Emerald Insight

Kybernetes

An explanatory framework for understanding teachers resistance to adopting educational technology

David Griffiths Timothy Goddard

Article information:

To cite this document:
David Griffiths Timothy Goddard , (2015),"An explanatory framework for understanding teachers resistance to adopting educational technology", Kybernetes, Vol. 44 Iss 8/9 pp. 1240 - 1250
Permanent link to this document:
http://dx.doi.org/10.1108/K-11-2014-0274

Downloaded on: 14 November 2016, At: 22:16 (PT)
References: this document contains references to 23 other documents.
To copy this document: permissions@emeraldinsight.com
The fulltext of this document has been downloaded 201 times since 2015*

Users who downloaded this article also downloaded:

(2010),"Exploring international multicultural field experiences in educational technology", Multicultural Education & Technology Journal, Vol. 4 Iss 1 pp. 30-42 http://dx.doi.org/10.1108/17504971011034719

(2015),"Living in cybernetics", Kybernetes, Vol. 44 Iss 8/9 pp. 1174-1179 http://dx.doi.org/10.1108/K-11-2014-0258

Access to this document was granted through an Emerald subscription provided by emerald-srm:563821 []

For Authors

If you would like to write for this, or any other Emerald publication, then please use our Emerald for Authors service information about how to choose which publication to write for and submission guidelines are available for all. Please visit www.emeraldinsight.com/authors for more information.

About Emerald www.emeraldinsight.com

Emerald is a global publisher linking research and practice to the benefit of society. The company manages a portfolio of more than 290 journals and over 2,350 books and book series volumes, as well as providing an extensive range of online products and additional customer resources and services.

Emerald is both COUNTER 4 and TRANSFER compliant. The organization is a partner of the Committee on Publication Ethics (COPE) and also works with Portico and the LOCKSS initiative for digital archive preservation.

*Related content and download information correct at time of download.

Downloaded by TASHKENT UNIVERSITY OF INFORMATION TECHNOLOGIES At 22:16 14 November 2016 (PT)

The current issue and full text archive of this journal is available on Emerald Insight at:
www.emeraldinsight.com/0368-492X.htm

An explanatory framework for understanding teachers resistance to adopting educational technology

David Griffiths and Timothy Goddard
Institute for Educational Cybernetics, University of Bolton, Bolton, UK

Abstract

Purpose – The purpose of this paper is to propose a way of understanding the resistance shown by teachers to the adoption of some educational technologies.

Design/methodology/approach – The Wookie Widget Server is taken as a case study. This has been a long-term development project at the Institute for Educational Cybernetics, located at the University of Bolton, and has been used with teachers in a number of implementations. The efforts to enhance teachers' adoption of the system are outlined, and an explanatory framework is proposed called "MegaTech and MiniTech" which clarifies the reasons for teachers' resistance to adoption.

Findings – The explanatory framework combines theoretical approaches from Harré's positioning theory, Heidegger's concept of "to hand" and Popper's utopian and piecemeal social engineering. Application of this framework indicates that in deploying the Wookie Widget Server with teachers the researchers were adopting a position of power in relation to teachers. The nature of this power is explored by building on Bateson's writings.

Practical implications – The explanatory framework and analysis of power provide a tool for analysis of the adoption of educational technologies.

Social implications – Increasingly ambitious claims are being made for educational technology. This paper recognises the potentially oppressive nature of these technologies, and provides a starting point for a coherent analysis, which enables this danger to be avoided.

Originality/value – The combination of theories which makes up the proposed explanatory framework is new, as is the application to educational technology of Bateson's writing on power.

Keywords Bateson, Education, Heidegger, Adoption of technology, Popper, Positioning theory

Paper type Conceptual paper

Introduction

This paper introduces a long-term technological development project, and describes how this has been applied in recent educational research and development. It discusses how the development team adapted the implementations in order to promote adoption by teachers, and how this effort was ultimately unsuccessful. We then move on to describe an explanatory framework, which has helped us in understanding this lack of adoption. Finally we build on some comments by Bateson on the nature of power to shed light on the position of the researcher in educational technology interventions.

Wookie

The Institute for Educational Cybernetics (IEC), located at the University of Bolton, has been engaged in a sustained effort of research and development around the Wookie server. Wookie manages and delivers web applications that usually have a tight focus on a

The authors would like to thank the European Commission for funding the TENCompetence, Omelette and iTEC projects without which the work discussed in this paper would not have been possible.

Kybernetes
Vol. 44 No. 8/9, 2015
pp. 1240-1250
© Emerald Group Publishing Limited
0368-492X
DOI 10.1108/K-11-2014-0274

Downloaded by TASHKENT UNIVERSITY OF INFORMATION TECHNOLOGIES At 22:16 14 November 2016 (PT)

Downloaded by TASHKENT UNIVERSITY OF INFORMATION TECHNOLOGIES At 22:16 14 November 2016 (PT)

particular functionality, and are based on the W3C Widget Specification (W3C, 2011). The functionality of the widgets is provided by the Wookie server, but the user accesses them through a host application in which they are embedded, making it possible to articulate new structures for managing and making use of internet services and resources.

The work was informed by a view of pedagogy which considers it not as the study of the transmission and reception of educational content, but rather as the organisation of educational processes. Underlying this view was a theoretical understanding of education which was strongly informed by cybernetics. Beer's analysis had a strong influence on Liber, then head of the IEC, in his analysis of the education system as a set of cascading variety control mechanisms, for example in Britain and Liber (2004). The IEC team believed that the Wookie Widget Server could help teachers by increasing the number of resources and services available in the planning and execution of lessons. It was also hoped to make them easier to locate and more agile to deploy in response to the emerging needs of the classroom. This, we believed, would enable teachers to respond to the variety generated by their many students, by amplifying the choice of technologically mediated interactions which was available to them.

Second, conversation theory developed by Pask (see Scott, 2001 for an introduction) provided a model which could be used in the design of networked education systems. An example is Coloquia, also conceived and developed by members of the IEC team (Liber, 2000). The expectation was that Wookie's ability to configure resources and services in a more agile way would provide a basis for designing technologically mediated educational conversations whose evolution would not be overly constrained by the technological context.

Third, the development of Wookie was also closely tied to the concept of the Personal Learning Environment, proposed in an influential working paper by Olivier and Liber (2001), and further developed by Johnson and Liber (2008), while the technical aspects of the proposal were focused on in Wilson *et al.* (2006, 2011).

The development of these theoretical analyses was closely entwined with the evolving technological context of the internet. Monolithic servers and silos were giving way to portal-based systems which enabled users to have control over the configuration of their environment and the services they used. With the development of mobile platforms this customisation was carried out through the addition of apps to the system.

The way in which these theoretical perspectives were interwoven with the development of the Wookie server is discussed in greater detail in Griffiths *et al.* (2012a, b), but the above brief overview indicates that the work was grounded in a sustained and largely cybernetic analysis of education, and that this took place in a continuous process of system development and reflection on that development. A strong indicator of the quality of this development work is the fact that Wookie was accepted as an Apache project in 2012.

Promoting use of Wookie in iTEC

The IEC has recently completed work on the iTEC project[1], which ran from 2011 to 2014, with funding from the European Commission. Its purpose was to investigate how technologies could be used effectively in classrooms, and to spread this practice through pilots in 17 countries. This raised a problem: how to make a set of resources and services available in pilots across many countries, using a range of platforms and applications. The solution used Wookie to manage resources and services centrally, but share and deploy them on a wide range of web platforms. The ambition was that this project could become the default "place to go" for many teachers when they were looking for resources and services, and that these would be integrated seamlessly with their operating environment.

Downloaded by TASHKENT UNIVERSITY OF INFORMATION TECHNOLOGIES At 22:16 14 November 2016 (PT)

The iTEC project was assessed by its funders as being "excellent", has far surpassed its target of carrying out pilots in more than 1,000 classrooms, and has largely been well received by user groups. It may therefore be fairly identified as a success in terms of fulfilment of the workplan.

The details of the work carried out are available in the iTEC project deliverables[2], but the main phases as they relate to our present concerns may be summarised as follows:

(1) A framework was created which enabled widgets to be chosen from a web page generated by the Wookie server and embedded by a teacher in a teaching environment. This was implemented for Moodle and LRN. This worked on a technical level, but had clear user interface shortcomings.

(2) An "app store" was developed to extend the metaphor of "apps" into the education space and provide teachers with a simplified way of finding and deploying widgets. This was built on the earlier EduKapp software (Wilson, 2012), which was radically revised and extended during iTEC. Evaluation told us that the resulting Widget Store was well received, but not used extensively by teachers.

(3) Iterative revision of the Store was carried out, in order to support adoption of the Widget Store, with input from pilots and collaborations with teachers and teaching coordinators. Over the remainder of the project the Widget Store interface was radically transformed, easy to use Widget creation tools were provided, and much more sophisticated search functionality made available. However, we found that teachers still did not adopt our system beyond the pilots.

In practical terms, the final system has three aspects:

(1) Curation: users can upload widget-based resources and services, create new ones using a suite of tools, and describe and categorise their widgets. A particular strength was the ability to easily encapsulate functionality from the web in widgets. This enabled pedagogic coordinators or teachers to identify valuable functionality on the web, to contextualise this (e.g. by indicating that it would be of value in an aspect of the curriculum, or to a particular group of students), and to make these resources available to their colleagues.

(2) Discovery and searching: users are provided with a range of search mechanisms, which support them in finding the resources that they need on the iTEC Widget Store. The search facilities include taxonomies established by the system administrator, free form tagging, shared favourites and recommender systems.

(3) Deployment: the iTEC Widget Store can be embedded in learning environments with very modest programming effort. Once this has been achieved, teachers can call up the store from any course or lesson which they are editing, select a widget-based resource or service, and with one click include the widget in their course or lesson. Among other benefits, embedding widgets in this way enables teachers to provide direct access to recommended web resources, without their students having to navigate through the wide range of material on the web, with all the confusion and distraction which this involves.

There appeared to be many factors which should have made our work a success. We built on past work which had a theoretical justification, and was of demonstrable technical quality. The system was developed as the infrastructure for the iTEC project, which involved many pedagogical coordinators who worked closely with teachers and ministries

Downloaded by TASHKENT UNIVERSITY OF INFORMATION TECHNOLOGIES At 22:16 14 November 2016 (PT)

of education. The pedagogic coordinators and teachers were consulted extensively about project plans and deployment, and the developers of the Widget Store took every opportunity to obtain feedback from users. We made the system easier to use by providing an app store, which we also hoped would build on the popularity of smart phone app stores. We iteratively developed interfaces for searching and describing widgets and refined them with users; as well as building on feedback from teachers in providing tools for creating widgets. So why was it not being adopted[3]?

Investigating lack of adoption

An additional phase of work with Wookie (which took place in parallel with phase three) was conducted independently of iTEC in the PhD research of Goddard, one of the present authors (Goddard, 2014). He had been working on IMS Learning Design (LD), seeking to support its adoption and to understand the barriers to its use. In many respects the iTEC project sought to offer an alternative to the formal and institution centred approach adopted by IMS LD. In practice, however, both approaches seemed to experience similar barriers to adoption. Goddard proposed that the lack of adoption of the Widget Store could be investigated by minimising the degree to which other factors obscured the underlying question of how widgets could be usefully deployed in the classroom and, by extension, how evolving web technologies could be used in education. A project was established with the teachers of a special school where he had formerly been employed. This minimised the obscuring factors in two ways. First, a very simple system was required, because of the complex classroom management to be undertaken in a special needs classroom, and the limited attention span and academic achievement of the pupils. The system would provide just enough features so that teachers and pupils could use the Wookie widgets, so as to reduce or eliminate the user interface and training issues which are often proposed as an explanation for lack of adoption. Second, in developing the application Goddard could draw on direct experience of the specific classrooms he was designing for, and could consult closely with his former colleagues. It was hoped that this would ensure that the system would be useful to the teachers. The result was the development of the Simplest Possible ONline Grouping Environment (Sponge) software, which we now describe.

Sponge enables teachers to choose and instantiate a Wookie widget from a graphical list, and then assign that instance to a group of pupils. This offered the teachers an expanded range of tools which they could deploy with very little effort. Teachers have a shared password to prevent access by pupils to teachers' functionality, but pupils choose from a simple list of their photographs, and they simply click on their photograph to log in. The school already uses passwords based on names for pupils to access the school network, which are both easy to remember and to guess, which indicated that impersonation would not be problematic. Moreover, as the system was intended for support of face-to-face teaching in a small group, the teacher could detect impersonation by monitoring activity and the complaints of participants.

Teachers can instantiate a collection of widgets in advance of a lesson, and during the lesson they can decide which pupils can see them and in what order. Teachers can add widget instantiations in the light of the progress of the lesson, the process taking less than a minute. When a group of learners is using a set of Sponge widgets, the teacher can bring a widget to the foreground, to coordinate their attention. Pupils are presented with a list of links to the widget instances which have been assigned to them. They see a very simple split screen, so that two widgets can be displayed, if necessary, and can engage in individual or collaborative work as directed by the teacher.

Downloaded by TASHKENT UNIVERSITY OF INFORMATION TECHNOLOGIES At 22:16 14 November 2016 (PT)

Teachers were taken through the Sponge processes at a workshop. It was immediately clear that not only could the teachers understand how to use Sponge, but also that they had many ideas for its use in lessons. Enthusiasm varied between teachers, mainly because some were concerned that younger pupils had extremely low levels of literacy, and most of the widgets required some reading. The stage seemed set for an interesting pilot. In order to avoid imposing our own motivations for the use of Sponge, it was left with the teachers to see how they used it in lessons in a spontaneous way. The system included usage tracking to show levels of activity, and how teachers and pupils were using the system. The results were clear: after six weeks none of the teachers had used it at all.

A model for understanding lack of adoption

We have been involved in many eLearning projects, and been closely aware of many more. In our experience in many of these, indeed perhaps the majority, educational software is produced, focus groups and trials are conducted which show that teachers and/or learners like the software and say that they would like to use it. The software is archived pending further research or exploitation (which in many cases never takes place), and the reality of adoption is tested much more infrequently. On the occasions when adoption is tested, the conversion of project outcomes into sustainable educational initiatives is rare. These projects may be successful, in that the research carried out meets its objectives and may generate insight, and that the software produced may be of high quality and useful to other developers and researchers. We believe that this is the case for iTEC, and a strong case can be made that the Widget Store is a high-quality open source software project, whose architecture makes it valuable as a generic "app store" for a wide range of applications. On a much smaller scale the same is true for Sponge. However, without adoption that makes a difference to the practice of education the research runs the risk of being marginalised and sterile. Consequently explanations for lack of adoption that avoid consideration of the fit between the educational context and the technology are not sufficient. Such explanations hypothesise, for example, that the system will be adopted when the interface is improved, or when it is deployed in a slightly different context, or presented differently, or better documentation or training is provided (along with additional funding). These hypotheses are unfalsifiable until and if further funding is made available, and if this is forthcoming the result may be a similar set of explanations. We felt the need to ask ourselves more fundamental questions about our roles as educational technologists, and it is to this which we now turn.

Our repeated use of Wookie, of which iTEC was only a part, made it no longer sustainable to attribute its lack of adoption in education to poor usability, lack of new features, or training, or lack of collaboration with the user group. Rather, we were forced to conclude that our implementations, including Sponge, did not fit with how teachers did things in the classroom, nor with institutional requirements, despite the enthusiasm of teachers and schools for the system as it was planned, designed and developed. This conclusion, however, does not articulate the relationship of teachers with educational technology in a way which makes sense of their ambivalence towards the system. In the course of our development and use of technologies the IEC has continually sought and discussed theoretical perspectives which could throw light on the use of technologies in education. In considering his results, Goddard realised that a combination of three of these perspectives provided an explanatory framework which could make sense of both the results of Sponge and those of iTEC, as well as casting

Downloaded by TASHKENT UNIVERSITY OF INFORMATION TECHNOLOGIES At 22:16 14 November 2016 (PT)

light on IEC's earlier work with IMS LD (IMS Global Learning, 2003). The framework offers a way of analysing how the same tool or technology can be experienced very differently depending on the perspective of the individual or the institution. It was seen to be important that this framework could be simply described, so that we could go back to consult the user group to find out if our explanation resonated with them. Consequently the framework was baptised as MegaTech and MiniTech. The terminology is not intended to identify the absolute size, feature set or complexity of the technology, rather it refers to experience (i.e. MiniTech: in control of the technology and how it is used; MegaTech: overwhelmed by the technology, belittled by it). The three theories which contribute to MegaTech and MiniTech are positioning theory (Harré); readiness to hand (Heidegger); and piecemeal and utopian social engineering (Popper).

The first contributory theory is positioning theory, set out by Harré and Van Langenhove (1998). It describes how people position themselves and others in the conversations that constitute their interactions, and Johnson *et al.* (2011) apply it in relation to earlier IEC technology. A technology embodies the understanding and goals of its creators, but these are often not involved in the same conversations as the technology's intended users. Even if the creators are involved in users' conversations, their differing professional activities (teaching and technology development) make it impossible for them to participate fully. Learning technologists therefore have a detached understanding of all the potential users' conversations. In positioning theory terms, they engage in rhetorical repositioning, i.e. when a third party interprets a conversation in which they did not directly take part. To the degree that this rhetorical repositioning is inaccurate or incomplete, the technology will be inappropriate in the context of users' conversations.

To accommodate a technology in their practice, users must accept any impact it might have on their positioning. If a technology fits with a user's position, or repositions them in an acceptable way, then the user may be willing to use the technology. Moreover, there are certain aspects of what it is to be a teacher in a classroom that are so deeply ingrained that they correspond to Harré and Van Langenhove's (1998) characterisation of ritual, which is particularly resistant to change. We propose that if a technology knowingly or unknowingly constitutes an unwelcome rhetorical repositioning of a teacher in the teacher pupil relationship, then the conversation will be rejected by the teacher, if this is within their power. If the tool has been mandated, then the enforced conflict of imperatives will create a double bind (Bateson, 1972b, p. 201). The double bind, in turn, prevents the teachers from explaining the dichotomy in which they have been placed.

The second contributory theory derives from Heidegger's concept of readiness to hand (Heidegger, 1978), which describes a tool that is intuitive to use, and serves an obvious purpose. He proposes three modes of unreadiness. The first two, conspicuous (damaged), and obtrusive (something missing) are functional approaches to evaluating technology, and imply conceptually simple solutions. However the third, obstinate unreadiness, implies that the technology gets in the way of what the user wants to do. The implication of our discussion above is that it is no easy matter to establish "what the user wants to do" in the field of educational technology. The complexities of rhetorical redescription have to be negotiated, and, moreover, the teacher may be positioned in a double bind which precludes clear communication. Similarly it may also be unclear whose interests are served by the deployment of educational technology.

Although the proposed benefits may be to the teachers and learners, in practice the technology may be primarily a tool of management. Resolving this question requires an inquiry in organisational factors, and perhaps also into policy and politics.

Downloaded by TASHKENT UNIVERSITY OF INFORMATION TECHNOLOGIES At 22:16 14 November 2016 (PT)

Consequently obstinate unreadiness may be found even where the declarations of the people involved would seem to rule it out.

This is a different order of problem, which cannot be resolved from within the technology itself. In ensuring that there was nothing broken or missing with the Widget Store or with Sponge, and in making the system as simple as possible, we were addressing conspicuous and obtrusive unreadiness, but by elimination we are forced to conclude that obstinate unreadiness had been the problem.

The third contributory theory is derived from Popper's distinction between utopian and piecemeal social engineering (Popper, 1966, p. 158). As we use the terms, utopian refers to top down social initiatives informed by a high-level analysis that is applied inflexibly to local situations, whereas piecemeal describes social initiatives which take as their starting point a local problem to be solved. Because technological development is time consuming and expensive, there is a tendency for it to be informed by the top down analysis of those who pay for it, and agile development methodologies may be seen as an attempt to counteract this. A similar argument may be framed in terms of Illich's conviviality, by which he meant "autonomous and creative intercourse among persons, and the intercourse of persons with their environment; and this in contrast with the conditioned response of persons to the demands made upon them by others, and by a man-made environment" (Illich, 1974, p. 11).

The ideas of both Popper and Illich lead to the related question of "who benefits?". Is it policy makers and politicians, or is it the people on the ground? In the more modest context of the iTEC Widget Store and Sponge, is it the researchers or the teachers? A technology which attempts to enact wider systemic change, beyond the context of an individual user of that technology, has utopian characteristics, and this would apply to iTEC's goal of spreading good practice through European Schools, or Sponge's goal of understanding the mechanisms of educational technology. We do not argue that high-level social or political analysis is in any way undesirable per se. Rather we suggest that if the benefits of use of a technology occur outside the immediate context of the user, then motivation for using the system will be limited, unless its use is mandated by an authority.

The MegaTech and MiniTech explanatory framework is summarised in Figures 1 and 2. The three arrows indicate examples of how any educational technology may be situated in on these three vertices. The longer the arrow, the more the technology is seen to exhibit that trait.

The purpose for developing this framework was to provide a tool for developers and users to engage in joint analysis of the dynamics involved in the use of a tool, during and shortly after its deployment. However, we also find the framework useful as a

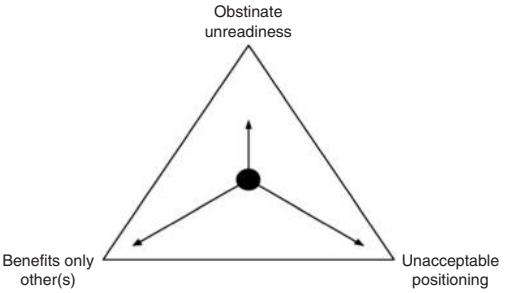

Figure 1.
A graphical representation of "MegaTech"

Downloaded by TASHKENT UNIVERSITY OF INFORMATION TECHNOLOGIES At 22:16 14 November 2016 (PT)

thinking tool. This is relevant both to designers, enabling them to think through the implications of what they are proposing, and in post-hoc analysis of the use of educational technology. It would be possible to operationalise this model as a method, with instruments for use in circumscribed contexts. But this is not our intention here, and such a formalisation might undermine the exploratory value of the framework, as a means to articulate an inquiry. Moreover, when considering the above diagrams, the personal perspective of the observer may determine the conclusions drawn. This suggests that the framework is best suited as a means of revealing divergent experience, rather than a means of identifying a single truth. We now illustrate these personal perspectives with our own work on iTEC and Sponge:

- Benefits vertex: for us as researchers the Widget Store and Sponge were piecemeal solutions, and benefited us by directly addressing our immediate research goals. This was not the case for teachers, as the benefit depended on accepting that if the experimental system were to be a success, then a better working environment would result.
- Positioning vertex: as researchers and experts we took up the rhetorical position of telling the teachers that given our analysis of their communicative context, they should make use of new systems. Teachers were positioned in such a way as to elicit responses agreeable to the researchers by a number of factors, including the prestige of the academic, social conventions (avoidance of conflict), institutional policy (the school had agreed to the trials) and professional codes (desire to be better informed). The teachers' favourable response may have been entirely honest at the time of the discussion, but may nevertheless be misleading, because once the above factors are no longer present, their disposition towards the technology may change. Moreover, we have argued that teachers are in a double bind, and unable to resolve the conflict between what they would like to do and what they have to do. Indeed, the same may be said for what they think they are doing, and what the institution thinks they are doing.
- Readiness to hand vertex: from our perspective as developers, we experienced our technologies as ready to hand: they were relevant, easily accessible and simple to use. However, from the teacher's perspective they implied a request to change their practice. Even with the very simple Sponge, teachers had to think about grouping pupils, and how to incorporate new (and potentially disruptive) channels of pupil-to-pupil interaction into their existing practice. While the teachers could see in the abstract that the tool could be useful to them, there were in practice either no immediate problems for which teachers found it to be the

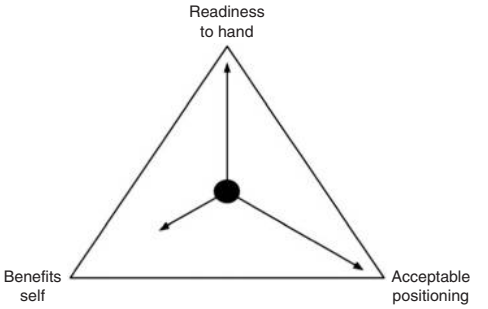

Figure 2.
A graphical representation of MiniTech

Downloaded by TASHKENT UNIVERSITY OF INFORMATION TECHNOLOGIES At 22:16 14 November 2016 (PT)

most to-hand solution, or the tool actively obstructed their goals. This is parallel to the common experience of buying a seemingly useful gadget, but finding that in practice it sits in a drawer unused.

There is a great deal more to be said about each of these aspects, but this brief overview provides an indication of how we believe this explanatory framework may be of value.

The problem of power

The implication in all three vertices is that we as researchers are to some degree able to impose our vision onto the context in which we are intervening. In general terms we might say that we are in a position of power, and need to exercise great care to avoid the outcomes which we have characterised as MegaTech. However, this observation does not help to identify situations where this is a danger, or the aspects of practice which need to be monitored. Indeed, from a cybernetic perspective the concept of power is itself problematic, as explored by Guddemi (2010). He draws our attention to Bateson's argument that the concept of social "power" is an unacceptable metaphorical application of a concept from the world of physics into the biological world. In Bateson's draft "Scattered Thoughts for a Conference on 'Broken Power' " he suggests that "The 'power' metaphor must therefore be carefully pulled to pieces for whatever meaning it has – and must be looked at, as a functioning falsehood or error, causing what pathologies? Self-validating up to what point?" (Bateson, 1974)[4]. Bateson offers partial meanings of "power" and "control" (in italics below), and we have found these useful in identifying areas of educational technologists' practice to examine for evidence that they may be impacting on the educational context which they are seeking to study objectively:

(1) "*Power*" *is (or is located at) bottlenecks of information flow.* Educational technologists and system administrators, and also education managers, can determine whether information is passed on to teachers, and which information is included in reports and research results. This can extend to a partial, or even misleading, representation of the functionality or performance of an application. They can also specify or filter the information to be provided by teachers.

(2) "*Power*" *is located at points of decision regarding distribution of rewards and punishments.* In their various roles, education managers and education researchers can, for example, offer recognition for in service training, promotion (or the lack of it). Researchers can also use their status as experts to formally or informally validate (or not) the competence of teachers in technological matters.

(3) "*Power*" *is located at points of decision regarding "values" – _ what _ shall be rewarded and punished.* Within the context of piloting, engagement with the prototype technology is rewarded (or punishment is averted). Positive attitudes to the technology are rewarded by the researcher's satisfaction and a mutually congratulatory experience.

(4) "*Control*" *(by example, charisma, etc.)* …. The researcher's status as an expert confers control in this sense.

(5) "*Control*" *of the definition of contexts, punctuation, etc.* Managers and researchers determine how, when and where pilots will be carried out.

(6) "*Control*" *of the flow of goods and services.* Managers and researchers determine which applications and what functionality will be made available to teachers.

Downloaded by TASHKENT UNIVERSITY OF INFORMATION TECHNOLOGIES At 22:16 14 November 2016 (PT)

Conclusions

We have found the characterisations of MegaTech/MiniTech to be a helpful way to conceptualise resistance to the adoption of educational technology, and also a simple way of discussing this with teachers. We propose that this explanatory framework should be combined with an analysis of the mechanisms of power in any given deployment situation, and we offer our application of Bateson's reflections on power as a starting point. We have focused in this paper on the role of teachers, but the same explanatory framework could be applied to students' use of technology. We hope that the combination of these approaches can contribute to the design of educational technology interventions which align the interests of all parties when proposing technological change, and provide a guide to evaluation. In this way educational technology can be less coercive, avoid the creation of double binds and lead to more fruitful results.

Notes

1. http://itec.eun.org/
2. D8.1, D8.2, D8.3 and D8.4, available at: http://itec.eun.org/web/guest/deliverables
3. We draw the reader's attention to Johnson (2014), which provides a valuable complementary discussion of these issues in the iTEC project.
4. See also the concluding section of Bateson (1972a).

References

Bateson, G. (1972a), "Pathologies of epistemology", in Bateson, G. (Ed.), *Steps to an Ecology of Mind*, Ballentine Books, New York, NY, pp. 454-463.

Bateson, G. (1972b), "Toward a theory of schizophrenia", in Bateson, G. (Ed.), *Steps to an Ecology of Mind*, Ballentine Books, New York, NY.

Bateson, G. (1974), "DRAFT: scattered thoughts for a conference on 'Broken Power', co-evolution quarterly (Winter Solstice), pp. 26-27, available at: http://unauthorised.org/anthropology/anthro-l/march-1996/0378.html (accessed 19 November 2014).

Britain, S. and Liber, O. (2004), "A framework for the pedagogical evaluation of eLearning environments. higher education", available at: www.jisc.ac.uk/uploaded_documents/VLE Full Report 06.doc (accessed 19 November 2014).

Goddard, T. (2014), "MegaTech and MiniTech", available at: http://tpg.me.uk/2014/11/11/megatech-and-minitech-part-1/ (accessed 19 November 2014).

Griffiths, D., Johnson, M.W., Popat, K., Sharples, P. and Wilson, S. (2012a), "The educational affordances of widgets and application stores", *Journal of Universal Computer Science*, Vol. 18 No. 16, pp. 2252-2273.

Griffiths, D., Johnson, M.W., Popat, K., Sharples, P. and Wilson, S. (2012b), "The Wookie Widget Server: a case study of piecemeal integration of tools and services", *Journal of Universal Computer Science*, Vol. 18 No. 11, pp. 1432-1453.

Guddemi, P. (2010), "A multi-party dialogue about power and cybernetics", *Integral Review*, Vol. 6 No. 1, pp. 197-207.

Harré, R. and van Langenhove, L. (Eds) (1998), *Positioning Theory*, Blackwell, Oxford.

Heidegger, M. (1978), *Being and Time*, Wiley-Blackwell, Hoboken, NJ.

Illich, I. (1974), *Tools for Conviviality*, Calder & Boyars, London.

IMS Global Learning (2003), "Learning design specification", available at: www.imsglobal.org/learningdesign/ (accessed 19 November 2014).

Downloaded by TASHKENT UNIVERSITY OF INFORMATION TECHNOLOGIES At 22:16 14 November 2016 (PT)

Johnson, M. (2014), "Learning design, social ontology and unintended functionalism in the ITEC project", *Design4learning Conference, Open University*, *Keynes, November*.

Johnson, M. and Liber, O. (2008), "The personal learning environment and the human condition: from theory to teaching practice", *Interactive Learning Environments*, Vol. 16 No. 1, pp. 3-15.

Johnson, M., Griffiths, D. and Wang, M. (2011), "Positioning theory, roles and the design and implementation of learning technology", *Journal of Universal Computer Science*, Vol. 17 No. 9, pp. 1329-1346.

Liber, O. (2000), "Colloquia – a conversation manager", *Campus Wide Information Systems*, Vol. 17 No. 2, pp. 56-62.

Olivier, B. and Liber, O. (2001), "Lifelong learning: the need for portable personal learning environments and supporting interoperability standards", available at: http://wiki.cetis.ac.uk/images/6/67/Olivierandliber2001.doc (accessed 19 November 2014).

Popper, K.R. (1966), *The Open Society and its Enemies Volume I, The Spell of Plato*, Routledge and Kegan Paul, London.

Scott, B. (2001), "Conversation theory: a constructivist, dialogical approach to educational technology", *Cybernetics and Human Knowing*, Vol. 8 No. 4, pp. 25-46.

W3C (2011), "Widget packaging and XML configuration", W3C Recommendation, 27 September, available at: www.w3.org/TR/widgets/ (accessed 19 November 2014).

Wilson, S. (2012), "Edukapp a white – label open – source web app store", CETIS: Scott's Workblog, available at: http://scottbw.wordpress.com/2012/02/27/edukapp-a-white-label-open-source-web-app-store/ (accessed 9 April 2012).

Wilson, S., Liber, O., Johnson, M., Beauvoir, P., Sharples, P. and Milligan, C. (2006), "Personal learning environments: challenging the dominant design of educational systems", 2nd International Workshop on Learner-Oriented Knowledge Management and KM-Oriented Learning (LOKMOL 06), in Conjunction with ECTEL 06, Crete, pp. 67-76, available at: http://hdl.handle.net/1820/727 (accessed 19 November 2014).

Wilson, S., Sharples, P., Griffiths, D. and Popat, K. (2011), "Augmenting the VLE using widget technologies", *International Journal of Technology Enhanced Learning*, Vol. 3 No. 1, pp. 4-20.

Corresponding author
Professor David Griffiths can be contacted at: d.e.griffiths@bolton.ac.uk

For instructions on how to order reprints of this article, please visit our website:
www.emeraldgrouppublishing.com/licensing/reprints.htm
Or contact us for further details: **permissions@emeraldinsight.com**