

Exploring the function of online narratives to develop critical thinking and localisation of knowledge in an international science program

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Abstract

While elearning practitioners have long recognised the benefits of using online training to achieve knowledge transfer. Less is understood about facilitating the sharing of values, attitudes, critical thinking and localisation using online platforms.

In this paper we evaluate an online learning platform in the context of an international scientific program. The platform uses a narrative approach to convey stories with the explicit aim of developing critical thinking and localisation. The platform embeds formative assessment within the stories to transfer the tacit understandings of the program to project site staff. We explore some of the challenges this approach encounters, particularly with regard to the expression of localisation.

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Practitioner Notes

What is already known about this topic

- Shared values are essential for successful medical/public health interventions.
- Narratives are an effective way to shape values, norms and trust.
- Online learning can support critical thinking and problem solving skills.

What this paper adds

- Evaluates whether a purpose-built online platform can support shared values, localisation, critical thinking.
- Identifies the successes and areas for further exploration of an online narrative-driven learning platform using formative assessment.

Implications for practice and/or policy

- Describes some of the challenges facing designers in implementing an online platform for tacit knowledge transfer, critical thinking and localisation.
- Identifies approaches to localisation that may assist or inhibit innovation and creative problem solving.

Introduction

Educationalists have long recognised the importance of narratives as a method for sharing values and providing learners with a set of tools to problem solve (Jonassen & Hernandez-Serrano, 2002). The use of narratives within a science communication context has been gaining increasing interest (Dahlstrom, 2014), especially in online learning environments (Lester, Mott, Robison, Rowe & Shores, 2013). The effectiveness of the online learning environment can be increased when narratives are supported with formative assessment aimed at assisting the participant in their learning (Hattie & Timperley, 2007; Gikandi, 2011).

The Eliminate Dengue Program (EDP; <http://www.eliminatedengue.com>) is an international, multi-site, field-based and experimental research project aimed at reducing the incidence of dengue fever. Until recently, project members were taught skills and knowledge about EDP through face-to-face training, trouble-shooting via video-conference calls and emails, and text-based protocols and instruction manuals. With a view to expanding the program, the EDP team recognised that a more sustainable approach had to be found resulting in the design and development of the EDP technology transfer platform, *Catalyst*.

Catalyst utilises a narrative approach and integrated formative assessment to transfer knowledge about protocols and standard operating procedures. Importantly, *Catalyst* also aims to foster the core values of EDP. These values include supporting local adaptations of scientific protocols and procedures (localisation) and collaborative communication sharing these scientific innovations with other users. To be successful *Catalyst* must develop critical thinking and localisation in its users.

Our research investigates how effective the *Catalyst* design is for supporting and facilitating critical thinking and localisation through multi-modal narratives and embedded formative assessment.

Background

Eliminate dengue program

EDP is a multi-site, international scientific research program that aims to reduce the spread of dengue fever, which is caused by a virus transmitted by the *Aedes aegypti* mosquito. The program uses a technology that reduces the *A. aegypti* mosquito's capacity to pass on the dengue virus through a number of mechanisms. To test the technology, EDP is currently undertaking a number of field trials in Australia, Indonesia, Vietnam, Brazil and Colombia, with the aspiration of scaling up to 100 project sites within ten years. Given the diverse international locations, the EDP involves a multi-national group of employees who need to complete the scientific protocols. Such an ambitious scaling up requires a new approach towards implementation of the program.

The EDP team recognised several key components for successful implementation of the technology in this international environment. These include contextualising techniques and problem solving for each unique environment, building strong relationships with the community and gaining the community's trust and acceptance about the use of the technology in their community.

McNaughton (2012) suggests many medical and scientific interventions fail, not because the science or the technology is flawed, but because of the scientists' "limited understanding of lay knowledge of the disease and the broader sociopolitical context" (p.6). Similar concerns have been raised in reference to public health interventions (see Kernick, 2006).

Catalyst and the use of narratives

In response to these needs the EDP team built *Catalyst*, a purpose-built, online learning platform. Within *Catalyst* narratives are used develop critical thinking, support localisation, share information, create connectedness, and distribute power and authority from the Melbourne-based lab to the other project sites. In *Catalyst*, narratives take the form of video, images, text and audio that are created specifically for the cross-cultural adult learning environment that they are used within.

Narratives can exert a powerful influence on how individuals perceive and respond to the world (Bruner, 1986; Gerrig, 1993; Strange, 2002). They can introduce novel information (Schank & Abelson, 1995; Schank & Berman, 2002), defamiliarise existing information (Oatley, 2002), and provide models for new behaviour (Singhal & Rogers, 2002). Narratives have been utilised within organisational settings to help

employers convey norms and values and help learners to understand complex and highly contextualised tacit knowledge (Sole & Wilson, 2002).

Formative assessment is used to increase the effectiveness of the narratives.

Assessment can highlight the purpose of the story, acts as a point to check for misconceptions and to provide participants with an opportunity to share their own experiences with the rest of EDP. Formative assessment in *Catalyst* is either short answer questions or multiple choice. The immediacy of formative assessment in an online environment enables collaboration between learners through meaningful dialogue, self-reflection, peer-learning and the building of community through a shared purpose (Russell, Elton, Swinglehurst & Greenhalgh, 2006; Morgan & O'Reilly, 2001).

The dual mechanisms of using narratives and formative assessment encourages the development of critical thinking and localisation skills in the participants. Critical thinking and localisation are essential skills within the context of EDP. Critical thinking can be developed in an online context when the technology is used to encourage participants to articulate their knowledge, reflect and make meaning from their learning and support purposeful thinking (Huang, 2002). In fact, some studies argue that virtual narratives can result in higher levels of critical thinking than face-to-face narratives (Kamin, O'Sullivan, Deterding & Younger, 2003).

The EDP team defined localisation in two ways. The first involved modifying the language used in materials, protocols and instruction manuals. This aligns with the definition of localisation within a technology context, where it is "taking a product and making it linguistically and culturally appropriate to the target locale (country/region and language) where it will be used" (e.g. Spanish subtitles, instead of English; Esselink, 2000). The second is more closely aligned with the idea of 'contextual intelligence', which is the ability to "understand the limits of our knowledge and to adapt that knowledge to an environment different from the one in which it was developed" (Khanna, 2014). For *Catalyst*, localisation means identifying where procedures, materials and approaches can be altered to reflect the physical and socio-political reality of the project site.

The capacity to modify, adapt and innovate is essential for the successful implementation of EDP because the contextual diversity across the different project sites means that what works in one project will not necessarily work across different sites.

Methods

Sites:

Four sites were used to examine the use of *Catalyst*, including the EDP Laboratory at Monash University (Melbourne, Australia), and three project sites, at Townsville (Australia), Colombia and Vietnam. The project sites were purposefully chosen from a possible six sites to maximise the diversity present within the study (Patton, 1980) and to obtain perspectives from across EDP. The research was undertaken between August and October 2014.

Participants

The 19 participants (12 men, 7 women) work within EDP (Table 1). The participants included employees in the EDP from the Monash University laboratory (6), Townsville (6), Colombia (4) and Vietnam (3) sites. The participants performed a variety of roles including Laboratory Managers and Technicians, Community Liaison Officers, Communications Officers, Associated Researchers and Project Managers. All participants were recruited via an invitation from an EDP Director to be involved in the research.

Evaluation design

The evaluation was designed in three stages. The first stage involved interviews with the EDP platform design team, based at Monash University, to identify their design intentions, learning aims and aspirations. By interviewing the design team, the parameters of the study could be established to be useful to them (Mertens, 2015) and to support their decision-making. The results from the interviews of the design team are reflected in the background description of *Catalyst* above.

The second stage involved conducting interviews with project site staff at Townsville, Colombia and Vietnam. These interviews identified their learning needs and how the platform could assist them and their teams with the challenges they face in their projects. The further aim of these interviews was to (a) identify the attitudes towards the platform and (b) elicit what they thought the learning aims were. The third stage asked participants from the same project sites to engage with two learning objects that were specifically designed for the participants to test *Catalyst*, along with accompanying external questions relating to their experience of *Catalyst* and the learning objects. All responses were anonymised and each participant was given an identifier code to indicate their role in the research. The participants formed three groups, the Design Team Members were given a DTM# identifier, the Project Site Team Members were given a PTM# identifier, and those who completed the Learning Objects within *Catalyst* are identified with LO#.

IDEAL POSITION FOR TABLE 1 HERE

Interview procedure

Semi-structured interviews were conducted with the project site participants to generate data concerning how effectively the platform could meet their learning needs and their attitudes about whether *Catalyst* could meet these needs. These interviews were carried out face-to-face with the Melbourne-based staff and via videoconferencing software for those in Cairns, Vietnam and Colombia. The interviews were recorded and transcribed, and data was entered into the NVivo software package (QSR International) for coding.

Semi-structured interviews are “well suited to the exploration of attitudes, values, beliefs and motives”, particularly for complex issues (Barriball & While, 1994). In addition, the diverse cultural, linguistic and socio-economic backgrounds of the participants necessitated the personalisation of questions (Barriball & While, 1994).

Formative assessment procedure

Formative assessment was used to establish the effectiveness of the narrative approach and evaluate the participants understanding of the information. Participants interacted with two stories: 1) ‘Embracing Engagement’ (text and images) about a change of attitude in a staff member to valuing the role of community engagement; 2) ‘Reducing mosquitoes before release’ (text, images and video), which explained how a scientific approach to reduce the mosquito population before the release of EDP mosquitoes failed from an entomological perspective, but succeeded in reengaging the local community with EDP. The formative assessment, in the form of a short answer prompt and a multiple choice/answer question, was embedded in an appropriate position in the context of each narrative. Following a participant’s response to a multiple choice question, feedback pertaining to their answer appeared. The short answer responses aggregated at the end of the page, allowing for participants to read their peers’ comments and respond via the prompt.

Learning object procedure

Participants in this group were asked to complete an online learning object, which comprised two stories, embedded formative assessment and a set of evaluative questions in an online questionnaire. The participants were sent an email link to the two webpages specifically set up for their participation in the research by *Catalyst* designers. To engage with the two stories participants needed to read text, watch videos, and complete multiple choice/answer and short answer questions. Following each story, participants completed an online questionnaire, answering questions that assessed the length and clarity of the story, identified its purpose, and asked whether the story had achieved that purpose. Data from the completion of the formative assessment in *Catalyst* and from the questions about *Catalyst* were recorded and entered into NVivo for coding. The data was initially coded based on categories that described the data, followed by re-coding for concepts, to denote more abstract ideas (Bazeley, 2009).

Results and Discussion

The main findings of this evaluation suggest that an online narrative approach with embedded formative assessment can support the development of critical thinking skills and localisation. However, as a mechanism for change it will not necessarily shift already established attitudes, including those of exceptionalism and replication, as explored below.

Critical thinking through Catalyst

The EDP design team hoped that by using narratives that showed participants examples of problem solving techniques and innovative solutions to common problems *Catalyst* might assist users to develop their critical thinking and understanding of EDP.

Within the Learning Object group, five of the six participants identified that after reading 'Embracing Engagement' they saw how it encouraged them to think critically about what they do and why. For example, one participant stated that it "got me thinking about how scientists and C[ommunity] E[ngagement] officers work together in my current working environment" (LO3).

Equally, when asked how *Catalyst* as a whole might help them think critically, they noted that "By showing the problems being faced by others, that could be simmlars [sic] to the ones we have or may eventually have, and how they solve them or prevent other issues" (LO6) and "We can also get to an "end point" in the decisionmaking [sic] process more quickly, as we can see what others have tried, what has worked, what hasn't worked and why" (LO3).

Localisation

Localisation was present as an attitude in the responses of both the interviewees and learning object group. Examination of the emergent themes from the interviews and short answer questions demonstrated two additional, and conflicting, attitudes, identified here as exceptionalism and replication.

Exceptionalism has been applied to states or sites where the claim of 'uniqueness' has been seen as a barrier to change, adaption or innovation (Bomhoff & Gu, 2012; Dionne, Gerland & Watkins, 2011). Replication occurs when local contextual factors are ignored in favour of adhering to the way it was done elsewhere. In the case of EDP this is often replicating protocols from Australia without the contextualisation, adaptation and innovation that are necessary for a successful field trial. Similar concerns have been raised in reference to public health interventions (see Kernick, 2006; Marchal, van Belle, van Olmen, Hoérée & Kegels, 2012)

For EDP, the attitude of exceptionalism was the sense that their own site was so different from any other site that there was no utility for them in hearing how others

had approached problems. For instance, one interviewee noted “everything we are doing here ... is completely different to everywhere else” (PTM6).

This attitude was echoed, particularly when participants were asked about their own area of expertise. They claimed that for them, their context was “much harder and the restrictions are totally different” (PTM5). At the other end of the spectrum, the same participant cited the importance of replication, of “keep[ing] it [the protocols] the way it should be rather than to look for things that are different” (PTM5). As a result, the participant struggled to see the purpose or utility of *Catalyst*, suggesting that the designers would not be able to “design something that is one size fits all” (PTM5).

Both ends of the spectrum, exceptionalism and replication, can undermine the success of EDP and its aims. The middle ground of localisation and contextual intelligence, where contextual elements are accounted for and yet quality assurance is maintained, is a challenging space to inhabit.

Communicating localisation through Catalyst

For the majority of the Learning Object group, *Catalyst* provided them with examples, prompts and support to assist them in localising the EDP technology and approach to their project site. The EDP design team hoped that seeing others’ localisation efforts across EDP would demonstrate the program’s support for innovation and give team members ideas for how they might encounter and approach issues at their own sites. For the most part, this desire was borne out through the evaluation. Learning Object participants responded that *Catalyst* could “provide different perspectives on problems and solutions and get me thinking about ideas that we might not have thought about locally” (LO3).

The Learning Object participants also positively responded to sharing their own examples of how they had changed their work practices to suit their context. For instance,

Before the next release, our project found out that the BG traps haven't [sic] worked properly because of unstable electricity ... or intensional [sic] unplugging (The households said that they didn't have enough sockets to use). Therefore, we distributed chargers and triple sockets to each house that has BG trap. At first we did not notice but then we realised households seemed to be happier and felt more comfortable with these traps (LO1).

This participant's response to the opportunity to share her own knowledge sits in tension with her sense of exceptionalism. When asked the question “Did the questions in the story get you to think about your current working environment?” about the story where the above prompt appeared, her response was “No, as the program here has wide community support” (LO1). Her detailed response to the prompt suggests that while she did not perceive any value in reading the story, she did value the

opportunity to share her own story of localisation and innovation. While this evaluation is not aimed at identifying factors contributing to her attitude, the data did suggest that an attitude that saw little value in others' stories but some value in sharing their own in order to 'teach' others was present in at least two of the three sites. As the platform expands, this problematic attitude of reticence in listening to others, while wanting to share one's own story, will need to be explored and addressed. Moreover, such an attitude may well result in inhibiting creative problem solving and innovation, both key elements to the success of EDP.

Narratives and formative assessment

Beyond being passive consumers of the narratives on *Catalyst*, the Learning Object participants also contributed their own stories through the formative assessment, suggesting a perceived value in sharing their stories with their peers. In all cases, given the opportunity to share their own story about an innovation or approach they had used at their site, the participants responded positively, outlining the details, outcomes and actions they had taken. Their short answer responses were comprehensive and contained detailed notes about their experiences, their changes in practice, and the outcome of their actions. For instance, in response to the short answer prompt "Share an example of one of your project activities that had unexpected community engagement benefits", one participant detailed:

One of our routine activity ... is larval sample collection I think this activity may have some unexpected community engagement benefits:

Local people see ED team sweeping water containers every week, and they think the team are removing larvae to help reduce mosquitoes at their house. Therefore, at some extend [sic], this activity may create another positive picture of ED team at the field site. Furthermore, during the work, the ED field staff also have chance to talk and listen to people in households to get feedbacks [sic] related to the release and other ED activities that help the CE staff identify target topics to talk to the people at community meetings. (LO4)

The short answer responses from the Learning Object participants demonstrated both the advantages and challenges of using short answer responses, rather than more traditional elearning question stems, such as multiple choice or matching pairs. The process of constructing their response to the prompt uses a different level of cognitive engagement than choosing from a set of responses (Jordan & Mitchell, 2009).

The challenge of using short answer responses for a multi-lingual project reflects the degree to which participants have adequate English language skills to feel competent and confident in responding in writing. For instance, one participant, on being unable to understand the video in 'Reducing mosquitoes before release', did not respond to the written question prompts. Ensuring accessibility needs to be addressed explicitly for online platforms with international users.

Limitations

The research presented here has two limitations. First, it was not possible to attain the oral or written English levels of participants from non-English speaking backgrounds prior to the evaluation. As noted above, one of the respondents did not have adequate spoken English to respond to the video. The relationship between levels of English and the accessibility of the video compared against the text and image story is beyond the scope of this evaluation, but need to continue to be considered as the design of the platform iterates. Second, the sample size used in this evaluation was necessarily small, considering the context of the Eliminate Dengue team and the maturity of the platform at the time. However, many published qualitative studies have used similar, or even fewer participant numbers. For example, Buttler & Lukosch (2012); Garrison, Anderson & Walter (2001); and Hansberger, Schunn & Holt (2006), had respective sample sizes of 5, 23 and 13.

Conclusion

As an online learning platform *Catalyst* aims to share with participants a set of values and skills through narrative and formative assessment. The platform achieves the creation of an online environment where localisation and critical thinking can take place. As EDP expands to additional international sites the concerns raised here over language, and attitudes of exceptionalism and replication will need to be explored and addressed. The use of narratives and formative assessment shows promise for multi-site, international projects needing to transfer knowledge and to support and facilitate shared values, skills and attitudes.

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Accepted Article

Peer review only

Location	Experimental Group	
	Interview <i>n</i> = 12	Learning Object <i>n</i> = 7
Melbourne		
- M	<i>n</i> = 1	--
- PDT	<i>n</i> = 5	--
Townsville		
- PSL	--	<i>n</i> = 1
- PST	<i>n</i> = 3	<i>n</i> = 2
Colombia		
- PSL	<i>n</i> = 1	--
- PST	<i>n</i> = 1	<i>n</i> = 2
Vietnam		
- PSL	<i>n</i> = 1	--
- PST	--	<i>n</i> = 2

Table 1: Participants by location, division and experimental group. Abbreviations: Management (M), project development team (PDT), project site lead (PSL), project site team (PST), number (n).



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