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The synthesis approach to analysing educational design dataset: Application of three scaffolds to a learning by design task for postgraduate education students

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Abstract

The aims of the Synthesis and Scaffolding Project were to understand: the role of specific scaffolds in relation to the activity of learners, and the activity of learners during a collaborative design task from multiple perspectives, through the collection and analysis of multiple streams of data and the adoption of a synthesis approach to the research. The Synthesis Approach to Analysing Educational Design (SAAED) dataset is

comprised of video, audio and image files, transcripts of the discourse, as well as copies of physical artefacts generated by three groups of three postgraduate education students during a 90-minute design session. The data were collected in January 2013. Each group was given a different scaffold related to the design process, the social interactions or the use of the tools available to the participants. Researchers interested in analysing the SAAED are required to sign a collaborator agreement to become part of the project team.

Dataset

The SAAED dataset comes in three packages, each with multiple components (see Tables 1–3). For each group, files related to the capture of URLs visited during the experiment (image files, HTTP tracker and screen capture) for each computer, three video recordings, audio files, physical and digital artefacts, images of the whitewalls, as well as coded data based on the audio transcripts are available.

Tools group dataset

Location and doi: The data are located at CoCo Research Centre at the University of Sydney, Australia.

Creators: K. Thompson and L. Carvalho

Date: January 2013.

Format: See Table 1.

Restrictions to use: Permission must be given by the creators before access; a collaborator agreement must be signed.

Table 1: Description of the dataset for the Tools Group

Data source	*File/Folder name*	*Description*
Computer[1] name: ds_1	Folder: 20130130_1_ip_track_charles	This folder contains 5 image files that correspond to the URLs visited on ds_1.
	20130130ds_1_ip_track_charles.csv	The output from Charles[2] for ds_1
	20130130ds_1_screen.mov	Screen capture of ds_1
	KT LC Blog design 30_01_13	Digital artefact—word file of design concept
Computer name: ds_2	Folder: 20130130_2_ip_track_charles	This folder contains 5 PNG files which are screen shots of the screens that correspond to the URLs visited on ds_2.
	20130130ds_2_ip_track_charles.csv	The output from Charles for ds_2
	20130130ds_2_screen.mov	Screen capture of ds_2
Interactive whiteboard (ds_iwb)	Folder: 20130130_iwb_ip_track_charles	This folder contains 20 image files that correspond to the URLs visited on ds_iwb.
	20130130ds_iwb_ip_track_charles.csv	The output from Charles for ds_iwb
	20130130ds_iwb_screen.mov	Screen capture of ds_iwb
Images	108_12	Images of whitewall that ds_2 was projected onto
	108_0101	Images of ds_iwb
	112_3001	Images from the whitewall between ds_1 and ds_iwb
	114_3001	Images of whitewall that ds_1 was projected onto
Video	20130130_comp.mov	Video to be imported into the D3 tool[3]
Transcript and coded data	Scaffolding and synthesis/coded data/Tools group—DFCS.xlsx	An Excel spreadsheet with 6 columns: ID, time, name, utterance, decision (see design process coding scheme), DFCS code (see decision function coding scheme)

[1]Participants had access to two computers (ds_1 and ds_2) and an interactive whiteboard (ds_iwb). The computers were projected onto walls painted with whiteboard paint, and some of that wall was not projected onto.

[2]http://www.charlesproxy.com/ was used to record web traffic.

[3]The Working Group currently uses a tool (D3) that compiles multiple video and audio streams that can be watched simultaneously.

Design group dataset

Location and DOI: The data are located at CoCo Research Centre at the University of Sydney, Australia.

Creators: K. Thompson and L. Carvalho

Date: January, 2013.

Format: See Table 2.

Restrictions to use: Permission must be given by the creators before access; a collaborator agreement must be signed.

Table 2: Description of the dataset for the Design Group

Data source	*File/Folder name*	*Description*
Computer name: ds_1[1]	Folder: 20130131A_1_ip_track_charles	This folder contains 5 image files that correspond to the URLs visited on ds_1.
	20130131A_ds_1_ip_track_charles.csv	The output from Charles[2] for ds_1
	20130131A_ds_1_screen.mov	Screen capture of ds_1
	Task_2_310113A.docx	Digital artefact—word file of design concept
Computer name: ds_2	Folder: 20130131A_2_ip_track_charles	This folder contains 5 PNG files which are screen shots of the screens that correspond to the URLs visited on ds_2.
	20130131Ads_2_ip_track_charles.csv	The output from Charles for ds_2
	20130131Ads_2_screen.mov	Screen capture of ds_2
Interactive whiteboard (ds_iwb)	Folder: 20130131A_iwb_ip_track_charles	This folder contains 20 PNG files which are screen shots of the screens that correspond to the URLs visited on ds_iwb.
	20130131Ads_iwb_ip_track_charles.csv	The output from Charles for ds_iwb
	20130131Ads_iwb_screen.mov	Screen capture of ds_iwb
Images	108_12	Images of whitewall that ds_2 was projected onto
	108_0101	Images of ds_iwb
	112_3001	Images from the whitewall between ds_1 and ds_iwb
	114_3001	Images of whitewall that ds_1 was projected onto
Video	20130131A_comp.mov	Video to be imported into the D3 tool[3]
Transcript and coded data	Scaffolding and synthesis/coded data/ Design group—DFCS.xlsx	An Excel spreadsheet with 6 columns: ID, time, name, utterance and coded data (design process and decision making)

[1]Participants had access to two computers (ds_1 and ds_2) and an interactive whiteboard (ds_iwb). The computers were projected onto walls painted with whiteboard paint, and some of that wall was not projected onto.

[2]http://www.charlesproxy.com/ was used to record web traffic.

[3]The Working Group currently uses a tool (D3) that compiles multiple video and audio streams that can be watched simultaneously.

Social group dataset

Location and doi: The data are located at CoCo Research Centre at the University of Sydney, Australia.

Creators: K. Thompson and L. Carvalho

Date: January 2013.

Format: See Table 3.

Restrictions to use: Permission must be given by the creators before access; a collaborator agreement must be signed.

Table 3: Description of the dataset for the Social Group

Data source	*File/Folder name*	*Description*
Computer name: ds_1[1]	Folder: 20130131B_1_ip_track_charles	This folder contains 5 PNG files which are screen shots of the screens that correspond to the URLs visited on ds_1.
	20130131B_ds_1_ip_track_charles.csv	The output from Charles[2] for ds_1
	20130131B_ds_1_screen.mov	Screen capture of ds_1
Computer name: ds_2	Folder: 20130131B_2_ip_track_charles	This folder contains 5 PNG files which are screen shots of the screens that correspond to the URLs visited on ds_2.
	20130131B_ds_2_ip_track_charles.csv	The output from Charles for ds_2
	20130131B_ds_2_screen.mov	Screen capture of ds_2
Interactive whiteboard (ds_iwb)	Folder: 20130131B_iwb_ip_track_charles	This folder contains 20 PNG files which are screen shots of the screens that correspond to the URLs visited on ds_iwb.
	20130131B_ds_iwb_ip_track_charles.csv	The output from Charles for ds_iwb
	20130131B_ds_iwb_screen.mov	Screen capture of ds_iwb
Images	108_12	Images of whitewall that ds_2 was projected onto
	108_0101	Images of ds_iwb
	112_3001	Images from the whitewall between ds_1 and ds_iwb
	114_3001	Images of whitewall that ds_1 was projected onto
Video	20130130_comp.mov	Video to be imported into the D3 tool[3]
Transcript and coded data	Scaffolding and synthesis/coded data/Social group—DFCS.xlsx	An Excel spreadsheet with 6 columns: ID, time, name, utterance and coded data (design process and decision making)

[1]Participants had access to two computers (ds_1 and ds_2) and an interactive whiteboard (ds_iwb). The computers were projected onto walls painted with whiteboard paint, and some of that wall was not projected onto.

[2]http://www.charlesproxy.com/ was used to record web traffic.

[3]The Working Group currently uses a tool (D3) that compiles multiple video and audio streams that can be watched simultaneously.

Introduction

Scaffolding is an issue that is of particular importance in computer-supported collaborative learning. Most current research agrees that students need to be scaffolded in their collaborative activities (Hmelo-Silver, 2013; Maloney & Simon, 2006; Nivala, Saljo, Rystedt, Kronqvist & Lehtinen, 2012). The concept of scaffolding involves providing support to learners in various ways, as these learners undertake complex or difficult learning tasks (Wood, Burner & Ross, 1976). Many studies have focused on scaffolding that could be classified under the Activity-Centred Analysis and Design (ACAD) framework (Carvalho & Goodyear, 2014): set design, epistemic design or social design. The context in which the learning experience occurs is of relevance when considering scaffolding. Technology scaffolding (set design) can include information about how to use a tool for the learning activity (Davis & Linn, 2000). The Ecology of Resources Approach (Luckin, 2010) is a learner-centred framework for the use of technology to scaffold learning. Collaboration scripts have been used to scaffold the social processes of collaborative learning (Hogan & Pressley, 1997). Recent work on scaffolding has focused on combining scaffolds, and identifying scaffolding synergy (Tabak, 2004) such as technology- and social-focused language learning in Singapore (Chen, Looi & Wen, 2011), or social- and epistemic-focused collaboration scripts (El-Rifai, Kollar & Fischer, 2011). These studies have found that by using complementary scaffolds, multiple potential blocks to student learning were overcome.

Lacking in the field of scaffolding is an examination of differences in the activity of learners as a result of specific scaffolds, and a framework in which to place methods and analysis. In combination with the ACAD framework, the synthesis approach to analysing complex collaborative environments achieves these. Kemp and Boynton (2011) identify five steps in synthesis research: problem identification; data assembly; data integration; explanatory model development; and testing model validity. In this study, we collected multiple streams of data that facilitated analyses of the activity of learners by groups provided with different types of scaffolds. The analyses and results were then synthesised, and the streams of data visualised, to provide a greater understanding of the interaction of learner activity and the effects on learning and design outcomes.

The research setting

The data collection was carried out in the Design Studio at the University of Sydney (Australia). The Design Studio is a purposefully designed space for researching the processes of design. The Design Studio is equipped with a range of tools (digital and physical) for participants, and recording technology (multiple video and digital cameras, audio recorders, capture of log files of computer-based interaction) for researchers. Recent research conducted within this space has explored aspects of learners' social and epistemic activity and that related to the use of the physical and digital learning environment (Martinez-Maldonado *et al*, 2015; Thompson, Ashe, Wardak, Yeoman & Parisio, 2013a; Thompson *et al*, 2013b, 2015; Wardak, 2014; K. Thompson & P. Yeoman, under review). In these studies, multiple streams of data were collected, processed and presented to researchers, combining video, audio and image files. The tools available to these participants included: an interactive whiteboard (IWB), writeable whitewalls, two computers (ds_1 and ds_2), two projectors, large pieces of paper, and pencils, markers and pens, as well as personal devices (Figure 1). The software available was limited to web browsers and Microsoft Office.

Research methods

Three groups of three postgraduate education students were brought together to discuss the design of an educational resource about a socio-environmental issue. The focus of the study was a *design for learning* scenario in which participants were asked to design an educational blog about

Figure 1: (a) Computers ds_1 and ds_2 projected onto the scribeable whitewalls. (b) The interactive whiteboard (iwb)

a complex socio-environmental system in Australia (Thompson *et al*, 2015). Participants were expected to access multiple websites (resources) as they explored the problem and designed their solution (eg, a resource that would encourage a target group to save water, or address the large number of stakeholders). Participants were asked to produce a short statement containing the main ideas for their design concept after 60 minutes, and after a further 30 minutes, they were asked to produce a sketch or brief outline of their design solution. These were presented to two of the researchers.

Each group was given a different scaffold. The group given the *Tools Scaffold* was guided in their selection of digital resources, the use of available tools. They were given suggestions about how to arrange themselves in the space, combinations of tools to use, or methods of finding tools to integrate into the digital resource, which were the focus of their design work. The group given the *Design Process Scaffold* received detailed information about how to complete the task: ways of understanding the design problem, coming up with a plan and developing their design concept, along with strategies they could use as they addressed their design problem. The group given the *Roles Scaffold* received information related to social roles in the team (subject matter expert, educational designer and a learner/member of the target audience). Each person in the group was required to adopt and argue on behalf of one of these.

Participants in each group were expected to consider multiple aspects related to their design task, such as: social and environmental issues; ways to approach teaching and learning of these issues; issues that would be key to different audiences; and how multiple factors should be translated into the design of a blog. Participants came to the task with different views and backgrounds, and during the design session they were expected to develop a shared goal, agreeing on key aspects of the problem, as well as the decisions they made.

The dataset for each group (Tables 1–3) includes three videos of different angles of the room, high-resolution photos of the writing surfaces, audio recordings, screen capture of the digital devices, tracking of the websites accessed, the digital and physical artefacts created, as well as transcripts of the discourse. The transcripts have been coded using the Decision Function Coding Scheme (DFCS, Poole & Holmes, 1995) and the Design Process Coding Scheme (DPCS, Thompson, 2015), and the videos have been coded for the tools used.

Limitations

The SAAED datasets are stored at the University of Sydney. In addition to the ethical considerations, the CIs (Thompson and Carvalho) will monitor the use of these data, as collaborators are required to contribute to the ongoing project work with additional perspectives, and acknowledge the data source and funding when published.

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Statements on open data, ethics and conflict of interest

Data are available, on request, from the CIs, at the University of Sydney.

The University of Sydney's Human Research Ethics Committee approved the study and the use of the data for research purposes only. Signing a collaborator agreement is necessary for anyone requiring access to the data. The purpose of the collaborator agreement is to: protect the original research subjects' legal rights; make sure that any other analyses to those intended for participation as part of the Synthesis and Scaffolding Working Group (SASWG, the authors of this paper), are discussed and agreed upon in writing prior to permission to use the dataset for other purposes it is obtained; ensure that any findings are reported freely to other members of the SASWG and the broader scientific committee; agree to contribute any additional transcription, coding or enhancements performed on the dataset with others in the SASWG to build a common resource for future community use.

There is no conflict of interest in the work reported here.

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