

Implementing a QUAL-qual Methodology Using a Prism Metaphor for the CHAT triangle

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When researching multifaceted tasks such as explanatory animation creation, Cultural Historical Activity Theory (CHAT) is well positioned to capture the dynamic nature of evolving artefacts in pivotal moments of convergence, when the same artefacts can function as both tools and objects in different contexts. Morse and Niehaus (2009) identified two conditions in which a QUAL-qual design is appropriate: 1. To obtain two different perspectives on the same phenomena. 2. To obtain different levels of analysis (p. 110). This paper will discuss examples using data from children's explanatory animations, to show how the intrinsic sophistication of the CHAT model can be used to problematise multifaceted tasks.

What is QUAL-qual?

The double use of the qualitative term in “QUAL-qual” might appear to be superfluous, which would probably be the case if “qualitative” was used as an adjective in each instance. QUAL-qual is more about *affordances* which is why Morse and Neihaus (2009) listed conditions pertaining to different perspectives and multiple levels of analysis. It is not unusual for qualitative data to warrant analysis on multiple levels but a QUAL-qual methodology involves designing a framework to surface and interpret these multiple perspectives.

QUAL-qual affordances

Examples of a QUAL-qual methodology will be presented with reference to a case study which I conducted at a bayside Melbourne primary school in 2011. The study involves 8 boys and girls in Grade 5 and 6 who created explanatory animations for topic of their own choosing. The case study ran for one hour per week for a whole Semester. It was also practitioner action research as I am a full-time teacher at this same school. As the Performing Arts teacher responsible for teaching all students, I

had also known and taught each of the 8 participants for several years prior to the study. The research question for this study was:

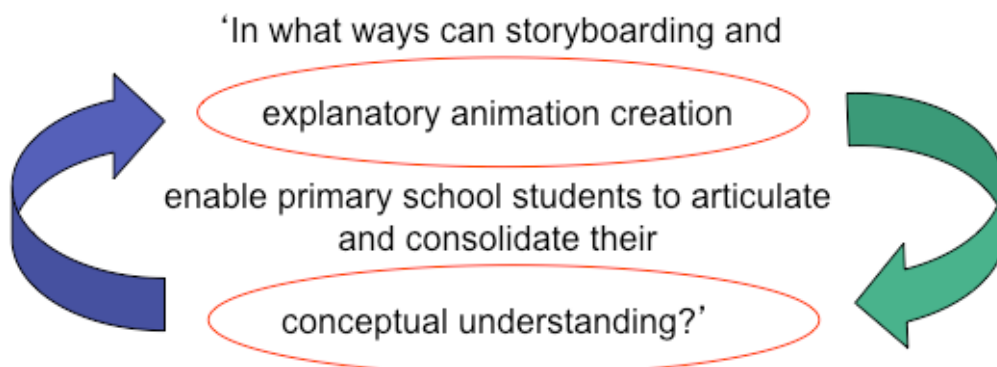


Figure 1: Research question

The reason for representing this question graphically is to focus attention onto the task (explanatory animation creation) and the intended purpose (conceptual understanding) of this research and how these two components can be mutually informative. Figure 1 also illustrates the dual nature of the question which provided a rationale for using Vygotsky and Sakharov’s dual stimulation method which Giest (2008) has described as the “cornerstone” (p, 103) of the cultural historical school.

Vygotsky (1987) proposed that the dual-stimulation method is appropriate for conceptual tasks as “the subject must be faced with a task that can only be resolved through the formation of concepts” (p. 124). The dual stimulation method provided a powerful rationale for seeking conceptual gains through the selection of an appropriate task. Indeed, it constituted a wider rationale for valuing the preliminary data that was generated throughout the task as “the path through which the task is resolved in the experiment corresponds with the actual process of concept formation” (ibid. p. 128).

The purpose of this paper is not to answer the research question posed in Figure 1, but rather, to provide examples of what a QUAL-qual design might look like and what sorts of data might be involved. The current study used 12 data sources. Two of these 12 data sources will now be discussed:

1/ Voice-over script. Each explanatory animation contained a voice-over script which was recorded by each child as audio narration. Although the voice-over script was only recorded towards the end of the project, the text itself was preserved as 17 different versions as the children used date-based file names so that the earlier versions of their work was preserved. This is an example of multiple levels of analysis as a textual analysis of final version of the voice-over script was further

enhanced by tracing the evolution of the text across the 17 weeks. As such, the first 16 versions of the voice-over script were provisional texts.

Smagorinsky (2001) is insightful here about the dual role of provisional texts created by students. He argued that provisional texts simultaneously function as indicators of a child's conceptual understanding and as a mediator for ongoing development of that concept. As such, provisional texts function as cognitive tools in the explanatory animation creation task.

2/ The second example is the use of director's commentaries. A review of the literature suggests that the director's commentary, as a genre for research data, is unique to the current study. The notion, however, is more widely understood in the general sense when a viewer watches special features for film such as on a DVD. In these instances, the director's commentary uses the same video but with a different audio channel where the director provides additional insights about the film. As a research genre, a director's commentary functions in the same way. One obvious difference between the two contexts, however, is that on a feature film, there is no expectation that viewers will bother with this option. In qualitative research, the director's commentary is mandatory viewing as it wouldn't exist if it wasn't a necessary part of the data analysis.

QUAL-qual examples using mental models

The existence of mental models (Mayer, 1993; Rapp, 2007) is a generally accepted phenomenon where learners actively construct a mental model of the content which they are considering. These mental models are ubiquitous but somewhat elusive. When the author of an explanatory animation is attempting to represent their conceptual understanding, their mental models are given tangible expression through the words and images which are used to construct the animation. This does not automatically lead to conceptual consolidation but it does provide a privileged level of insight into what the author is actually thinking. When an additional level of reflexivity is added through the use of director's commentaries and the whole process is conducted over many months, a unique and multifaceted picture emerges. These multimodal data, including the director's commentaries recorded by the children, was an attempt to achieve what Vygotsky (1962) referred to as "tapping the child's thinking" (p. 52).

Figure 2 is a storyboard which I have constructed as an overview to describe one of the case study participants, who chose to create an explanatory animation about the acoustic considerations involved in designing a stadium. (The actual animation can be viewed at <http://www.brendanpauljacobs.com/stadiumreview.htm>).


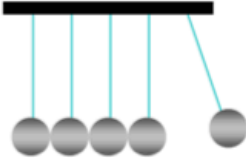
Grade 6 boy	Prior knowledge	Issues or obstacles
Stadium design	“My subject is stadium design, and, based on acoustics, I don't know anything except I'm amazed how it can stand such sound and noise without you feeling it in your body.”	This boy didn't know where to begin until he started to consider appropriate metaphors. He described the decision to use each metaphor as a “breakthrough”.
Choice of metaphor 1	Choice of metaphor 2	Relevant variables
		<ul style="list-style-type: none"> • Energy • Vibration of air molecules • Transmission of sound energy through air molecules • Changes in direction of sound energy through air molecules being reflected off hard surfaces
Behind the scenes	Different perspectives	Summary
The <i>falling ball</i> in the screen shot for “Choice of metaphor 1” is erroneous in that the ball is supposed to represent the transmission of sound energy. When sound energy has dissipated, the ball should disappear as there wouldn't be any sound energy.	Our discussion around <i>wind</i> helped to clarify what sound energy is not. He included the example of wind in his voice-over script, which was also a factor in the misunderstanding about the falling ball.	This animation best illustrates the practice of explaining and critiquing metaphors as his critique became an explicit part of the voice-over script.

Figure 2: Storyboard of the “Stadium Design” animation

The “Stadium Design” boy’s work is a good example of how the animation elements functioned as mediating tools to develop conceptual understanding. A Representation Construction Approach (RCA) to learning (Tytler, Hubber, Prain & Waldrup, 2013) describes a related, pedagogical approach based on the central practice of students making representations and then using these representations as catalysts for conceptual change through classroom discussion. The RCA acknowledges that representations must be explained and critiqued because representations are not always self-evident. This resonates with Harrison and Treagust (1996) who made the same point about metaphors.

Figure 3 is from a Grade 5 girl who chose to animate the musical convention of “Sol Feige” which is a naming device for the major scale. (The actual animation can be viewed at <http://www.brendanpauljacobs.com/solfeigereview.htm>). It was only when the “Sol Feige” girl began constructing her grid that I realised that she didn’t understand that the chromatic scale contained 12 notes. This insight was surfaced through viewing her imagery.

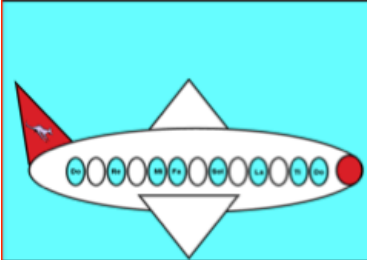
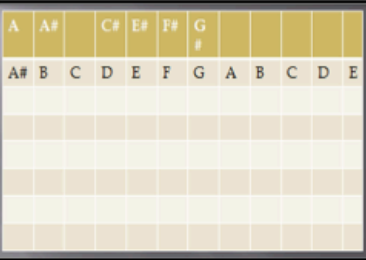
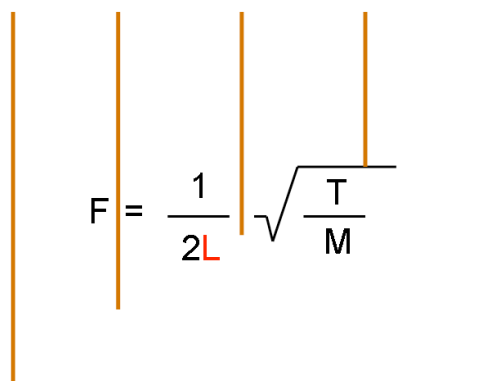
Grade 5 girl	Prior knowledge	Issues or obstacles
Sol Feige	"I'm doing sol feige, and I know nothing about it, umm, except it's a musical, umm, thingy and I think it includes the do, re, mi, fa, sol, ti, do."	On 11/08/2011, this student was at a crossroads as she wanted to quit, thinking that her topic wasn't very interesting.
Choice of metaphor	Implementing the metaphor	Relevant variables
		<ul style="list-style-type: none"> All notes (Chromatic scale) Intervals Required notes (Major scale) Key signatures
Behind the scenes	Different perspectives	Summary
Through assisting this student, I began to theorise that the explanatory animation creation task can be a diagnostic tool. This insight allowed me to direct the student towards consolidating her understanding of the sequence of the 12 notes in the chromatic scale.	Looking at the topic spatially was the inspiration for the aeroplane metaphor. These spatial elements were already present in the musical notation conventions as notation is a graph of pitch over time.	The selection of an appropriate metaphor saved this project from being abandoned, and cemented this girl's understanding of her topic.

Figure 3: Storyboard of the “Sol Feige” animation

Figure 4 is a screen shot from another animation where a Grade 6 girl was animating how the variables of tension, length and mass all affect the frequency of a vibrating string. (The actual animation can be viewed at <http://www.brendanpauljacobs.com/stringedreview.htm>). Her animation appeared to be correct in every respect:



$$F = \frac{1}{2L} \sqrt{\frac{T}{M}}$$

Figure 4: Screen shot from the “Stringed Instruments” animation

Recording the director’s commentary for this animation, however, revealed that this girl didn’t understand the formula itself. I still gave her credit for understanding

the concept of vibrating string frequencies as she had understood the relevant variables correctly. For example, she knew that a higher tension produced a higher frequency whereas a higher mass (i.e., thicker string) produced a lower frequency.

QUAL-qual implications

Third generation activity theory was used in this study as a methodological lens to examine the explanatory animation process at various stages as both a tool and an object. The explanatory animation creation task was initially the object of activity but as reflexive practice, the project itself became the unit of analysis. My claim here is that the children's mental models, as depicted through the animation key frames, functioned as both explanatory models and diagnostic tools.

Engeström and Escalante (1996) have noted that objects appear in two fundamentally different roles; as objects and as mediating artefacts or tools. "There is nothing in the material makeup of an object as such that would determine which one it is: object or tool. The constellation of the activity determines the place and meaning of the object" (pp. 361-362).

The voice-over script and director's commentary examples hint at the fact that explanatory animation creation is a multifaceted activity. Harel and Papert (1991) were amongst the earliest researchers to note that constructing digital artefacts, also involves *multitasking*, as digital artefacts are multifaceted. "The child-producer who wants to design a lesson on the computer must learn about the content, become a tutor, a lesson designer, a pedagogical decision maker, an evaluator, a graphic artist, and so on" (p. 78). Figure 5 shows how some of these facets are evident at various times throughout the explanatory animation creation task and how that plays out in relation to the division of labour:

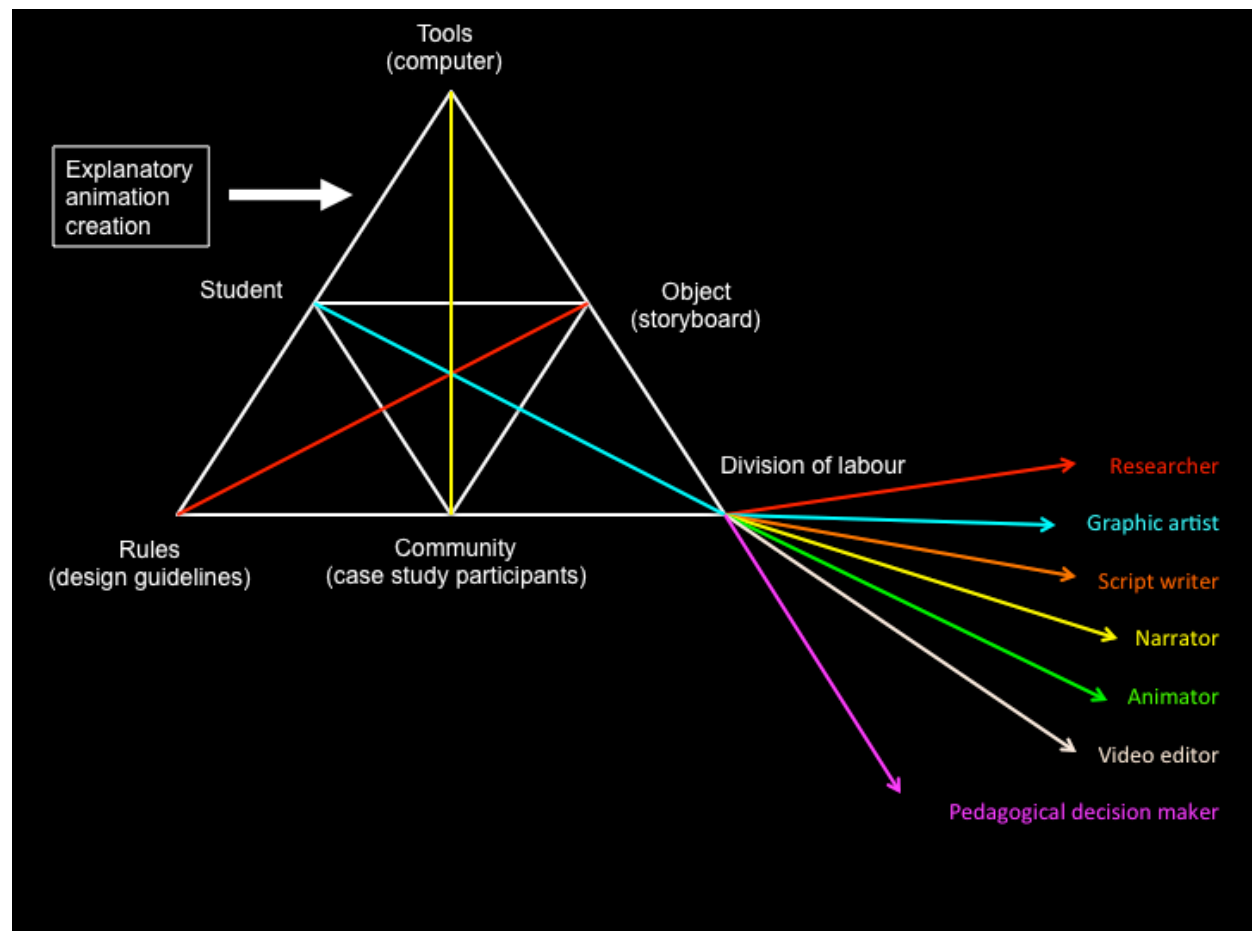


Figure 5: A Prism metaphor for the CHAT triangle

Whilst it often beneficial to seek multiple levels of analysis and look for different perspectives on phenomena, the power of using a QUAL-qual design should come into play *before* the data analysis stage. The point of QUAL-qual is to influence the initial data design so that QUAL-qual data are generated in the first place. Such data are intrinsically multifaceted which positions the researcher in such a way that they are more likely to gain additional insights.

References

- Engeström, Y. & Escalante, V. (1996). Mundane Tool or Object of Affection? The Rise and Fall of the Postal Buddy. in Nardi, B.A. (Ed.) *Context and Consciousness: Activity Theory and Human-Computer Interaction*. Cambridge (MA): MIT Press. (pp. 325- 374).
- Giest, H. (2008). The Formation Experiment in the Age of Hypermedia and Distance Learning. in Van Oers, B., Wardekker, W., Elbers, E. & Van Der Veer, R. (Eds.) *The Transformation of Learning*. New York: Cambridge University Press. (pp. 100-126).
- Harel, I. & Papert, S. (Eds.) (1991). *Constructionism*. Norwood NJ: Ablex Publishing Corporation.

- Harrison, A.G. & Treagust, D.F. (1996). Secondary Students' Mental Models of Atoms and Molecules: Implications for Teaching Science. *Science Education*, 80. 509-534.
- Mayer, R.E. (1993). The Instructive Metaphor. in Ortony, A. (Ed.) *Metaphor and Thought*. (2nd ed.) New York: Cambridge University Press. (pp. 561-578).
- Morse, J. M. & Niehaus, L. (2009). *Mixed Method Design*. Walnut Creek (CA): Left Coast Press.
- Rapp, D. (2007). Mental Models: Theoretical Issues for Visualizations in Science Education. in Gilbert, J. K. (Ed.) *Visualization in Science Education*. Netherlands: Springer. (pp. 43-60).
- Smagorinsky, P. (2001). If Meaning is Constructed, What's it Made From? Toward a Cultural Theory of Reading. *Review of Educational Research*, 71(1), 133-169.
- Tytler, R., Hubber, P., Prain, V. & Waldrip, B. (2013). A Representation Construction Approach. in Tytler, R., Prain, V., Hubber, P. & Waldrip, B. (Eds.) *Constructing Representations to Learn in Science*. Rotterdam: Sense Publishers. (pp. 31-50).
- Vygotsky, L. (1962). *Thought and Language*. Cambridge, MA: The M.I.T. Press.
- Vygotsky, L. (1987). *Collected Works of L.S. Vygotsky*, Vol. 1. Rieber, R.W. & Carton, A.S. (Eds.) New York: Plenum Press.