

Teacher Reflections on Trialled Embodied Learning Principles

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Teacher reflection as a practice in education provides a window into teachers' interpretations of what they are teaching. This paper analyses 8 teachers' reflections within the ELEMS project. Teachers recorded reflections on the trialling of embodied learning principles in Pre-school to Year 2 classrooms. Reflections were analysed through the lens of Teacher noticing. Results revealed that teachers identified and described the use of multiple embodied learning principles at once (what they noticed), often including examples of students' actions as supporting evidence (how they interpreted what they noticed). Several reflections translated what was noticed and interpreted (past tense) into future-directed teaching principles (future tense).

One of the key objectives of the Embodied Learning in Early Mathematics and Science (ELEMS) Project (2021-2024) is to produce a professional learning package for teachers to support their development of pedagogy inclusive of embodied learning principles. Way and Ginns (2022) presented a need for translational research on embodied learning where researchers “collaborate with teachers in naturalistic classroom settings to translate research findings into curriculum-connected pedagogy” (p. 538). They proposed that the project will potentially empower teachers to expand their ‘repertoire of teaching practices’—focusing on embodied learning principles, enhancing young children’s ‘repertoire of representational modes’ to communicate mathematical and scientific concepts. In 2022, the ‘explore’ phase of the ELEMS project was undertaken in one school. The purpose of Phase 1 was for teachers to trial embodied learning and teaching approaches and provide feedback as to what they tried. Teacher feedback and reflections were then used to develop a set of suggested embodied learning activities as a Teaching Guide in preparation for implementation in Phase 2 in 2023. The aim of this paper is to present initial findings drawn from teacher-reported reflection data collected via the online platform SeeSaw (<https://web.seesaw.me/>) during Phase 1 of the ELMS project. Reflections provided insights into the teachers’ classroom practices during the trialling of a range of embodied learning principles. The teacher reflections included self-reflections on their own teaching in relation to the embodied principles, and student-reflections in relation to student engagement and learning.

Collectively, the embodied learning principles utilised in the ELEMS project draw on research in relation to gesture, touch-pointing or tracing (Alibali & DiRusso, 1999; Alibali & Nathan, 2012; Ginns et al., 2016; Martinez-Lincoln et al., 2019), conceptual body movement (Mavilidi et al., 2018; Shoval, 2011), and drawing (de Freitas & Sinclair, 2012; Machón, 2013; Preston, 2016; Way, 2018) as external representational modes that can enhance learning. Research suggests that these external representations can be both thinking and communication tools (Goldin & Shteingold, 2001) young children can engage with, assisting them to “notice and attend to the essential properties, structures and relationships of the mathematical and scientific ideas” (Way & Ginns, 2022, p. 539). The current paper shifts this action of noticing and attending to the teachers, employing *teaching noticing* as a critical lens through which to view the teachers’ reflections on trialling the embodied learning principles to answer the following research question:

- What do teachers notice and attend to when reflecting on trialling embodied learning principles?

Theoretical Underpinning

The theoretical construct of teacher noticing was employed to analyse reflections data from teachers trialling embodied learning principles in their classrooms. Although the teachers (2023). In B. Reid-O’Connor, E. Prieto-Rodriguez, K. Holmes, & A. Hughes (Eds.), *Weaving mathematics education research from all perspectives. Proceedings of the 45th annual conference of the Mathematics Education Research Group of Australasia* (pp. 139–146). Newcastle: MERGA.

themselves were not participating in a study on developing the intentional act of teacher noticing (Mason, 2011), their reflections may naturally illustrate aspects of teacher noticing. Sherin and van Es' (2005) earlier research on learning to notice focused on *what* the teachers noticed and *how* they interpreted what they noticed. More recently van Es and Sherin (2021) continue to focus on *what* teachers notice, "identifying key events that take place in a classroom" (p. 19) and *how* they interpret what they notice, drawing "inferences about particular features of instruction based on broader principles of teaching and learning" (p. 19). They also expanded teacher noticing to include shaping. Their research, along with research by Jacobs et al. (2010), highlight 'next steps' teachers notice regarding; potential decision-making (Jacobs et al.) that occurs *after* the fact; the shaping of classroom interactions that occur *during* teaching (van Es & Sherin, 2021) based on what they noticed. Adapting the act of teacher noticing to analysing teacher reflections within the current study provides space for 'noticing teacher noticing' from the researchers' perspective. As the teachers implement new knowledge and practices from the project's professional development sessions, noticing what teachers naturally notice and reflecting on is important. Eden (2020) makes this connection stating that "teacher noticing is an important element of reflective practice, and teacher reflection is key to strengthening the impacts of teaching by making sense of teaching/learning experiences and then using these to inform future practice" (p. 300). The critical point Jaworski (2003) makes in connecting noticing and reflection, mentioned by Eden (2020), is that reflecting "on aspects of past practice can support the development of enhanced noticing within future practice thus influencing classroom actions and potentially changing practice" (Eden, 2020, p. 301). Reflecting on the implementation of embodied learning principles by teachers in the current study has the potential to influence their classroom actions and change practice. The application of teacher-noticing connected with teacher reflections may shed light on how the teachers are translating research into practice aligned to the researchers' goal "to transform the findings into pedagogical knowledge and practice" (Way & Ginns, 2022, p. 542).

Research Design

The aim of the three-year (3 phase) ELEMS project is to develop an evidence-based, classroom-ready professional learning resource centred on the use of embodied learning principles. The overall research approach is mixed methods including the collection of both quantitative and qualitative data components from teachers and students within each phase. The three phases follow an iterative *development-testing-upscaling* process. The collaborative nature of the project where researchers directly interact and cooperate with practising teachers to implement the embodied learning principles aligns to a design-based research methodology (Reimann, 2010). The focus of this paper is on Phase 1: translating the prior research, applying the collective findings from the field of embodied learning research, into early years classrooms (Preschool through to Year 2) to develop a professional learning resource.

Participants

In Phase 1 the researchers partnered with a NSW Department of Education school situated in a low socio-economic area of South-Western Sydney, NSW, Australia. The school has 340 students, with an additional 38 students in an attached preschool. The students come from a diverse range of cultures and 78% of students are from Non-English Speaking Backgrounds (NESB). Eight teachers and their students participated in Phase 1. This paper focuses on the teacher reflections ($N = 40$) collected during the project via the online platform SeeSaw. Teacher demographics and the number of reflections collected are presented in Table 1. Pseudonyms are used for the teachers.

Table 1*Teacher Demographics and Number of Reflection Posts*

Teacher	Class	Years of teaching experience	Reflection posts (N = 40)
Lauren	Pre-school	6–10 years	1
Rhonda*	Kindergarten	>15 years	1
Isla	Kindergarten	6–10 years	14
Melissa	Kindergarten	>15 years	16
Rosa	Year 1	6–10 years	0
Crystal	Year 1	4–5 years	6
Kathleen	Year 2	>15 years	0
Elani	Year 2	6–10 years	2

*Rhonda withdrew from the research study during Term 1.

Phase 1 of the Project: Teacher-Focus

Phase 1 involved three professional learning days for the teachers (April, June and September) that presented the research background to embodied learning and the modes of gesture, tracing, body movement and drawing, and suggested activities to trial. Throughout the year, one of the project researchers acted as a mentor, visiting the school on a weekly basis to provide in-class support and to collect observational data. The classroom observations were a means to collect teachers' strategies and activities they were using in conjunction with the embodied learning principles. Note that these activities were later refined and developed into the Teaching Guide resource that will be implemented in the Phase 2–*testing* process of the research project.

Data Collection and Analysis: Teacher Reflections

Teachers were encouraged to regularly reflect on the embodied learning principles they were trialling in their classrooms. The following questions were provided as a scaffold to guide teachers' reflection posts: What embodied learning did you try in your classroom? What was the lesson's mathematical or scientific focus? How did the embodied learning link to the concept you were teaching? Comment on how you felt the use of the embodied learning went (for you and for the students)

Teachers used the SeeSaw app as a journaling space to share what and how they were implementing the embodied learning principles, often accompanied by photographs and videos. Written reflections were transcribed from the app and were deductively analysed against Sherin and van Es' (2005) teacher noticing actions: *what* did they notice? and *how* they talked about what they noticed—descriptively, evaluatively, and interpretively. Additional iterative rounds of analysis occurred where the reflections were read and re-read considering any emerging ideas or themes not discovered through the deductive analysis.

This is the initial analysis of teacher data. Pre- and post-questionnaire data on embodied learning and post-project teacher interview data have also been collected and will be used in triangulating any emerging findings from the ELEMS project. In particular, noticing growth in the teachers' thoughts about embodied learning and any changes in their teaching practices.

Findings

What Teachers Noticed

Most reflections (37/40) included noticing of student actions. Of these 37 comments, 15 also included noticing of teacher actions or pedagogy. For example, Kindergarten teacher Isla wrote:

Today I tried something that we trialled during the first PL—the mystery bag. I placed a 2D shape in the bag and students had to draw what they felt. After a few shapes I placed a cube in the bag. All students drew a square on their page. This started our discussion on 3D shapes. I felt like the drawing aspect made the students differentiate between 2D and 3D shapes easier. They could see that their drawings did not represent the whole cube. I have also started to notice that students are using gestures. I do have to refrain myself from saying "use your words" when asking students to describe things.

Of the 40 reflections, 33 mentioned embodied learning principles specifically, using terms such as tracing/pointing (n = 7), gesture (n = 13), body movement (n = 19), or drawing (n = 11). The number of references to embodied learning totals more than 40 as 17 of the reflections mentioned using combinations of embodied learning simultaneously in lessons, see Table 2.

Table 2

Evidence of Combined Embodied Learning Principles

Combination of embodied learning principles	Excerpt from teacher reflection
Gesture, touch and tracing	Great fun with finger tracing and developing important use of touch and teacher gesture to recall lines and patterns [Melissa].
Body movement and gesture	We continued our body movement and gesture theme this week, applying it to our science concepts. We have been looking at materials and their properties and used our bodies to represent these properties [Melissa].
Body movement, gesture and drawing	Students were given the opportunity to make the patterns using their bodies ... Here some students demonstrated the use of gestures to describe the patterns ... Students were then given the opportunity to draw their own patterns [Crystal].

Year 1 teacher Crystal commented on how her lesson combined multiple embodied learning principles of body movement, drawing, and gesture by the students:

I feel the body movement enabled students to gain a deeper understanding of patterns and that they can be more than just colours repeated. It was interesting to see the use of gestures, as this lesson was more about body movement and drawing.

How Teachers Noticed

Reflection data aligned to Sherin and van Es (2005) teacher noticing actions in relation to *how* they noticed: *restating*—describing the classroom events, *investigating*—evaluating student actions as evidence of what they noticed, and *generalising*—making connections between student learning and teaching pedagogy. Presented in Table 3 are reflection excerpts, italics has been used to highlight evidence that aligns to aspects of the teacher noticing actions.

Table 3

Teachers' Reflections Aligned to Teacher Noticing Actions (Sherin & van Es, 2005)

Teacher noticing action	Excerpt from teacher reflection
<i>restating</i> —describing the classroom events	Today we <i>used body movement</i> to learn the time on a clock. <i>We moved our arms</i> in the direction of the hour hand and identified each o'clock time [Melissa].
<i>investigating</i> —evaluating student thinking/doing as evidence of what they noticed	I modelled at the beginning of the lesson what hard and soft might look like through gesture, <i>which some students were able to demonstrate again in our discussions</i> of our observations and summary concluding the lesson [Isla].
<i>generalising</i> —making connections between student learning and teaching pedagogy	Last week we used movement by looking at numbers before and after ... students took turns to be directed to a number and move backwards and forwards to state the numbers (before and after). <i>I believe having students up and moving really made them more aware of this concept</i> [Rhonda].

The reflections that included *investigating*—evaluating what the students were doing, and *generalising*—making connections between student learning and teaching pedagogy, were a rich source of data. These reflections illustrated the enactment of embodied learning principles in the classroom and their effect on student learning and teacher knowledge:

Student engagement while using embodied learning:

I think the students were engaged and came up with a lot of movements themselves, making them more meaningful [Melissa].

Students were engaged in the experience, and it was interesting to see those with less control (fine motor skills) complete the activity [Melissa].

Students' mathematical understanding revealed through embodied learning:

... revealed a lot about their understanding of time and ability to recreate a clock! [Melissa]

... we used this line to do subtraction as well. Students who don't normally respond to questions were able to confidently answer the questions [Crystal].

Students' misconceptions exposed through embodied learning:

We did the numbers 1-4 using our bodies and looked at formations. Interestingly we had to correct some reversals (a huge focus on class) within body positioning [Melissa].

Teachers' developing understanding of embodied learning as a pedagogy:

Rosa and I went outside to trial a body movement lesson. Students were given a simple equation and had to find the total then move that many steps forward. Students enjoyed moving but we realised this movement was not embodied learning [Crystal].

Challenges to teachers' conceptions related to embodied learning:

... some students were frustrated by the limited time to draw and the fact they could only use pencil. Would it have been better to allow a longer time period and let them colour it in? Are students more invested when using colour? What is the best representation of true knowledge? [Melissa]

Noticing the Future, Not the Past

After deductively analysing the reflections and aligning them to the teacher noticing *what* and *how* actions, evidence emerged that did not fit within Sherin and van Es (2005) actions. During a re-

reading of the reflections, several narratives made reflective commentary related to ‘enduring understandings’ in the form of future teaching and learning principles:

This week I focused on simply 'being aware' of different ways I use gesturing and tracing principles within my lessons. Noticing how natural and embedded it is within my teaching practice ... highlighting it gives me confidence that it is present within my classroom and will add value to my lessons. It is something I feel I can continue [Melissa].

I would normally use drawing as a method to gather and organise data and more verbal conversations to determine students' knowledge on interpret results. I am beginning to understand how drawing can be an important tool in Mathematics [Crystal].

These initial findings provide illustrations of what researched embodied learning principles look like in classroom settings. The findings revealed *what* teachers noticed (Sherin & van Es, 2005) in terms of (a) teacher use of embodied learning principles “*I modelled at the beginning of the lesson what hard and soft might look like through gesture*” [Isla]; (b) student use of embodied modes “*I have also started to notice that students are using gestures*” [Isla]; (c) curriculum concepts “*We have been looking at materials and their properties and used our bodies to represent these properties*” [Melissa]; and (d) teachers' own pedagogy “*This week I focused on simply 'being aware' of different ways I use gesturing and tracing principles within my lessons*” [Melissa].

Discussion

In ‘noticing teacher noticing’, data showed that teachers took a blended approach to using embodied learning principles in their lessons. This connection was seen for example when teachers utilised gesture and body movement together to explore concepts. The connection was likewise observed when embodied modes were used sequentially within a lesson, or to confirm what happened physically. For example, drawing was often the follow-up embodied learning principle used to ‘check’ understanding after gesture or body movement were used. These results of combining embodied learning modes will add new findings to research on embodied learning—particularly the enactment of this research into practice. In relation to *how* teachers noticed (Sherin & van Es, 2005), teachers wrote about the positive impact embodied learning principles had on student engagement and learning, as well as on their own teaching practices and pedagogy. In addition, the online platform appeared to be as a ‘safe space’ for teachers to acknowledge limitations or areas for improvement. This was visible in Crystal’s reflection on co-teaching with Rosa reflecting that “*students enjoyed moving but we realised this movement was not embodied learning*”. Teachers also noted that students could now access content through embodied principles that perhaps was not accessible prior, such as Crystal’s comment, “*students who don't normally respond to questions were able to confidently answer the questions*”. Similarly, common misconceptions became visible through embodied principles, for example, “*interestingly we had to correct some reversals (a huge focus on class) within body positioning*” [Melissa]. Change in teacher pedagogy aligned with embodied teaching practices were also observed. This critical reflection on their own pedagogy is evident in Melissa’s musing about the use of pencils and colour when drawing for mathematical purposes. Melissa posed important questions “*Would it have been better to allow a longer time period and let them colour it in? Are students more invested when using colour? What is the best representation of true knowledge?*” Melissa’s self-reflection is a practical illustration of what Mason (2011) calls taking a stance of inquiry during noticing, in that noticing entails ‘holding on to an observation and seeking multiple, preferably, conflicting possibilities’ (p. 40).

An unexpected result, due to the limited length of time teachers had been implementing embodied learning, was their broader future-pedagogical reflections. For example Melissa stated “*it gives me confidence that it is present within my classroom and will add value to my lessons. It is something I feel I can continue*” and Crystal’s comment, “*I am beginning to understand how drawing can be an important tool in mathematics*”. When compared to previous research on teacher noticing, specifically van Es (2011) framework for learning to notice, these reflections somewhat

aligned to van Es' level 4 "extended noticing" (p. 139) category. Teachers made "connections between events and principles of teaching and learning" (p. 139), in the present study's case, the embodied learning principles. These translational comments were also compared with Jacobs et al.'s (2010) action of decision-making. However, teachers were not so much proposing "alternative teaching approaches" (p. 146) for the lessons being discussed, their comments were concerning the translation of embodied learning principles in general. The comments indicated a beginning growth in the teachers' understanding of the embodied learning principles and the benefits of embedding them within future practice. Their comments were not related to decision-making for teaching, as Mason (2002) would use the root of reflection, "'flection' to refer to noticing *in the moment* [emphasis added]" (p. 84). But appeared to be deeper *after-the-moment* comments, "preflection[s] meaning to look ahead" (Mason, 2002, p. 84), that may potentially impact their own teaching philosophy and future pedagogies. This new additional action of 'translating' could be attached to the teacher noticing construct. This suggestion aligns to van Es and Sherin's (2021) acknowledgement of the expanding and new aspects of teacher noticing emerging; "we have also come to the conclusion that restricting noticing exclusively to attending and interpreting does not fully embrace what teacher noticing involves" (p. 23).

A limitation of analysing this data set from Phase 1 of the ELEMS project is the small number of reflections ($N = 40$) the findings are drawn from. It is acknowledged that as the school year progressed, teachers found it difficult to find time to commit to posting reflections. A discovery not surprising due to the ongoing impact of COVID19 and illness within the school staff creating a time-poor teaching environment. These findings are not purporting to be generalisable. The findings are exploratory in nature and revealed what these specific teachers noticed when trialling embodied learning principles in their classrooms. These results however do provide illustrations of what embodied learning principles look like in the context of the classroom. Results shed light on teachers' noticings of the impact embodied learning principles had on student engagement and learning and their own teaching practices and pedagogies.

Concluding Remarks

The theoretical construct of teacher noticing was applied as a lens through which to analyse teacher reflections of trialled embodied learning principles. The data provides illustrations of how asserted embodied learning principles from research can be translated into curriculum-connected pedagogy. These initial findings create a promising picture for how research on embodied learning can be transformed into classroom practice within a short time frame. Much of the embodied learning research reports on haptic modes (such as gesture, tracing or body movement) in isolation. However, the main finding from the teachers' reflections suggests that when enacted in a naturalistic classroom setting, embodied learning principles meld together. A second important finding relates to the potential addition of a new teacher noticing action—*translation*. Analysis of reflections through the act of teacher noticing showed *what* teachers noticed and *how* teachers noticed (reflection—past tense), and how teachers *translated* what they noticed (preflection—future tense). These initial findings contribute new knowledge to embodied learning research related to the interplay of haptic modes, and provide a potentially new observable action within the teacher noticing space that requires further investigation.

Acknowledgments

The ELEMS project is funded by the NSW Department of Education, Strategic Research Fund (2021–2024). The University of Sydney research team: Dr Jennifer Way (Mathematics), Dr Paul Ginns (Educational Psychology), Dr Christine Preston (Science), Dr Amanda Niland (Early Childhood), Dr Jonnell Upton (TESOL), Dr Katherin Cartwright (Mathematics).

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