Open education and technology’s symbiotic relationship: Insights from two OER cases

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Abstract

Through the examination of two cases developed in a fully virtual environment, we illustrate and uncover the role and value of open educational pedagogy and practices as part of building educational resilience. The first project, Form and Function, wove together for teachers of secondary students, an interdisciplinary OER animation and learning activities as part of developing computational thinking. Following from this work, the Accelerating Vaccine Confidence project produced a science and digital literacy OER animation including open learning assets embracing student stakeholder voices. Throughout the co-creation of these curricular assets, the projects had collaborative design teams ranging from university professors and graduate students in the first case to high school students, their teachers and community members in the second. Hegarty’s (2015) attributes of open pedagogy frames and informs both projects and allows for a structured analysis of the processes and choices made. Participatory technologies formed a keystone of both projects and contribute toward the processes of educational resilience. The two cases highlight how interweaving open education with technology as a set of values and a mindset contributes toward educational innovation and resiliency.

Introduction

Changes the COVID-19 pandemic has thrust upon education have been enlightening and, for some, frustrating. The leap to online delivery would not have been possible even 20 years ago, changes in technology, particularly technologies that facilitate participation, have allowed an accidental experiment to happen. However, just because something can happen does not mean it happens effectively or appropriately, popular narrative is awash with comment that simply using the technology at face value and in a rush doesn’t provide good educational experiences. As an open online University, we with others in the open and distance sphere, have been quietly working on developing effective distance and online educational experiences decades before the pandemic. Open educational practices (OEP) and open educational resources (OER) being a key part of this work. As Hegarty and others highlight, “The Open Educational Resources (OER) movement is considered to thrive on “distributed collaboration” using mobile, Internet, and social media applications and the consumption and production of artifacts for learning (Conole, de Laat, Dillon, & Darby, 2008, p. 511).” (2015 p3.). We examine Hegarty’s assertions in our practice and identify the effects of intentionally interweaving technology with open educational practices. Furthermore, we propose that because of the close relationship between OEP and technology, there is increased strength in the role and increased value for open educational pedagogy and practices in building educational resilience.

Educational resilience arises in response to barriers to education. These barriers take the form of access, collaboration, inclusion, finance and language. In cases of OER development, where technology is present, we consider what is the role of this interwoven technology building resilience to such barriers and enabling innovation in education. Through two cases of OER development we explore where barriers (collaboration, inclusion, access, financial) can be addressed. Both projects tackle science within society, they are interdisciplinary in focus, in response, we take a STEAM approach in both. Our approach requires collaborative design due to the range of specialist knowledge in both projects and in the second case, the design collaboration is extended to include stakeholders from the audience demographic, youth, as co-creators.
Background

OEP and OER were chosen as methods for development in the two cases considered in this paper. Hegarty (2015) grounds open pedagogy in understandings of “openness” and open educational practices. In her consideration, both the proliferation of digital information and the presence of participatory technologies are now foundational to the idea of open pedagogy and an attribute of OEP. Open education has also been shown to develop constructs of open thinking: openness to multiple perspectives, openness to new learning, openness to collaboration, openness to sharing, openness to change, and openness to diversity and inclusion, in learners (Jung and Lee 2022).

Figure 1. Eight attributes of Open Pedagogy (after Hegarty 2015 based on Conole 2013)

Open educational practices can be described as eight attributes (Hegarty 2015) which support the activities of open pedagogy: (1) participatory technology, enabling community, collaboration and sharing; (2) openness and trust with the people involved; (3) innovation and creativity in content, process of finding information and working together; (4) sharing of ideas and resources creating a different cultural view around ownership; (5) connected community for the longer term, persistence for 1, 2, 3 and 4; (6) learner generated, influences and promotes engagement; (7) reflective practice away from a broadcast model; (8) peer review, again 7 and 8 create a longer term validity to the materials produced. In addition to its pedagogical direction the use of OEP in the production of OER, following the UNESCO definition (UNESCO 2012), ensures a focus on addressing issues in educational equality through redistribution, adaptation and no-cost access whilst respecting the intellectual property of authors’ contributions.

For problems requiring interdisciplinary use of knowledge, STEAM and collaborative design team approaches have been shown to be effective. The use of STEM as a pedagogy which promotes learner examination for ill defined problems, typically involving many disciplines is known to have instruction rich in context and student engagement, considered beneficial for all types of student (Margot and Kettler, 2019). The introduction of arts to the collaboration, STEAM, has been shown to “promote students’ interest in STEM” (Parks et al. 2016).

Collaborative design teams are complex entities that require thought on creation to their: structure e.g., team composition; operation e.g., communication, distribution, design approach; as well as their focus e.g., information, and nature of the problem (Ostergaard and Summers 2009).
Participatory technologies for educational technologies enable a culture of participation (Blackall, 2011 and Hegarty, 2015) (and although similar to, not to be confused with, participatory technologies used in the field, often in agriculture, limits technology to that collect near/real time input). Acting in support of creativity, co-creation and collaboration educational participatory technologies play a central role in communication for idea and product sharing. As well as meeting the practicalities of participation, a participatory culture leads to “peer-to-peer learning, a changed attitude toward intellectual property, the diversification of cultural expression, the development of skills valued in the modern workplace, and a more empowered conception of citizenship” (jenkins et al., 2006, p. 3) Hegarty (2015) refers to delivery and post delivery participatory culture, we apply her framework to the process of co-creation of the OER.

Case Descriptions

Two cases of OER development are explored. Both projects tackle science within society, the first “Form and Function” addressing sustainable architectural design and computational thinking and the second, “Accelerating Vaccine Confidence” addressing public and personal health decision making, critical thinking and digital literacy. Both projects are naturally interdisciplinary and we chose to add to the disciplines by taking a STEAM approach creating a visual media presentation in both. The incorporation of art as visual animation and as storytelling aimed to create an appealing OER with the intent to broadening its audience. A collaborative design approach is required due to the range of specialist knowledge needed by both projects, and in the second case, the design collaboration was extended to include stakeholders from the audience demographic, youth.

The Form and Function project, wove together for teachers of secondary students, an interdisciplinary OER, comprising an eight minute animation and a selection of learning activities related to computational thinking and teaching plan routes through the materials. We situated computational thinking inside a large real world problem (i.e., sustainable design and motivators from climate science) that doesn’t have clear single discipline based solutions. An environment was created in which to explore the impact of computational thinking in the real world before presenting specific of how computational thinking works and the math underlying it. The animation was compelling at a high level as a stand alone information source and connected ideas in the more specialised teaching aids provided in the OER package.

The Form and Function project provided open-endedness, ‘hooks’ for adding additional content were placed the OER to encourage re-work as well as re-use by educators. The modular nature of the OER allowed teachers to re-use the materials within their existing plans easily.

The Accelerating Vaccine Confidence project produced a science and digital literacy OER seven minute fast paced animation with connection to open learning assets about building confidence in decision making in the context of vaccination. Again situated in a complex and nuanced real world problem, perspectives in science, health, social science and critical thinking in the digital environment are required to develop meaningful content. With the target audience being youth (mid-high school) the animation was co-created with and embraces youth stakeholder voices. Inclusion of the voice of our youth co-creators was of primary importance to this project. Each stage of content co-creation and design was active shaping message and style to ensure youth voice with professional art and animation input to match context with a suitable style.

Throughout the co-creation of these curricular assets, the projects used collaborative design teams ranging from university professors and graduate students in the first case to high school students, their teachers and community members in the second.

Analysis and Discussion

In both OER cases we chose to promote an open education mindset in the process of creation of the OERs as well as in the delivered OER content. Our discussion focusses on how technologies were used, and the combined impact of them with education practices on the process of creating OER and the outcome OER.
In alignment with Hegarty (2015) these OER projects utilized a suite of technologies and digital information. The technologies chosen were allowed for the use of technologies that were most easily acceptable to participants. For the *Form and Function* case primarily this was MSTEams environment through work computers for virtual face to face meetings with shared access to project files on MSTEams and in Sharepoint/Onedrive. For the Accelerating Vaccine Confidence Project a wider range of technologies were used, our youth co-creators were participating through mobile phones, library computers or shared family computers. Although the youth were capable of using a range of technologies and introduced technologies of their own during the process (one example being the introduction of the quiz app to build connection) their access was often limited (web based apps were accessible, installation not so) and accessibility became a priority for the project.

In these two cases we used a network of technologies for content creation and co-creative process including art and animation software, synchsketch. padlet, google docs, quiz app, ZOOM, MS Teams, Jupyter notebooks and for content delivery, YouTube, GoogleDocs and OER sharing platforms. Table 1 describes the relationship of OEP attributes with OER Content and the process of OER development.

<table>
<thead>
<tr>
<th>People openness and trust</th>
<th>in relation to OER CONTENT</th>
<th>in relation to OER development PROCESS and OEP</th>
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<tbody>
<tr>
<td>TECH USED: quiz app, presentation software, Google Docs, Padlet, Synchsketch, ZOOM, YouTube</td>
<td>Complex real world problem provides meaningful connection for those involved. STEAM approach to content opens access, inclusive of art, animation and sound as well as integration of ideas from math, science and engineering related to larger world problems. Creative Commons licensing to ensure outcome products are open access.</td>
<td>Sharing of personal perspectives through art, quizzes and of ideas builds understanding between participants and trust to share more. Virtual face to face used to build relation. Visuals, sounds and text all available but not mandated. Opportunity to lead by example. Breakout rooms for active work in smaller groups. Transparency of materials during and after creation. Openness to having to put ideas aside was reflected in use of comments fields of shared documents. Creative Commons licensing explained and included in all agreement with participants from day one. Creative Commons licensing challenges idea of ownership and collaboration.</td>
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**Innovation and creativity**

| TECH USED: Google Docs, Padlet, Synchsketch | Complex real world problems provide challenge and opportunity in providing learning materials Storytelling within animated environment. Audience voice (tone and vocabulary) core to script. | Active sourcing of inspiration and direction from popular culture via internet and social media. Synchronous, bouncing ideas off each other and asynchronous pre-session thoughts and post session |
### Sharing ideas and resources

**TECH USED:** presentation software, Google Docs, Padlet, Synchsketch, ZOOM, MS-Teams

- Complex real world problems are those need interdisciplinary treatment to build understanding about them.
- OER materials are shared under licence CC-BY on open platforms, YouTube for the animations and links to OER Commons storage.
- Areas where additional materials can be added are provided as ‘open hooks’ in the OER to encourage future collaborations.

- Encouragement to source examples and direction from internet and popular culture.
- Many ways of sharing provided: synchronous (e.g. voice, chat emoji functions, ZOOM, MS-Team, Padlet, Google Docs) and asynchronous (Google Docs, Padlet, Synchsketch)

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### Connected community

**TECH USED:** OER platforms, email, ZOOM, YouTube

- STEAM approach focussed content towards integration of concepts. E.g. In form and Function: Cross fertilization of ideas in math, biology, physics and computing.
- After project: OER Commons a peer platform for sharing and open re-use and re-work.
- Acknowledgement of incompleteness encourages others to add to the OERs. Open platforms and formats allow easy access to engage.

- Regular virtual face to face used to stay in contact. Agenda and invites circulated in advance to facilitate purposeful meetings. Time for additional discussions allowed. Recordings and additional catchup meetings used to preserve connection in management of conflicting schedules.
- Visuals, sounds and text all available but not mandated in respect for different type of access that participants had.
- Opportunity to lead by example provided.
- Inclusion of all co-creators in regular meetings including...
The role of technology and OEP for OER development. In our work on these two cases we have experienced OER and OEP enabled by technology. OER materials post production are available at little or no cost, and technical, legal and consistency barriers to access are also removed. The network of participatory technologies (see above) used with an OEP mindset supported the creation and delivery of OER content, and also the communication processes within the project.

Open licensing, under CC-BY, creates a climate for sharing in the project team and professional collaborators throughout the project along with ensuring access to educational audiences on an ongoing basis. Technologies, as tools, survive because they are used and can be used in combination with other technologies that fulfill specific needs. Access to technologies for these cases is largely based on web interfaces, not requiring complex account creation and can be accessed from mobile smart devices and shared computers (many youth use family computers or library computers in public spaces, or with no microphones or cameras and allocated internet time limits.). Technology is used in these projects to support synchronous at a variety of levels, visual, voice and text, and asynchronous engagement for easing communication barriers. Very few of these technologies operate for a fee and those that do often have free use areas or free equivalents. Participatory technologies provide varied routes to participation and support widening available routes through which to be heard. The outcome OER animation including open learning assets embrace student stakeholder voices and provide a platform for youth the voice their thoughts in educational discussion settings. The open licensing and technologies allow the art from these projects to be used as social media artefacts without creative control. The OER are as accessible to youth to start/continue adding their voice (a diversity of voices was deliberately included in the Accelerating Vaccine Confidence OER).

Teaching resources are connected to the central thematic resource, building access across disciplines, across learning differences and, inbuilt opportunity to tailor to future needs. Permission and access for re—use and re-work are
actively encouraged which means it is easy for educators to select portions of the materials for use in their own context. In Form and Function OER materials are laddered such that selection of activities for specific disciplines and different skills levels is straightforward but also relatable to the whole for teacher and learners. In Accelerating Vaccine Confidence currency in the discussion is key and participatory technologies such as social media can be used to inform debate from current news stories employing the “quality info” checks presented in the OER.

One role projects such as these have is embedding digital literacy skills in project work for all participants and stakeholders. The university professors involved in this project all work in a near virtual university, that offers open, distance online education. One of the co-creation groups are youth from a virtual school and one a community group who have during COVID-19 become an online group. All were comfortable with participatory technologies without having used all the technologies employed in the project previously. Transferrable digital skills (knowing what to expect vs knowing how to use this one app) which supports flexibility in the use of future participatory technologies. Both cases also expose users of the OER to digital literacy as a part of their content. In form and function the focus of the material is computational thinking in the context of complex real world problems and interactive Jupyter notebooks are accessed as part of the supporting materials providing supportive and structured access to digital skills in modelling and coding which integrates user actions with instruction and explanation. In Accelerating Vaccine Confidence digital literacy is embedded into the storytelling without being the main focus of the animation, with the protagonist having to decide what is credible information to pass on to their own “audience”.

In the employment of an open educational approach to the development of our OERs we have been able to illustrate elements of educational resilience. Taking an open pedagogical approach, integrating technologies as described and working to create OER products supports access, engagement and cost restrictions that are known to be barriers to education and thus contribute toward the processes of educational resilience.

Conclusions

In current times open educational resources (OER) exist most practically inside the electronic / virtual sphere and thus open education and technology appear to have a direct relationship. With technology involved in the production and delivery of OER, and also in the process of creation, illustrated by the open education mindset of these example cases, the technologies used are more than independent tools, there is a symbiotic, relationship i.e., a close, cooperative, or interdependent relationship between the technology and open education pedagogy and practices.

We can conclude that symbiotic interweaving of technology and creative commons licensing with open education as a set of values and a mindset contributes toward educational innovative and resiliency.

Current Limitations and Next Steps

One of the challenges of creating OER is making the OER easily found and used by the target audience. For any OER project such as this were the resource is not a simple release of something done for ourselves/our own students, tasks (and costs) around marketing for awareness of the resource are important to include. The Form and Function project won a DEFINITE CNIE award and is structured in a mo0dule way so that it can be easily used by a wide range of high school disciplines in part, in full or in relation to other subjects but communicating this to high school teachers even not during times of high stress (such as pandemic pivots to online learning) can be challenging.

The project teams would have liked to have extended the project animations in other languages relevant to their audience but project timing and finances limited Form and Function to be English only and Accelerating Vaccine Confidence to English and French. Both animations were constructed such that replacing the soundtrack to the animation in another language is possible (i.e., no lip synching required, independent narration track). Technologies such as YouTube also provide subtitling facilities in their settings function.

The nature of a symbiotic relationship is that of two-way benefit. As much as participatory technologies in education enable educational co-creation and delivery, there is a duty for users of educational technology to push back to
technology developers and researchers in educational technologies their unmet needs of the technology as they experience them. With a mindset of openness this reciprocity for collaborative research and empirically driven improvements is in alignment for the open educational community.

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