7 The integration of embodied learning in a language learning classroom: conclusions from a qualitative analysis

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Abstract

Embodied Learning (EL) is now an emerging teaching paradigm that takes into consideration the impact of bodily movements into the learning process. This paradigm, in combination with movement-based technologies, provides strategies and methods for delivering a more engaged and interactive lesson. Following previous empirical evidence, this study presents the results of an educational intervention, based on EL, in the context of language learning in mainstream elementary schools. The study aims to examine whether this practice would improve students' language performance and enhance their engagement in, and motivation for, learning a language. One hundred and eighteen (N=118) elementary students and six teachers were involved in this investigation. Data were collected from video recordings of 12 intervention sessions in the classroom. The analysis of video recordings provided rich information about the engagement of the students in the classroom during the sessions. It revealed that the EL practice enabled students to actively engage in the lesson, increasing their motivation and participation. Finally, the manuscript discusses the use of such an EL approach in language learning and teaching.

Keywords: embodied cognition, embodied learning, elementary education, language learning, qualitative analysis.

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1. Introduction

The existing literature in the area of EL demonstrates that the integration of movement could improve students' academic and emotional performance (Kosmas, Ioannou, & Retalis, 2017; Kosmas, Ioannou, & Zaphiris, 2018). The EL framework points out the inseparable link between brain and body, and offers alternative practices and solutions on how bodily movements can be integrated into our teaching methodologies. This link between brain-body has been investigated by many researchers in different disciplines, such as in the areas of cognition, psychology, and linguistics, among others. The focus of the research was related to the value of the involvement of the physical body in the learning process and how this involvement can change people's learning and cognitive performance (Wilson, 2002).

Thus, over the last decades, EL has evolved as one paradigm of contemporary teaching and learning practice (Foglia & Wilson, 2013). In that way, the concept of EL plays a significant part in the area of educational research intending to examine whether this practice affects students' overall performance (Lindgren & Johnson-Glenberg, 2013). The use of technology is also one thing that we have to consider when we talk about EL. Technologies that require movement (e.g. Kinect, leap motion, etc.) provide solutions with regard to the integration of the EL approach into the classroom. In this context, students can take part in the whole learning process, engage in a more meaningful way in learning, and have direct physical interaction with the learning material (Chandler & Tricot, 2015).

Despite the recent growing interest in EL in educational settings, empirical research focusing on qualitative data in real school settings is limited (Kosmas & Zaphiris, 2018). The contribution of this research is to provide an insight into how students react in these EL conditions, since video recording can capture all students' behaviour during the intervention sessions. It also provides one example of how teachers can integrate or introduce EL into their teaching practice.

Specifically, the EL intervention described in this study shows empirically how technology can support the EL approach in the context of first language

acquisition (L1). The educational interventions were carried out in real language learning classrooms to examine:

- students' engagement and motivation in participating in this type of learning; and
- the factors which can affect the delivery of EL.

2. Theoretical background

2.1. Embodied Cognition (EC)

The involvement of the physical body in the cognitive and learning process is part of the theoretical framework of EC. The theoretical framework of EC has gained attention over the last two decades (Fugate, Macrine, & Cipriano, 2019). It emphasises the relationship between sensory-motor processes and abstract cognitive processes (Duijzer et al., 2019) and claims that the body plays a significant part in cognitive mechanisms (Wilson, 2002). It is also believed that the connection between body-mind comes true when physical interaction and movement are linked with learning content (Ayala, Mendívil, Salinas, & Rios, 2013).

Although EC theory is in its early stages, there is a huge amount of multidisciplinary and interdisciplinary literature around the implications of EC in many areas, including education. The literature offers significant recommendations in terms of the use of EC in educational practice. One such recommendation is the EL framework, which can enhance educational practice offering new strategies and methods to make students' learning experience effective and meaningful (Shapiro & Stolz, 2019).

2.2. Empirical evidence of EL in language acquisition

There is a large and diverse body of literature on the significance of EC theory for language learning and teaching. Previous research emphasised the need for

more active learning experiences where students can use their bodily movements to understand the material that is being taught (Cassar & Jang, 2010; Kosmas, Ioannou, & Retalis, 2018; Kosmas, Ioannou, & Zaphiris, 2018). Scholars in this area suggest that the learner's ability to comprehend a language relates to the ability to simulate the action involved in the meaning (Fugate et al., 2019).

Focusing on a language learning context, many studies have explored how gestures or movements can affect specific areas of language learning, like phonological awareness and reading (Moritz et al., 2013), while some other studies have shown the impact of movement' integration for language development and comprehension. Findings from the study of Booth et al. (2014) have revealed that physical activity has a positive impact on student academic performance, while the study of Chaddock-Heyman et al. (2014), has demonstrated that embodied interaction improves neural connectivity within the brain. Along the same lines, other studies in this area have pointed out the link between movement and specific words demonstrating that children acquire new vocabulary better when they connect a movement with a word (Kosmas & Zaphiris, 2019a). Moreover, Glenberg (2010) highlighted that memory and perception are affected by movement, while Bokosmaty, Mavilidi, and Paas (2017) have claimed that physical movements enhance learners' memory by expanding their working memory capacity to deal with complex learning tasks. Other studies have demonstrated the impact of EL on the students' verbal information (Chang et al., 2013), others on students' recall of information (Gao et al., 2013) and others on students' second language comprehension (Lee et al., 2012).

More recently, in the same context, some studies have also revealed the potential of such EL activities for students' performance and memory. The results of previous research showed important considerations regarding the positive impact of physical activity during learning. For example, Schmidt et al. (2019), examining 104 elementary school children's performance, have concluded that children enjoy physically active learning scenarios more than the sedentary. Additionally, Kosmas and Zaphiris (2019a) have revealed significant gains in students' academic achievements in language acquisition

and documented improvements in students' emotional engagement. Finally, the qualitative analysis of 52 elementary students in EL conditions indicated that EL interactions facilitated collaboration between students by engaging them in learning activities physically and emotionally (Kosmas & Zaphiris, 2019b).

Outside of language learning, a huge number of studies have shown that EL approaches enhanced students' learning outcomes in mathematics and science (Abrahamson, 2013; Chen & Fang, 2014; Kellman & Massey, 2013). The study of Mavilidi et al. (2018) working with 120 pre-school children in different groups, has revealed that children in the physical activity group performed better than children in all other conditions. A recent work by Ioannou, Georgiou, Ioannou, and Johnson (2019) investigating students' learning and perceptions of technology integration in two different contexts (high-embodied and low-embodied), revealed improved learning gains and more positive attitudes towards technology integration, for the students in both conditions. Also, Voillot, Bevilacqua, Chevrier, and Eliot (2019) highlighted the important role of movement-based digital interfaces for empowering children and emphasised the need for active early childhood education.

Taking all the above into consideration, there is important empirical evidence for the use of movement in achieving better learning gains in different language learning contexts, such as first language acquisition, second language acquisition, foreign language acquisition, etc. What has not yet been investigated is the behaviour (e.g. engagement, participation, motivation) of the students in an EL environment that combines the teaching of language with embodied technology in real contexts.

3. Research design

The analysis of this study focused on qualitative data. A qualitative approach was used in this study to analyse the video data from 12 consecutive intervention sessions in the classroom. In terms of having and analysing qualitative data from students' activities, researchers claimed that capturing classroom dynamics

makes it possible to analyse exactly what goes on between the students and the teacher (Raca & Dillenbourg, 2014). Video data provide a clearer picture of the students' behaviour during the sessions and make possible the holistic view of the whole research process (Jacobs, Kawanaka, & Stigler, 1999). The cycle of coding and analysis of video data includes watching, coding, and analysing the data, with the goal of transforming the video images into objective and verifiable information (Jacobs et al., 1999).

3.1. Participants

A total of 118 elementary classroom students from two different schools were involved in the study and participated in a three-month intervention in order to complete 12 EL sessions in the classroom. Students attended mainstream public schools in Cyprus and the average age of students was 7.6 years old. The students' mother language was Greek, and the intervention took place in L1 lessons in first and second-grade classes. In the study, six primary school teachers were involved in the intervention.

3.2. The interventions in the classroom

As mentioned earlier, the intervention sessions were designed, organised, and prepared based on an EL perspective. All the activities were aimed at engaging students in an EL environment, where they could move while learning a new vocabulary. To achieve this, we have designed a movement-based intervention, based on the idea of EL, in order to enhance the vocabulary and language acquisition of first and second graders using the strengths of their bodily movements (for a detailed analysis of the movement-based intervention see the work of Kosmas & Zaphiris, 2019a). In a nutshell, the intervention included short video presentations combining bodily movements with specific words. The video presentations included in total 80 movement-words accompanied by easy steps to be followed by students. All the sessions were designed to be implemented collaboratively in the classroom with increased difficulty across the sessions.

All the intervention sessions were delivered once a week over three months during L1 lessons. Students completed 12 courses of 30 minute duration each. The video presentations had clear visual instructions (using animations) on how to perform each movement, each of which represented one specific word. Students engaged in an EL environment using their bodies to learn and acquire new vocabulary. Figure 1 presents some episodes from the EL intervention session in the classroom.

Figure 1. Students in 'action': episodes from interventions in a language classroom

3.3. Qualitative dataset

All classroom sessions were video recorded. The video data were used to yield information about the physical engagement and interaction of the students and to understand how EL worked in the classroom.

Notably, as Garcez, Duarte, and Eisenberg (2011) stated, video recording, as a data collection strategy, is a rich source of information, especially in research with children. The cameras were positioned in two different places in the classroom and captured most of the students' movements. In the end, 40 minutes of material were recorded for each classroom per session. The video material was

intended to yield rich information about the physical engagement and interaction of the students and to show just how EL worked in the classroom. Collecting video material also allowed us to view what users actually did in the learning setting, capturing behaviour that would otherwise have gone unreported. Indeed, video data gave us opportunities to capture aspects that may go unnoticed during the intervention session. Many episodes of video data gave us a whole picture of students' performance and engagement in the classroom.

4. Findings

4.1. Students' language learning performance

Based on the analysis of video recordings of 12 intervention sessions, it seems that students enjoyed the EL activities and managed to improve their L1 language skills. The fact that students were motivated to participate in all the activities using technology enabled them to perform successfully in all the in-class activities and improve their skills. The EL practices facilitated the delivery of the lesson since all students participated actively in the activities following the instructions of the teacher.

Specifically, analysing some video episodes and focusing on students' reactions and discussions at the end of interventions, students improved their language skills in terms of new vocabulary acquisition and comprehension of new words. From the collected data, it is obvious that children learned some new words which are significantly important at this stage of their education (first and second grade). What has emerged from the recordings is that students can memorise new words easily when those are linked with a movement. This assumption is explained from the fact that every time that students have been asked to recall one new word, they imitated the specific movement of this word. At the end, students managed to connect most of the new words with the respective movement which is a kind of proof that EL helped them to develop a new way in words' understanding.

4.2. Students' behaviour and factors for implementing EL in the classroom

The analysis of the video data was employed according to the procedure described in Barron and Engle (2007), as follows: (1) guiding questions and indexing (field notes), (2) macro-level coding, (3) narrative summaries, (4) categorisation of the themes, (5) final coding, and (6) discussion of emerged categories.

Video analysis revealed many important insights into how EL can be implemented in authentic language classroom environments. As derived from video data, the essential point is that this intervention enabled all students to participate actively in learning and to improve their performance in language. Data from video recording revealed that the effective implementation of EL in the classroom is based on five factors: (1) the teacher's role, (2) the technology used for EL purposes, (3) collaboration between students, (4) classroom setting, and (5) organisation of in-class activities.

First, an important factor in implementing successful EL interventions in class-wide settings is the teacher, whose participation is critical at the beginning. The teacher must provide clear guidelines for children on how they can complete the EL activities. These guidelines should be repeated if necessary. Encouraging children to continue is also very important, especially during the first interventions. In subsequent sessions, the role of the teacher is more instructive. The teacher should help children where needed and intervene only when children find it challenging to progress. For instance, observing an episode in the classroom, the teacher encouraged students to continue their activity and gave them some guidelines, as showcased in the following information flow example.

> **Teacher**: Come on, guys; follow the instructions! [Points to a particular area on the screen that contains the instructions.]
> **Student 1**: And now? What will I do now?

Teacher: Look at the screen [points to the specific area on the screen]. The guy (animation) says that you should raise your left hand.
Student 1: [Follows the instruction]
Teacher: Good job! Great!
Student 1: And now?
Teacher: Continue.... [Points again on screen]. Be careful of what the animation says.
Student 1: Ah, ok...

The classroom setting is also significant for the development of interventions. Children need to have the space to move about the classroom without any obstacles. They need to feel comfortable and familiar with the space so they can participate actively throughout the process. Students must have easy access to the screen so they do not miss the instructions. For example, observing some children during the session, we realised that the children in the back rows of the classroom had no direct access to the screen, and could not follow the instructions, as shown in the example below.

Student 2: What should we do now? I don't know!
Student 3: Look at the screen!
Student 2: [student tries to read the instructions]
Teacher: Come on! Do you see what the animation is doing?
Student 2: No, the screen is far away from me! I can't see!
Student 4: And now? I don't see the animation's movements very well!

Technology also plays an essential role in successful implementation of EL in the classroom. Everything should be ready and organised in advance so as not to waste time or create confusion when the intervention starts. The more playful the activities, the more kids like them. Technology encourages children to participate in the learning process, but when the technology does not work, it makes the situation difficult and the classroom experience more chaotic. Due to the physicality of EL learning activities, the technological tools that teachers use should make the classroom physical and flexible. Finally, activities need to

change from session to session because children get bored quickly. Each new activity must build on the last so that children are motivated to continue, as in the example below.

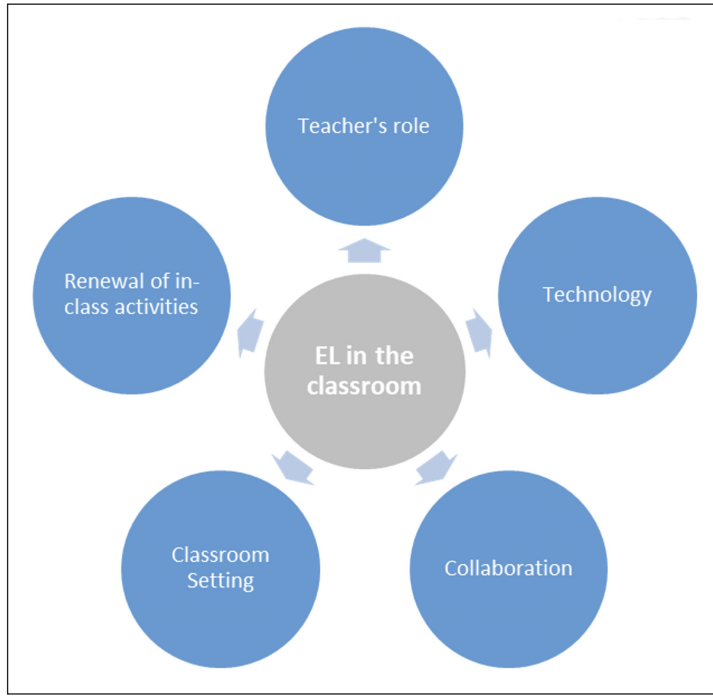
> **Student 5**: Oh! This is a new movement!
> **Student 6**: Yep.... It's difficult! I am not sure if I will manage it!
> **Student 5**: [Tries to do the movement showing the way to his classmate]
> **Student 7**: I did it! Great!
> **Student 5**: I did it too! Cool!
> **Student 6**: Look at this [shows the animation's movement and laughs].
> **Student 5**: Let's try then!

As stated by Kosmas and Zaphiris (2019b), "it is also important […] to cultivate an atmosphere of cooperation in the classroom because [… interventions often require teamwork…] it was often observed during the intervention that some children were encouraged to continue by their classmates. At other times, when students didn't understand [the] instructions, they followed their classmates in order to advance to the next step" (p. 192), as in the example below.

> **Student 8**: What is this?
> **Student 9**: What? It's easy! [Tries to perform the movement]
> **Student 8**: [Observe what his classmate is doing]
> **Student 9**: You see? I did it! Do you see it? [Perform the movement again]. Did you understand?
> **Student 8**: [tries one more time to perform the movement]
> **Student 9**: Bravo! That's it!

Given the positive results from this investigation, I can argue categorically that EL-driven technologies should be integrated into the language learning classroom. Figure 2 below visualises the pattern of the implementation of EL in class-wide classroom context, highlighting the five factors of such implementation. These factors are the teacher's role, the use of technology, collaboration between students, the set-up of the classroom, and the type of in-class activities.

Figure 2. Essential factors for the implementation of EL in a language classroom



5. Discussion

This study, focusing on the analysis of qualitative data collected from the video recording, provides insights for the use of EL in a language learning environment. The video data provide more evidence of how the body can be used in educational interventions, taking into consideration the interaction and engagement of students during the intervention sessions. This type of practice in teaching, known as EL, encourages students to engage in learning activities both physically and emotionally. At the same time, this specific experiment

offers a paradigm for movement-based language lessons, especially for first and second graders.

This investigation offers a paradigm based on the EL idea and claims that the EL can create an enjoyable collaborative environment in the classroom. All students were motivated during the sessions, enjoyed the process, and were willing to participate in more EL activities. EL and movement-based activities enable students to take action into the learning process and give them the opportunity to interact with the learning material. It is also suggested, based on the qualitative dataset analysed, that the implementation of EL in the classroom is based on five essential factors: the teacher's role in the classroom, the type and the use of technology, the opportunities for collaboration between students, the classroom orchestration, and the type of in-class activities. The consideration of the above factor is critical for the effective implementation of an educational intervention based on EL principles. Furthermore, this intervention presented in the study gives an example of how language teachers can enrich the teaching of language lessons by including aspects of bodily movements and physical interaction. The results of this research are in line with other research studies which believe that an embodied view of teaching and learning can improve students' language readiness and acquisition (Krog & Krüger, 2011).

In closing, given the positive results from this investigation, we can argue that the EL approach with the use of technology can be integrated into classroom language learning curricula. By doing so, teachers will have the opportunity to boost children's language skills in an enriched sensorimotor environment, which can positively impact not only their academic performance but also their engagement in the process.

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References

Abrahamson, D. (2013). Building educational activities for understanding: an elaboration on the embodied-design framework and its epistemic grounds. *International Journal of Child-Computer Interaction, 2*(1), 1-16. https://doi.org/10.1016/j.ijcci.2014.07.002

Ayala, N. A. R., Mendívil, E. G., Salinas, P., & Rios, H. (2013). Kinesthetic learning applied to mathematics using kinect. *Procedia Computer Science, 25*, 131-135. https://doi.org/10.1016/j.procs.2013.11.016

Barron, B., & Engle, R. A. (2007). Analyzing data derived from video records. In S. J. Derry (Ed.), *Guidelines for video research in education: recommendations from an expert panel* (pp. 24-33). Data Research and Development Center. https://drdc.uchicago.edu/what/video-research-guidelines.pdf

Bokosmaty, S., Mavilidi, M. F., & Paas, F. (2017). Effects of making and observing movements with interactive geometry software on learning geometry. *Computers & Education, 113*, 313-326. https://doi.org/10.1016/j.compedu.2017.06.008

Booth, J. N., Leary, S. D., Joinson, C., Ness, A. R., Tomporowski, P. D., Boyle, J. M., & Reilly, J. J. (2014). Associations between objectively measured physical activity and academic attainment in adolescents from a UK cohort. *British journal of sports medicine, 48*(3), 265-270. https://doi.org/10.1136/bjsports-2013-092334

Cassar, A., & Jang, E. (2010). Investigating the effects of a game-based approach in teaching word recognition and spelling to students with reading disabilities and attention deficits. *Australian Journal of Learning Difficulties, 15*(2), 193-211. https://doi.org/10.1080/19404151003796516

Chaddock-Heyman, L., Erickson, K. I., Holtrop, J. L., Voss, M. W., Pontifex, M. B., Raine, L. B., Hillman, C. H., & Kramer, A. F. (2014). Aerobic fitness is associated with greater white matter integrity in children. *Frontiers in human neuroscience, 8*, 584. https://doi.org/10.3389/fnhum.2014.00584

Chandler, P., & Tricot, A. (2015). Mind your body: the essential role of body movements in children's learning. *Educational Psychology Review, 27*(3), 365-370. https://doi.org/10.1007/s10648-015-9333-3

Chang, C. Y., Chien, Y. T., Chiang, C. Y., Lin, M. C., & Lai, H. C. (2013). Embodying gesture-based multimedia to improve learning. *British Journal of Educational Technology, 44*(1), E5-E9. https://doi.org/10.1111/j.1467-8535.2012.01311.x

Chen, N., & Fang, W. (2014). Gesture-based technologies for enhancing learning. In R. Huang, Kinshuk, N.-S. Chen & Editors (Eds), *The new development of technology enhanced learning. Concept, research and best practices* (pp. 95-112). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-642-38291-8_6

Duijzer, C., Van den Heuvel-Panhuizen, M., Veldhuis, M., Doorman, M., & Leseman, P. (2019). Embodied learning environments for graphing motion: a systematic literature review. *Educational Psychology Review, 31*(3), 597-629. https://doi.org/10.1007/s10648-019-09471-7

Foglia, L., & Wilson, R. A. (2013). Embodied cognition. *Wiley Interdisciplinary Reviews: Cognitive Science, 4(*3), 319-325. https://doi.org/10.1002/wcs.1226

Fugate, J. M., Macrine, S. L., & Cipriano, C. (2019). The role of embodied cognition for transforming learning. *International Journal of School & Educational Psychology, 7*(4), 274-288. https://doi.org/10.1080/21683603.2018.1443856

Gao, Z., Hannan, P., Xiang, P., Stodden, D. F., & Valdez, V. E. (2013). Video game–based exercise, Latino children's physical health, and academic achievement. *American journal of preventive medicine, 44*(3), 240-246. https://doi.org/10.1016/j.amepre.2012.11.023

Garcez, A., Duarte, R., & Eisenberg, Z. (2011). Production and analysis of video recordings in qualitative research. *Educação e Pesquisa, 37*(2), 249-261.

Glenberg, A. M. (2010). Embodiment as a unifying perspective for psychology. *Wiley Interdisciplinary Reviews: Cognitive Science, 1*(4), 586-596. https://doi.org/10.1002/wcs.55

Ioannou, M., Georgiou, Y., Ioannou, A., & Johnson, M. (2019). On the understanding of students' learning and perceptions of technology integration in low-and high-embodied group learning. *Repository of the International Society of Learning Sciences*. https://repository.isls.org//handle/1/1582

Jacobs, J. K., Kawanaka, T., & Stigler, J. W. (1999). Integrating qualitative and quantitative approaches to the analysis of video data on classroom teaching. *International Journal of Educational Research, 31*(8), 717-724. https://doi.org/10.1016/s0883-0355(99)00036-1

Kellman, P. J., & Massey, C. M. (2013). Perceptual learning, cognition, and expertise. *The psychology of learning and motivation, 58*, 117-165. https://doi.org/10.1016/b978-0-12-407237-4.00004-9

Kosmas, P., Ioannou A., & Retalis S. (2017). Using embodied learning technology to advance motor performance of children with special educational needs and motor impairments. In É. Lavoué, H. Drachsler, K. Verbert, J. Broisin, & M. Pérez-Sanagustín (Eds), *Data driven approaches in digital education. EC-TEL 2017. Lecture Notes in Computer Science, vol 10474.* Springer. https://doi.org/10.1007/978-3-319-66610-5_9

Kosmas, P., Ioannou, A., & Retalis, S. (2018). Moving bodies to moving minds: a study of the use of motion-based games in special education. *TechTrends, 62*(6), 594-601. https://doi.org/10.1007/s11528-018-0294-5

Kosmas, P., Ioannou, A., & Zaphiris, P. (2018). Implementing embodied learning in the classroom: effects on children's memory and language skills. *Educational Media International, 56*(1), 59-74. https://doi.org/10.1080/09523987.2018.1547948

Kosmas, P., & Zaphiris, P. (2018). Embodied cognition and its implications in education: an overview of recent literature. World Academy of Science, Engineering and Technology, International Science Index 139. *International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering, 12*(7), 946-952.

Kosmas, P., & Zaphiris, P. (2019a). Words in action: investigating students' language acquisition and emotional performance through embodied learning. *Innovation in Language Learning and Teaching, 14*(4), 317-332. https://doi.org/10.1080/17501229.2019.1607355

Kosmas, P. & Zaphiris P. (2019b). Embodied interaction in language learning: enhancing students' collaboration and emotional engagement. In D. Lamas, F. Loizides, L. Nacke, H. Petrie, M. Winckler, & P. Zaphiris (Eds), *Human-computer interaction – INTERACT 2019. Lecture Notes in Computer Science* (vol 11747). Springer. https://doi.org/10.1007/978-3-030-29384-0_11

Krog, S., & Krüger, D. (2011). Movement programmes as a means to learning readiness. *South African Journal for Research in Sport, Physical Education and Recreation, 33*(3), 73-87.

Lee, W., Huang, C., Wu, C., Huang, S., & Chen, G. (2012). The effects of using embodied interactions to improve learning performance. In *2012 IEEE 12th International Conference on Advanced Learning Technologies (ICALT), July 4–6 2012* (pp.557-559).

Lindgren, R., & Johnson-Glenberg, M. (2013). Emboldened by embodiment six precepts for research on embodied learning and mixed reality. *Educational Researcher, 42*(8), 445-452. https://doi.org/10.3102/0013189x13511661

Mavilidi, M. F., Okely, A., Chandler, P., Domazet, S. L., & Paas, F. (2018). Immediate and delayed effects of integrating physical activity into preschool children's learning of numeracy skills. *Journal of Experimental Child Psychology, 166*, 502-519. https://doi.org/10.1016/j.jecp.2017.09.009

Moritz, C., Yampolsky, S., Papadelis, G., Thomson, J., & Wolf, M. (2013). Links between early rhythm skills, musical training, and phonological awareness. *Reading and Writing, 26*(5), 739-769. https://doi.org/10.1007/s11145-012-9389-0

Raca, M., & Dillenbourg, P. (2014, November). Holistic analysis of the classroom. In *Proceedings of the 2014 ACM workshop on Multimodal Learning Analytics Workshop and Grand Challenge* (pp. 13-20). https://doi.org/10.1145/2666633.2666636

Schmidt, M., Benzing, V., Wallman-Jones, A., Mavilidi, M. F., Lubans, D. R., & Paas, F. (2019). Embodied learning in the classroom: effects on primary school children's attention and foreign language vocabulary learning. *Psychology of sport and exercise, 43*, 45-54. https://doi.org/10.1016/j.psychsport.2018.12.017

Shapiro, L., & Stolz, S. A. (2019). Embodied cognition and its significance for education. *Theory and Research in Education, 17*(1), 19-39. https://doi.org/10.1177/1477878518822149

Voillot, M., Bevilacqua, F., Chevrier, J., & Eliot, C. (2019, June). Exploring embodied learning for early childhood education. In *Proceedings of the 18th ACM International Conference on Interaction Design and Children* (pp. 747-750). https://doi.org/10.1145/3311927.3325347

Wilson, M. (2002). Six views of embodied cognition. *Psychonomic Bulletin & Review, 9*(4), 625-636. https://doi.org/10.3758/bf03196322

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