ROLES AND RELATIONSHIPS OF KINESTHETIC LEARNERS IN INTERACTION DESIGN

DECO3850 DESIGN REPORT

Team Rogue Learning

This report argues the importance of interaction design in kinesthetic learning and the roles that students play in this context. Through the discussion of the background research found in the development of spandx, the design of the research conducted throughout this process is presented with a focus on Fleming's (1992) model of Learning modalities and Acuff and Reiher's (1997) Four Stages of cognitive Progression.

16/07/2017

TABLE OF CONTENTS

ROLES AND RELATIONSHIPS OF KINESTHETIC LEARNERS IN INTERACTION DESIGN

Team Rogue Learning

Edward Liao–43555299
Physical Computing & Interaction Design Studio Reflective Report
16/06/2017

Introduction

DECO3850 Physical Computing and Interaction Design Studio is a course which offers students an opportunity to design, build and exhibit an installation over the course of a university semester. Students work in groups to develop their product through an iterative design process involving copious amounts of feedback with contact, workshop and studio sessions in which the lecturer and tutors offer sage—at times opposing thus confusing—advice. This semester's theme was: "Designing for playful and open-ended interactions in everyday life" for which four sub-contexts were provided: healthy ageing, learning in early years, street computing and social presence and awareness.

Spandx is an interactive surface on which students are introduced to the solar system. It consists of a table frame with a spandex sheet covering the gap such that, when pushed and pressed, a kinect underneath will register the amount of push. A projector is placed underneath to display an unobstructed simulation of the solar system. Push depth is registered by the Microsoft Kinect and translated into changes in gravitational pull in the simulation. Children are typically introduced to space and the universe in grade three; and through spandx, primary school students will be able to learn the basics of physics and astronomy in the universe. Spandx encourages learning through play and exploration, aiming to provide teachers and students with a platform that allows for kinesthetic learning to take place.

Over the course of this report, kinesthetic learning and cognitive development research will be used to answer the research questions mentioned below and to explain design decisions made throughout the building process.

Background Research

RESEARCH QUESTION

The primary research question that will encapsulate this report is: How can interactive design be integrated into kinesthetic learning to provide an effective teaching experience?

KINESTHETIC LEARNING AND COGNITIVE DEVELOPMENT

Learning styles lay the foundation for any higher-level methods and techniques by splitting the learning process into respective sections. One of the most common groups of these sections is VARK or Visual Learning, Auditory Learning, Read/Write Learning and Kinesthetic Learning. The VARK learning modalities were first presented in Neil Fleming's article "Not Another Inventory, Rather a Catalyst for Reflection" (1992). Fleming presented the model as a tool for students to understand themselves and has since been used by employers to understand employees and colleagues (Vark Learn, 2017).

Throughout this report, we will be referring to these 4 categories of learning "styles": Visual learners prefer graphic (as opposed to textual) representations (graphs, maps and other illustrations), Aural learners prefer information which is heard (podcasts, lectures and discussion), Read/Write learners have a preference for written texts (textbooks, journals and written articles) and finally Kinesthetic learners require a combination of the above. Although all four of these are common in all classrooms—primary through to tertiary—this report will focus primarily on the kinesthetic learning method due to its debated definitions and multi-modal nature.

Formally, kinesthetic learning refers to the "perceptual preference related to the use of experience and practice (simulated or real)" (Fleming, 1992). Its inherently multi-modal nature explains its popularity in the Acuff and Reiher (1997) stages of a child's cognitive progression. In the early points of the Emerging Autonomy Stage (ages 3–7) children begin to develop understanding of basic writing, rhyme and grammar. Basic conjunctions such as "and", "but" and "if" are used more cohesively (Bekker and Markopoulos, 2003). The graphical and animated attributes of early learning effectively represent the Visual learning modality of Fleming's model. It's the next Rule/Role Stage (ages 8–12) that involves the kinesthetic modality

The kinesthetic learning modality as proved itself to be a popular choice among both staff and student bodies. In "A Comparative Analysis of Preferred Learning and Teaching Styles for Engineering, Industrial, and Technology Education Students and Faculty" by Katsioloudis and Fantz (2012) it was revealed that kinesthetic learning and teaching was a popular choice and a "style" due to the hands-on nature of the disciplines.

Examples of Kinesthetic Approaches to teaching

Given the information outlined in the previous section, it's clear that kinesthetic learners present an opportunity to not only new teachers but also interaction designers. The combination of design and education isn't a new one (Kuuskorpi and González (2011), Dunne and Martin (2006)) but the integration of Augmented Reality and novel interfaces is a growing one. Through a study involving schools in six European countries, traditional teaching methods fell behind the techniques presented in a “dynamic space” by Kuuskorpi and González (2011) and another presented a statistical decrease in cognitive load using Augmented Reality to learn about the solar system (Slijepcevic, 2013). Other demonstrations have shown promise in teaching anatomy, reviewing OSHA regulations for scaffolding.

Individual Contribution

Spandx background research

Approach

With only an age group and a topic to navigate, my task as a researcher for material and supporting documents was surprisingly simple and easy. Students in grade 3 (aged 7–9) studying natural science in Australia was made simple with the resources supplied by the Australian Curriculum. This task was given to me along with documentation and copywriting.

Execution

Through discussion with teachers and education students, our understanding was that it had become apparent that even though teaching methods had been updated with regular PD meetings, the artefacts weren’t keeping up with them. The traditional pen and paper hasn’t evolved much aside from its transition onto screens. The aim to improve technological and digital literacy appeared to take the form of iPads and tablets. Having understood our problem space, we progressed to the brainstorming phase in which we came to realise that kinesthetic learning seemed to be the essential and most recurring topic. The integration of physical movement and whole-body applications in an otherwise sedentary environment have been proven to improve the cognitive functions in children (Sibley and Etnier, 2003). Jean Piaget, Swiss pioneer in child psychology, conceptualised four stages of cognitive development eponymously named Piaget's Stages of Cognitive Development. Since children start to learn the concepts of space between the ages 8 and 11, they fall in the category of "Concrete Operations" (or the Rule/Role Stage in the Acuff and Reiher model). This is the stage of cognitive development where operations such as ordering, logic, numbers, geometry and even physics are established at an elementary level (Piaget, 1997). According to the Australian and Queensland Science Curriculum, students in grade 3 would begin learning about the basics of the solar system (Australian Curriculum, 2017).

Reflection

Given the amount of time, the amount of background research regarding both student and teacher demographics could have been improved. The Department of Education was a source hiding in plain sight. Upon further inspection, the digital plan to introduce a higher exposure to STEM curriculum had been in place since 2014 as a part of the Smart Classrooms strategy (Queensland Government, 2016). In hindsight, more attention could've been paid to the students themselves as opposed to just the teachers. Although this would require a little extra paperwork (some release forms to be signed by parents) it could have allowed us more room to work with the actual user.

Druin (2002) presents an alternative role of children as—however radical—design partners. The diagram provided by Druin (shown here in Figure 1) represents the 4 different layers and roles that children can play in the design process. As a user, children use the product while adults observe the assumed sentiments of the child while they use it. Moving toward the tester, the child becomes more responsive in providing feedback to the unreleased product. While these two layers correspond with the complete product, the next two regard the stage of the design process in which nothing has been built. Children as informants can provide insight into the design in the form of sketches or low fidelity prototypes. Even when the product has been release to testers and users, they are able to provide direct feedback to the researchers. Finally, the children as design partners are seen as "equal stakeholders" in the process. The nature of this diagram is that each external layer encapsulates every sublayer; the child assumes the role of every role within it.

The two outer layers—informant and design partner—would have been of most value to the background research of spandx. In future iterations of the product, this would be strongly considered.

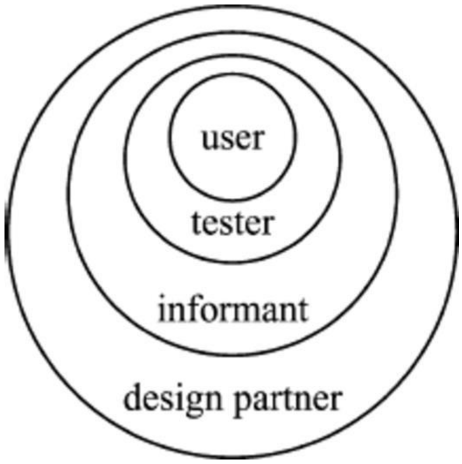

Figure 1 Four roles that children can have in the design of new technologies (Druin, 2002)

Research Responses

How can interactive design be integrated into kinesthetic learning to provide an effective teaching experience?

Given its hands-on nature, kinesthetic learning and interactive design go hand in hand. The aforementioned examples in of kinesthetic approaches to learning involve the growing domain of Augmented Reality but, much like iPads and tablets, those examples still had the study participants interacting with the object in a visual manner. If kinesthetic learning is the "perceptual preference related to the use of experience and practice (simulated or real)", then seeing the solar system through a set of VR goggles fits a more Visual Learning criteria. The rationale behind spandx was to provide a visual representation of the solar system through a kinesthetic paradigm. Students used a myriad of objects—phones, cameras, and even school bags—to visualize the changes in the solar system. The effect of gravity and the sun's mass as a centrifugal force in the solar system could be communicated and radically altered via a sheet of spandex, a projector and a sensor.

Conclusion

Kinesthetic learners are, arguably, the most difficult but most rewarding to teach. Their learning activities can involve nearly all five senses and at times, all five limbs. This "Hands-On Pedagogy" (Kyere, 2017) and physical computing is becoming increasingly important with the ubiquity of mobile computing. The rise in mobile X has seen conveniences in products and services and even education. What mobile technology can't replace is the application of knowledge. Internships force students into a context in which they're knowledge must be applied. Fundamentally, internships are kinesthetic. In their report "Ditching the desks: kinesthetic learning in college classrooms" Mobley and Fisher (2014) propose the introduction of kinesthetic learning into the tertiary domain. Outlined are various activities which can be implemented into a standard lecture or tutorial setting. It could be said that DECO3850 was an example of a 13-week long kinesthetic learning exercise.

Team Rogue Learning set out to build a prototype for a primary classroom tool. As a success criteria, the idea of a product adopted by students across Queensland seemed to be more of an entrepreneurial one than one of design. However, upon being approached by the UQ Idea Hub director during the exhibition, we had begun considering the startup avenue. The current prototype gave us enough feedback to fuel another iteration. Even if such a startup isn't pursued, the knowledge can be used elsewhere.

References

Acuff, D., & Rieher, R. (1997). *What Kids Buy and Why. The Psychology of Marketing to Kids.* New York: Free Press.

Dunne, D., & Martin, R. (2006). Design thinking and how it will change management education: An interview and discussion. *Academy of Management Learning & Education, 5*(4), 512-523. doi:10.5465/AMLE.2006.23473212

Fleming, N. D., & Mills, C. (1992). Not another inventory, rather a catalyst for reflection. *To Improve the Academy, 11*, 137-155.

Katsioloudis, P., & Fantz, T. D. (2012). A comparative analysis of preferred learning and teaching styles for engineering, industrial, and technology education students and faculty. *Journal of Technology Education, 23*(2). doi:10.21061/jte.v23i2.a.4

Kuuskorpi, M. a. (2011). The Future of the Physical Learning Environment: School Facilities that Support the User. *CELE Exchange, Centre for Effective Learning Environments, 11*. doi:10.1787/5kg0lkz2d9f2-en

Kyere, J. (2017). *Effectiveness of Hands-on Pedagogy in STEM Education.* Walden University. Retrieved from http://scholarworks.waldenu.edu/dissertations/2932/

Markopoulos, P., & Bekker, M. (2003). Interaction design and children. *Interact Comput, 15*(2), 141-149. doi:10.1016/S0953-5438(03)00004-3

Mobley, K., & Fisher, S. (2014). Ditching the desks: kinesthetic learning in college classrooms. *The Social Studies, 105*(6), 301-309.

Piaget, J. (1997). Development and learning. *In M. Gauvain & G. M. Cole (Ed.) Readings on the development of children. Second Edition*, 19-28. Retrieved from http://cepa.info/3043

Sibley, B. A., & Etnier, J. F. (2003). The relationship between physical activity and cognition in children: a meta-analysis. *Pediatric exercise science, 15*(3), 243-256.

Slijepcevic, N. (2012, April 27). *Occupational Safety Scaffolding.* Retrieved from Augmented Reality in Education: http://www.arined.org/?p=771

Slijepcevic, N. (2013). *The effect of augmented reality treatment on learning, cognitive load, and spatial visualization abilities.* Doctoral Dissertation, University of Kentucky, Curriculum and Instruction. Retrieved from http://uknowledge.uky.edu/edc_etds/4/

Slijepcevic, N. (2016, February 2016). *Basic Anatomical Structure of the Heart*. Retrieved from Augmented Reality in Education: http://www.arined.org/?p=1040

Vark | A guide to learning styles. (2017). Retrieved from Vark: http://vark-learn.com/