

# Live Linking of Fieldwork to the Laboratory Increases Students Inquiry Based Reflections

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**Abstract:** The Out There In Here (OTIH) system examines geology students distributed co-reflection and inquiry based learning collaborations using ‘live’ field based mobile technology (e.g. smartphones, ipads, laptops) and laboratory static technologies (e.g. tabletop, large screen displays, PCs). OTIH evaluations involved 23 students with video and log analysis, questionnaires, focus groups and scenario sorting exercises to identify how situated technologies support hypothesis generation with 3 types of collaborative reflection; remote sharing, dialogic and comparative information reflection.

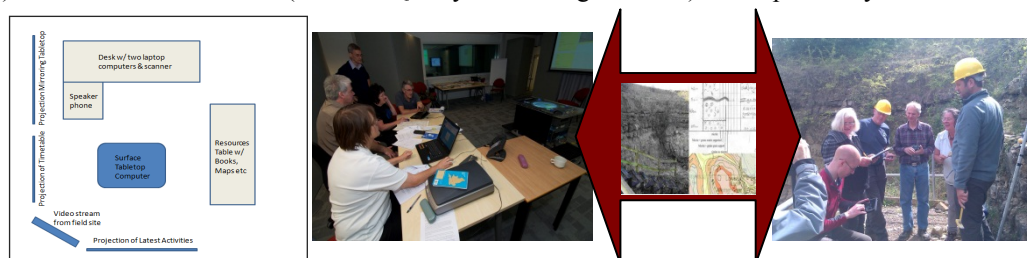
## Background

The ‘Out There In Here’ project reviews the specific concepts of situation (laboratory and field based) and togetherness (co-located and distributed groups connected with live interactions) as an impact on reflection within inquiry based learning. Distributed groups were supported in collaborative geology hypothesis generation and reflection through observations and analysis using situational appropriate technologies (i.e. Mobile devices for the field and static collaborative systems in the lab).

The concept of reflection goes back to Deweys (1933) investigation of reflection along with experience and interaction leading into the work on reflective practice (Boud, 1985). However, these approaches have tended to focus on practice based contexts with reflection as a personal activity. More recently co-reflection has emerged as concept which is defined by Yukawa (2006) as a ‘collaborative critical thinking process’ which involves tacit and active approaches to inquiry learning. The internet’s ability to support sharing within a community irrespective of time and space has been noted as valuable in supporting reflection (O’Malley and Scanlon; 1990). However, these approaches have focused on how to increase constructive criticism rather than detailing how these interact with technically mediated time and space. Land (2004) highlights the value for learning of encouraging students to reflect, over time, upon personal concepts through collaborative comparison with different approaches and models. Situational space, in contrast, is an important part of field work in many domains, particularly in the natural and social sciences, by providing a uniquely valuable experience beyond the classroom (Spicer and Stratford, 2001). Research highlights that field work improves learning and retention of information and skills (Kent et al, 1997) as well as improving community engagement and professional identity growth. However, the role of co-reflection in developing these learning outcomes is poorly understood.

## Research Trials

In situ evaluations of the system in two full day trials of the system with a total of 21 participants are presented here. Both trials followed the same layout and sequence (See figure 1). In each case a group of 4 students along with a tutor were stationed in the ‘In Here’ room, while another set of students (6 in the first trial and 5 in the second) were taken to a field site (Coombs Quarry in Buckinghamshire) accompanied by another tutor.



**Figure 1.** OTIH Lab and Field Based Students Use Multiple Devices for Sharing Photos, Maps and Logs.

Mixed methods were used for evaluation with researchers present In Here and Out There to observe interactions. A background questionnaire identified participant descriptive statistics and current technology usage patterns as a baseline to compare with trial interaction patterns and perceptions. Computer logs recorded data shared by co-located and distributed students. The ‘In Here’ room was filmed through several cameras whilst ‘Out There’ a mobile researcher filmed critical incident sequences. Both were thematically analysed for key interaction patterns and learning incidents. The two student groups took part in separate focus groups discussing their trial experiences focusing on: geology learning and technology mediated interactions. This data

was evaluated thematically and key issues were triangulated with findings from other data sources. Both tutors also attended a feedback session after each trial which were included in the analysis.

## Results

Descriptive statistics identified that the students all used a computer, however, 60% never used email and 25% used it frequently. The student participants had basic ICT literacy limited to specific technologies and systems (i.e. word processing for coursework). Further analysis identified specific issues around co-reflective learning.

## Distributed Co-Reflection

'Live' interactions (a-synchronous on the same day within minutes or hours) gave students a notion of increased importance attached to the sharing activity increasing team bonding and focusing on reflective activities. Three different types of reflective action supported scientific discovery learning:

*Remote Sharing Reflection:* The reflection occurred through students action of sharing their findings with other remote students inducing reflections. For example: 'this will be interesting because i don't know which one we want to send back or how many we want to send back in one go' (1OT4) 'we need to think of a neat way to summarize this for the in here team' (1OT3) 'I sent that one because its got the shells' (1OT5).

*Dialogic Reflection:* Further discussion about inquiries produced a dialogue which were full of unspoken assumptions that each student had because of their shared situation both in time and space. The dialogue and contradictions between the two groups were useful to initiate reflections:

In Here: "are there any differences between the fossils in the different beds?" (1IH)

[Pause as Out There team frown, look at the beds and reflect and discuss before agreeing]

Out There "No, no difference." (1OT)

*Collaborative Information Reflection:* Finally the students at different locations produced information at different levels of abstraction (i.e. the specific to the generic). "(previous field trips participant was on)... looking at grain size, sorting things like that, whereas this time I felt you looked at the whole picture." (1OT6). Contradictions in data at different levels of abstraction often led to deeper reflective discussions and conclusions. For example, the second trial revealed an error found in the published geological maps of the area, this emerged through discussions between those viewing the maps and those viewing the actual rock faces.

## Conclusion

The findings highlight the different inquiry roles that students learnt towards within each the field and laboratory situation. Students Out There understandably tended to concentrate on data collection and avoided abstract discussions whilst the In Here students tended towards abstract synthesis and discussions and avoided data collection. However, the research identified how valuable to the student's comprehension it was that the system and procedures encouraged these activities to occur. In particular, students noted the success of avoiding rigid role and sequence assignments whilst scaffolding the learning experience through a focus on distributed sharing and hypothesis generation. Of particular interest was the value attributed to the simple action of distributed sharing which encouraged a wealth of additional reflective activities for those in the field which were previously not supported in traditional approaches to geology field based inquiry learning. In short, sharing with those in remote situations forced students to reflect on information relevance and how to present it out of context.

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## Acknowledgments

With thanks for, EPSRC funding and Microsoft Research support as well as students and tutor engagement.