Pull, feel, and run

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Publication date:
2014

Document version
Peer reviewed version

Citation for published version (APA):
Johannsen, B. F., & Bruun, J. (2014). *Pull, feel, and run: Signs of learning in kinesthetic activities in physics*. Poster session presented at Physics Education Research Conference 2014, Minneapolis, United States.

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Pull, feel and run

Signs of learning in kinesthetic learning activities in physics

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1. Kinesthetic learning of forces

Kinesthetic learning activities as a teaching technology may have a central role to play in contemporary physics teaching [1]. Kinesthetic learning activities have students enact physical objects and student actions are linked to interactions between objects [2]. Here, we seek to characterize learning opportunities which occur and learning environments that unfold when teaching with kinesthetic learning activities.

Using a socio-semiotic perspective [3]. We look for signs that particular image schemata [4] are active, and we make inferences about the interplay between individual image schemata and social interaction [5]. Thus we are interested both in individual behaviour and social interaction.

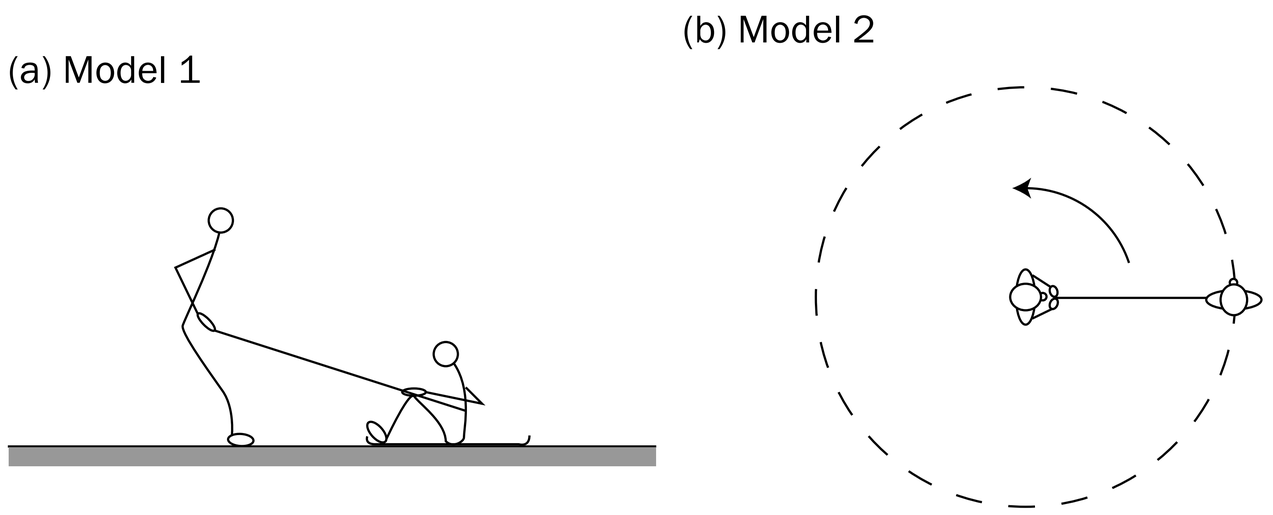


Figure 1: Model 1 involves a person using a rope to pull another person (sitting on a slab) over a rough surface. Model 2 involves a peripheral person running around a central person. In both cases, both persons can connect their bodily experience of force and movement with formal physics.

2. Signs and affordances of kinesthetic learning activities

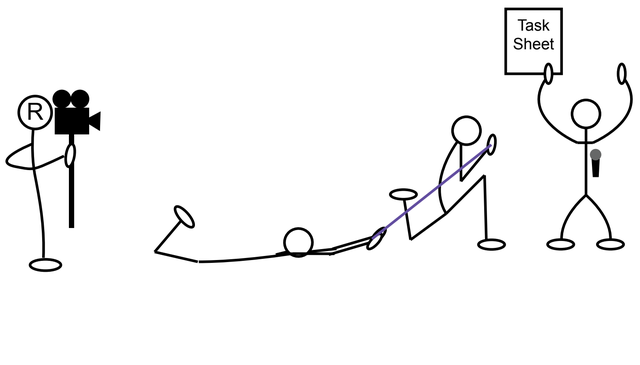


Figure 2: We use a steady camera, distributed audio recorders and to gather data. We search the recordings for characteristic student behaviour. One example is the shifting patterns of engagement with content and being playful.

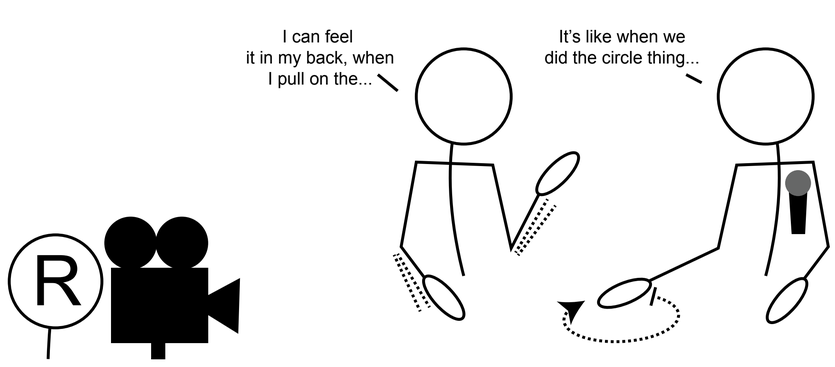


Figure 3: Student use the activities to bridge bodily understanding with physics understanding. We look for signs in speach and gesture that relate to the enactment of the kinesthetic learning activities. For example, how gestures/ speech acts are developed as discourses/metaphors that bridge between physics and bodily experience.

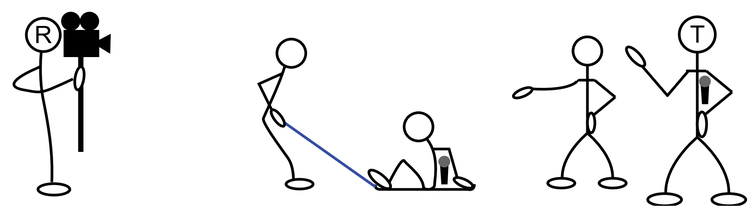
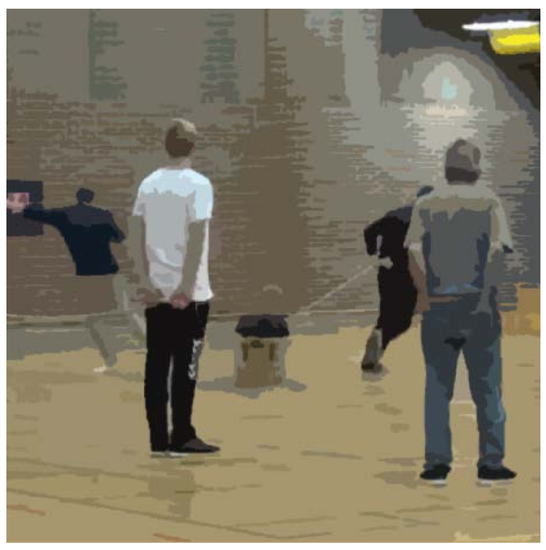


Figure 4: In a given context, students may enact the kinesthetic model with differences to the way illustrated in Figure 1. Such differences may profoundly influence the experience (for example, how it feels) and the physics (for example, where the force attacks).

3. Three characteristics of kinesthetic learning situations

Video 1

Figure 5: Students develop bodily understanding of forces through internal and external dialogue. Scan QR-code on the right of each of Figures 5-7 to watch Video 1-3 .



Video 2

Figure 6: Differences in enactment lead to opportunities for learning: In Video 2, students enact addition of forces by pulling a third student sitting in a box.

Video 3

Figure 7: Students 'oscillate' with different pacing between playful/chaotic behavior and more focused work throughout kinesthetic learning activities. Seemingly playful activities *can* be part of focused engagement.

Selected Literature

[1] Bruun, J. & Christiansen F.V. (2014). Kinesthetic activities in physics instruction: Image schematic justification and design based on didactic situations. Preprint at Arxiv.org
[2] Richards, T. (2012). Using kinesthetic activities to teach ptolemaic and copernican retrograde motion. *Science & Education, 21*(6), 899-910.
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[5] Bruun, J. & Johannsen, BF. (2014). The interplay between dialogue, cognitive schemata and kinesthetic learning: Bvodily explorations of force-related concepts in physics. *In preparation.*

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