance of gesture in a child's early language development, both in terms of the child's response to the presenter's gestures before vocal communication and that of the child's response to questions posed by the presenter. It was clear to see that action songs and rhymes have an important role to play in helping to develop vocabulary and in the practising of language production, where gestures complement and support spoken language.

The integrative nature of both the activities and the skills being promoted allowed learning to be holistic and natural. Children were not learning isolated skills, but skills embedded within the performance of the tasks. The integration of music and literacy within activities obviated the need for skill transfer from one domain to another. For example, prosody in a musical phrase was reflected in the accompanying song lyrics, or the descending musical pitch at the end of verse was reflected in the falling intonation of the voice; thus, promoting the ability to add expression to language production. Similarly, the alignment of musical tones with language syllables naturally supported the children's ability to syllabify.

The repetitive nature of many of the songs and rhymes helped children to practise and refine their co-ordination skills and fostered the ability to entrain to a beat, through the performance of gross motor skills, such as stamping along in time to a song or fine motor skills when controlling and tapping claves. Fostering the ability to physically keep time aligned with vocal production strengthens auditory memory and supports language fluency which subsequently influences reading and writing fluency (Zanto et al., 2024). Fine motor skills were also promoted through the use of finger puppets. When children were required to perform together and at the same time, this further reinforced skill building as this synchronisation unconsciously invokes dynamic coupling, where the brain naturally mirrors the rhythms and movements of others; this further reinforced the ability to entrain to a beat and to consistently keep time.

The enjoyable nature of the activities allowed children to behave naturally, and their behaviour illustrated how children learn when they are relaxed and happy as they requested that activities be repeated and also, they repeated melodies and lyrics to themselves, thereby reinforcing any learning that was taking place.

The Literacy-through-Music Model illustrates how the focus of music-based activities can be upon literacy outcomes. It is incumbent upon the presenter or teacher to select and present a range of activities through which children can assimilate.

Limitations

Limitations of the study were the duration of the study and the small sample size. A longitudinal study would be able to assess the longer-term benefits of implementation of a LtM program.

Recommendations

The findings of this study suggest that using integrated music and literacy activities as a vehicle through which to deliver foundational literacy outcomes would be propitious. Kraus (2019) suggested that two years is the optimum time for musical activities to effectively make changes in the brain, in which case, preschool settings would benefit from implementing a LtM program for children aged three to five years of age. Furthermore, where children have not had the advantage of such a program then provision to bolster any gap should be made and LtM activities can be used in formal as well as informal school settings.

Many activities cover a broad spectrum of competencies simultaneously, but the presenter must be aware of the ones that are deliberately being promoted and note where this is happening and where it is not, such that revisions can be made in any program. The main predictors of literacy success should be specifically promoted—listening and focusing upon sounds, language comprehension and production, phonological awareness and the ability to play with the sound segments within words. The presenter must be aware of the skills to be promoted.

The sessions should be informal, and activities should be enjoyable and engaging; the teacher should be observing and promoting foundational literacy behaviours, not testing them. These features are present in the Finnish curriculum where music is an integral part of a school day from early years through primary. The Finnish Curriculum states that “Children have a right to learn through play and with joy” (Finnish National Board of Education, 2010). Assimilation of these features into English curricula is recommended.

Conclusion

A unique contribution is made by this research into the benefits to the development of foundational literacy competencies through an integrated music and literacy program. It was able to address a gap in the literature of qualitative studies in early literacy learning through integrated music and literacy activities and it also bridged a gap between educational research and educational practice as the intervention was conducted as any other activity session in a normal day in a preschool setting.

Underlying the efficacy of the LtM program devised for this study is that the activities were enjoyable, engaging and motivational; they aroused interest and subsequent willingness to participate. Children learn best when they are interested (Harackiewicz et al., 2016). The children were relaxed and, in an environment, conducive to learning.

The differences between a music program and a LtM program lie predominantly in the focus upon literacy outcomes and the ability of the presenter to draw children’s attention to sounds in spoken language.

There are multifarious benefits of music participation and adding these to literacy learning serves to augment the value of a LtM program and specifically the competencies identified in Figure 6. Their relationship is illustrated in Figure 7. The integration provided by a LtM

program engages both hemispheres of the brain simultaneously, enriching learning capacity and stimulating neuronal activity. The multi-sensory nature of the experiences also promotes embodied learning in a rich learning environment which is ideally suited to children of this age.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

The author declares that no AI or AI-assisted technologies have been used to generate, refine or correct the content in the manuscript. The ideas, design, procedures, findings, analyses and discussion are originally written and derived from careful and systematic conduct of the research.

References

- Berninger, V. W., Vaughan, K., Abbott, R. D., Begay, K., Coleman, K. B., Curtin, G., Hawkins, J. M., & Graham, S. (2002). Teaching spelling and composition alone and together: Implications for the simple view of writing. *Journal of Educational Psychology*, 94(2), 291–304. <https://doi.org/10.1037/0022-0663.94.2.291>
- Berninger, V. W., & Winn, W. D. (2006). Implications of Advancements in Brain Research and Technology for Writing Development, Writing Instruction, and Educational Evolution. In C. A. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (p. 96–114). The Guilford Press.
- Bolduc, J., & Lefebvre, P. (2012). Using nursery rhymes to foster phonological and musical processing skills in kindergarteners. *Creative Education*, 3(4), 495–502. <https://doi.org/10.4236/ce.2012.34075>
- Bostelman, T. J. (2008). *The effects of rhyme and music on the acquisition of early phonological and phonemic awareness skills* [Master's thesis, Defiance College]. OhioLINK Electronic Theses and Dissertations. https://etd.ohiolink.edu/acprod/odb_etd/ws/send_file/send?accession=def1281545878&disposition=inline
- Cabrera, K. R., Gomez, R., & Franlin, J. (2024). *Early Literacy Matters: Economic impact and regional disparities in England*. Pro Bono Economics.
- Carr, K. W., White-Schwoch, T., Tierney, A. T., Strait, D. L., & Kraus, N. (2014). Beat synchronization predicts neural speech encoding and reading readiness in preschoolers. *Proceedings of the National Academy of Sciences*, 111(40), 14559–14564. <https://doi.org/10.1073/pnas.1406219111>
- Collins, A., Dwyer, R., & Date, A. (2020). *Music education: A sound investment*. A report commissioned by Alberts, The Tony Foundation.
- Corriveau, K. H., Goswami, U., & Thomson, J. M. (2010). Auditory processing and early literacy skills in preschool and kindergarten population. *Journal of Learning Disabilities*, 43(4), 369–382. <https://doi.org/10.1177/0022219410369071>
- Dice, J. L., & Schwanenflugel, P. (2012). A structural model of the effects of preschool attention on kindergarten literacy. *Reading and Writing*, 25, 2205–2222. <https://doi.org/10.1007/s11145-011-9354-3>
- Duke, N. K., & Cartwright, K. B. (2021). The science of reading progresses: Communicating advances beyond the simple view of reading. *Reading Research Quarterly*, 56(S1), S25–S44. <https://doi.org/10.1002/rrq.411>
- Finnish National Board of Education. (2010). *National core curriculum for pre-primary education*. <https://www.oph.fi/en/statistics-and-publications/publications/new-national-core-curriculum-basic-education-focus-school>

- Fiveash, A., Ferreri, L., Bouwer, F. L., Kösem, A., Moghimi, S., Ravignani, A., Keller, P. E. & Tillmann, B. (2023). Can rhythm-mediated reward boost learning, memory and social connection? Perspectives for future research. *Neuroscience & Behavioral Reviews*, 149. <https://doi.org/10.1016/j.neubiorev.2023.105153>
- Frasher, K. D. (2014). Music and literacy: Strategies using comprehension connections by Tanny McGregor. *General Music Today*, 27(3), 6–9. <https://doi.org/10.1177/1048371314520968>
- Goswami, U. (2022). Language acquisition and speech rhythm patterns: an auditory neuroscience perspective. *Royal Society Open Science*, 9(7). <https://10.1098/rsos.211855>
- Gough, P., & Tunmer, W. (1986). Decoding, reading and reading disability. *Remedial and Special Education*, 7, 6–10. <https://doi.org/10.1177/0741932586007001>
- Harackiewicz, J. M., Smith, J. L., & Priniski, S. J. (2016). Interest matters: The importance of promoting interest in education. *Policy Insights from the Behavioral and Brain Sciences*, 3(2), 220–227. <https://doi.org/10.1177/2372732216655542>
- Justice, L. M., & Kaderavek, J. N. (2004). Embedded-explicit emergent literacy intervention I: Background and description of approach. *Language, Speech and Hearing Services in Schools*, 35, 201–211. [https://doi.org/10.1044/0161-1461\(2004/020\)](https://doi.org/10.1044/0161-1461(2004/020))
- Kay, M. (2026a). An Exploration of the Use of Musical Activities to Promote Foundational Literacy Competencies for Children Aged 3-5 Years. *The Reading Teacher*, 80(1). <https://doi.org/10.1002/trtr.70068>
- Kay, M. (2026b). *My Cat Ben – Singalong*. Bryant and Kay Publishing.
- Kraus, N. (2019). *Music and the Mind with Dr Nina Kraus*. [Video] YouTube. https://youtu.be/43I_PHyb_K8?si=TJe-fVeAosm9kaCl
- Macrine, S. L., & Fugate, J. M. B. (2021). Translating embodied cognition for embodied learning in the classroom. *Frontiers in Education, Neuroscience, Learning and Educational Psychology*. <https://doi.org/10.3389/feduc.2021.712626>
- Macrine, S. L., & Fugate, M. B. (Eds.). (2022). *Movement Matters: How embodied cognition informs teaching and learning*. MIT Press.
- Martin, J., Bowl, M., & Banks, G. (Eds.). (2024). *Mapping the field: 75 Years of educational review, Volume 2*. Routledge.
- Meyer, G. F., Spray, A., Fairlie, J. E., & Uomini, N. T. (2014). Inferring common cognitive mechanisms from brain blood-flow lateralization data: a new methodology for fTCD analysis. *Frontiers in Psychology*, 5(552). <https://doi.org/10.3389/fpsyg.2014.00552>

- McWeeny, S., Choi, S., Choe, J., LaTourrette, A., Roberts, M. Y., & Norton, E. S. (2022). Rapid automatized naming (RAN) as a kindergarten predictor of future reading in English: A systematic review and meta-analysis. *Reading Research Quarterly*, 57(4), 1–20. <https://doi.org/10.1002/rrq.467>
- Milne, N., Cacciotti, K., Davies, K., & Orr, R. (2018). The relationship between motor proficiency and reading ability in Year 1 children: a cross-sectional study. *BMC Pediatrics*, 18, 294. <https://doi.org/10.1186/s12887-018-1262-0>
- Mirhosseini, S.-A. (Ed.) (2017). Introduction: Qualitative Research in language and Literacy Education in *Reflections on Qualitative Research in Language and Literacy Education* (pp. 1–13). Springer.
- NLT (National Literacy Trust). (2026). *Annual Literacy Survey*. <https://literacytrust.org.uk/research-services/annual-literacy-survey/>
- Novack, M., & Goldin-Meadow, S. (2015). *Learning from gesture: How our hands change our minds*. *Educational Psychology Review*, 27(3), 405–412. <https://doi.org/10.1007/s10648-015-9325-3>
- Parbery-Clark, A., Skoe, E., Lam, C., & Kraus, N. (2009). Musician enhancement for speech-in-noise. *Ear and Hearing*, 30(6), 653–661. <https://doi.org/10.1097/AUD.0b013e3181b412e9>
- Patel, A. D. (2011). Why would musical training benefit the neural encoding of speech? The OPERA hypothesis. *Frontiers in Psychology, Hypothesis and Theory Article*, 2(142). <https://doi.org/10.3389/fpsyg.2011.00142>
- Patel, A. D. (2014). Can nonlinguistic musical training change the way the brain processes speech? The expanded OPERA hypothesis. *Hearing Research*, 308, 98–108. <http://doi.org/10.1016/j.heares.2013.08.011>
- Polyanskaya, L., Samuel, A. G., & Ordin, M. (2019). Speech Rhythm Convergence as a Social Coalition Signal. *Evolutionary Psychology*, 17(3). <https://doi.org/10.1177/1474704919879335>
- Putkinen, V., Tervaniemi, M., & Huotilainen, M. (2012). Informal musical activities are linked to auditory discrimination and attention in 2–3-year-old children - an event-related potential study. *European Journal of Neuroscience*, 37, 654–661. <https://doi.org/10.1111/ejn.12049>
- Rautenberg, I. (2015). The effects of musical training on the decoding skills of German-speaking primary school children. *Journal of Research in Reading*, 38(1), 1–17. <https://doi.org/10.1111/jrir.12010>
- Register, D. (2001). The effects of an early intervention music curriculum on pre-reading/writing. *Journal of Music Therapy*, 38(3), 239–248. <https://doi.org/10.1093/jmt/38.3.239>

- Rohde, L. (2015). The comprehensive emergent literacy model: Early literacy in context. *SAGE Open*, 5(1). <https://doi.org/10.1177/2158244015577664>
- Roulstone, S., Law, J., Rush, R., Clegg, J., & Peters, T. (2011). The role of language in children's early educational outcomes. *Research Brief. DFE-RB 134*, <https://doi.org/10.1037/e603032011-001>
- Scarborough, H. S. (2001). Connecting early language and literacy to later reading (dis)abilities: Evidence, Theory, and Practice. In S. Neuman & D. Dickinson (Eds.). *Handbook for research in early literacy*, 97–110. Guilford Press.
- Schlaug, G., Jäncke, L., Huang, Y., Staiger, J. F., & Steinmetz, H. (1995). Increased corpus callosum size in musicians. *Neuropsychologia*, 33(8), 1047–1055. [https://doi.org/10.1016/0028-3932\(95\)00045-5](https://doi.org/10.1016/0028-3932(95)00045-5)
- Sedita, J. (2019). *The Strands That Are Woven Into Skilled Writing*. <https://keystoliteracy.com/wp-content/uploads/2020/02/The-Strands-That-Are-Woven-Into-Skilled-WritingV2.pdf>
- SERA. (2005). *Scottish Educational Research Association Ethical Guidelines for Educational Research*. SERA.
- Slater, J., Strait, D. L., Skoe, E., O'Connell, S., Thompson, E., & Kraus, N. (2015). Music training improves speech-in-noise perception: Longitudinal evidence from a community-based music program. *Behavioural Brain Research*, 291, 244–252. <https://doi.org/10.1016/j.bbr.2015.05.026>
- Slater, J., Tierney, A., & Kraus, N. (2013). At-risk elementary school children with one year of classroom music instruction are better at keeping a beat. *PLoS ONE*, 8(10), e77250. <https://doi.org/10.1371/journal.pone.0077250>
- Sosu, E., & Ellis, S. (2014). *Closing the Attainment Gap in Scottish Education*. Joseph Rowntree Foundation.
- Standley, J. M., & Hughes, J. E. (1997). Evaluation of an early intervention music curriculum for enhancing pre-reading/writing skills. *Music Therapy Perspectives*, 15, 79–85. <https://doi.org/10.1093/mtp/15.2.79>
- Stein, J. (2022). The visual basis of reading and reading difficulties. *Frontiers in Neuroscience*, 16, 1004027. <https://doi.org/10.3389/fnins.2022.1004027>
- Stothard, S. E., & Hulme, C. (1992). Reading comprehension difficulties in children. The role of language comprehension and working memory skills. *Reading and Writing*, 4, 245–256. <https://doi.org/10.1007/BF01027150>
- Tierney, A., & Kraus, N. (2013a). Music Training for the Development of reading skills. In M. Merzenich, M. Nahum and T. Van Vleet (Eds.). *Progress in Brain Research*, 209–241. Academic Press.

- Tierney, A. T., & Kraus, N. (2013b). The ability to tap to a beat relates to cognitive, linguistic and perceptual skills. *Brain and Language*, 124, 225–231. <https://doi.org/10.1016/j.bandl.2012.12.014>
- Tierney, A. T., & Kraus, N. (2014). Auditory-motor entrainment and phonological skills: precise auditory timing hypothesis (PATH). *Frontiers in Human Neuroscience*, 8, 949. <https://doi.org/10.3389/fnhum.2014.00949>
- Tierney, A. T., Gomez, J. C., Fedele, O., & Kirkham, N. Z. (2021). Reading ability in children relates to rhythm perception across modalities. *Journal of Experimental Child Psychology*, 210. <https://doi.org/10.1016/j.jecp.2021.105196>
- Toyka, K. V., & Freund, H. J. (2007). Music, motor control and the brain. *Brain*, 129(10), 2794–2798. <https://doi.org/10.1093/brain/awl231>
- U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, & National Assessment of Educational Progress. (2025). *The nation's report card: Grade 12 Reading*. <https://www.nationsreportcard.gov/reports/reading/2024/g12/>
- Verney, J. P. (2013). *Rhythmic perception and entrainment in 5-year-old children: An exploration of the relationship between temporal accuracy at four isochronous rates and its impact on phonological awareness and reading development* [Doctoral dissertation, University of Cambridge]. Apollo – University of Cambridge Repository. <https://doi.org/10.17863/CAM.16494>
- Winkler, I., Haden, G., Ladinig, O., Sziller, I., & Honing, H. (2009). Newborn Infants Detect the beat in music. *Proceedings of the National Academy of Sciences*, 106(7), 2468–2471. <https://doi.org/10.1073/pnas.0809035106>
- Zanto, T. P., Giannakopoulou, A., Gallen, C. L., Ostrand, A. E., Younger, J. W., Anguera-Singla, R., Anguera, J. A., & Gazzaley, A. (2024). Digital rhythm training improves reading fluency in children. *Developmental Science*, 27(3). <https://doi.org/10.1111/desc.13473>
- Zhakim, A. (2024). Pre-school children's learning and development of literacy in the Kazakh home learning environment. *Journal of Education and E-Learning Research*, 11(1), 142–154. <https://doi.org/10.20448/jeelr.v11i1.5398>

Contact email: a.maria.kay@btinternet.com