Live Physiological Sensing and Visualization Ecosystems: An Activity Theory Analysis

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Wearable Sensors

New Opportunities for Life-Relevant Inquiry Experiences







Sensor Based Learning





Analytic Representations E.g., Tinker, 1996

Model-based Representations

E.g., Lindgren & Johnson-Glenberg, 2016 Wearables

E.g., Lee et al., 2016

Live Physiological Sensing & Visualization (LPSV) Tools



Leveraging the Body as a Platform for Inquiry



Leveraging the Body **ds** d Platform for Inquiry



Two LPSV Tools





Moving Graphs



Model-based Representations

Norooz et al., 2015: Norooz et al., 2016



Sensor Based Learning Potential Inquiry and Conceptual Learning Interests, Goals, Dispositions **Towards Science**

E.g., Gallagher & Lindgren, 2015: Nemirovsky, Tierney, & Wright, 1998: Tinker, 1996



Lab Based

Pre & Post Test Analysis

Shorter-term Assessments



1st Grade

2nd Grade

4th Grade



vocabulary

Student Work

Ecosystems



Within and Across Grade Levels



Classroom Context





How the

Components of the Ecosystem Come Together



How does the LPSV **Ecosystem Influence** Children's Scientific Inquiry and Life-Relevant **Connections?**

How does Activity Theory Illuminate the Roles of Facilitators. Collaboration. Norms & Artifacts?



Day 1: Play and Discovery

Children discussed questions and engaged in freeform exploration with the tools in a scavenger hunt.



Day 2: Exploring Physical Activities

Children **brainstormed physical activities** with BodyVis. They then **tested their hypotheses** with SharedPhys.



Day 3: Science Experiments

Children **planned scientific investigations** of their choosing with **BodyVis or SharedPhys**.



Day 4: Presentations

Children **presented** their choice-based investigations.



4-Day Workshops



Participants (Total)



62 Participants



Undisclosed

24 1st Graders

17 2nd Graders

21 4th Graders







Teacher Interviews

Video Data

Pre & Post Assessments

Child Focus

Saldaña, 2015

Groups

Supporting Artifacts

Facilitator Post Observation Field Notes









Video Data

Types of Interactions with Artifacts & Motivations,

Life-relevant Experiences

Scientific Inquiry Experiences

Saldaña, 2015







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Scientific Inquiry

Life-relevant Connections

Scientific Inquiry

Differences Between Grade Levels

Role of Facilitators and Teachers

Importance of Space

Life-relevant Connections

Personal and Social Connections

Leveraging the Environment

Touching and Sensitive Topics

Scientific Inquiry

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Scientific Inquiry



Difference Between Grades

LPSV Tools

Life-Relevant Scientific Inquiry

Social Context Collaboration

1st and 2nd Graders Focused on the Modelbased Representations





62% 4th Graders

25% 1st Graders 24% 2nd Graders

4th Graders Especially Attuned to Scientific Inquiry

Tensions Between Life-Relevance And Inquiry

Word Wall

15 bon -> 160 bp

Importance of Space

LPSV Tools

Life-Relevant Scientific Inquiry

Classroom Governance





1st & 2nd Grade: Free Space



... rather than everyone standing in the back watching, specific seats. You're going to sit in your normal seat unless you're wearing a [bioharness].

99

2nd Grade Teacher



Life-relevant Connections to Inquiry





Community Aspects

PEACEFUL



* 0 0

Teacher: Access to Resources

7

Pop Culture

Scientific & Life-relevant Inquiry

Implications

Integrating SBL Tools in the Classroom



Designing Artifacts to Support Life-Relevant Inquiry

Link model-based and analytic representations to help children make connections

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Link model-based and analytic representations to help children make connections

Leverage non-technical artifacts to promote inquiry investigations and liferelevant connections

Integrating LPSV Tools into the Classroom Environment

1000

Allow for **incremental integration** of new variables into inquiry experiences for younger learners

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Allow for **incremental integration** of new variables into inquiry experiences for younger learners

Consider the **Social & Physical** constraints and opportunities for use of **space**





How Teachers Perceive LPSV Tools

How Kids Perceive LPSV Tools





Space & Layout

Supporting Artifacts



Need More Ecosystem Analyses of SBL Environments

Messy

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Hard

Advancing science learning & inquiry experiences Through wearables **BodyVis & SharedPhys Team**

Professors & Research





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