

Project Pulse: co-designing the ‘smart’ campus with Internet of (teaching and learning) Things

Jeremy Knox

Centre for Research in Digital Education, The University of Edinburgh, jeremy.knox@ed.ac.uk

Abstract

This short paper describes a research project which aims to co-design prototype Internet of Things (IoT) technologies with staff and students at a higher education institution in the UK. However, rather than adopting a technical approach, which would perceive devices simply as ‘problem solving’ instruments, this project seeks to engage with critical approaches to IoT through the use of speculative methods (Ross 2016), such as ‘design fictions’ and ‘objects-to-think-with’. This approach is intended to surface crucial conceptual and ethical issues for education, such as the radical intensification of digital networks potentially engendered by this technology, and the prospect of increasing surveillance and diminishing privacy in an era of ubiquitous connection. These are questions too often overlooked in the habitual forecasting and advocacy of ‘new’ educational technology, but also in the engrained approaches to ‘solutionist’ (Morozov 2013) technology design. This paper will outline the two initial stages of this ongoing project: firstly, the development of preliminary IoT provocations; and secondly, the outcomes from co-design workshops with staff and students. The preliminary IoT devices include: campus motion and sound-level sensors; live public PC login feeds from across the campus; collated social media feeds from distance students; wearable smart watches configured to receive feed data; a smart phone app with interactive functions that can respond to feed notifications; and a web-based interface to visualise the range of data feeds. These devices were produced to demonstrate specific, and provocative, educational applications of IoT technologies, and to encourage responses from workshop participants. The second stage will describe outcomes from two co-design workshops: the first with campus-based and distance students; and the second with teaching staff at the institution in question (scheduled for November 2017). Grounded in the themes of ‘presence’, ‘community’, and ‘surveillance’, these workshops are designed to elicit critical responses to IoT technologies in higher education through the development of speculative designs that 1) enact key issues for students and teachers by modelling practice, and 2) offer creative alternatives to established design cultures by resisting, and obfuscating (Brunton & Nissenbaum 2013) the drive for ‘big data’ collection and its promoted efficiency gains. Drawing on these designs, this paper will conclude with, not only the key challenges that students and teachers perceive in the networked futures of higher education, but also creative visions for alternative technologies that can approximate new ways of connecting the humans and ‘things’ involved in education.

Keywords

Internet of Things; IoT; speculative methods; design fictions; surveillance; ethics.

Research Context

Internet of Things (hereafter IoT) devices have been routinely hyped in higher education technology forecasting (for example, the recent New Media Consortium Horizon reports, see: Johnson et al. 2015, Johnson et al. 2016, Adams Becker et al. 2017), often focused on speculative applications, with overt links to commercial ‘tech industry’ developments (for example, Asseo et al. 2016). Despite the radical intensification of digital networks that such technologies would engender, alongside a significant escalation of potential ethical dilemmas related to increasing surveillance and diminishing privacy, critical responses to the conceptual territory hailed by the IoT has been slow to develop in the field of education. Important work has begun to tackle the educational implications of health monitoring devices and the so-called ‘quantified self’ (Eynon 2015; Williamson 2015), while the notion of the ‘smart’ environment and its relation to educational activity is receiving due critical attention (Williamson 2017a). While these much needed approaches - drawing from a burgeoning area of critical data and algorithm studies (for example, see Ziewitz 2016) - deal largely with approximate educational futures, research focused on technical development, particularly in the area of learning analytics, is beginning to

speed ahead with the establishment of frameworks (for example Lu et al. 2017), methods (for example Koren and Klamma 2017), and small scale studies (for example Di Mitri et al. 2016) of IoT applications in education. However, crucially, this technical development is grounded in specific disciplinary expertise: the 'learning sciences' (Gasevic et al. 2015), deriving from educational psychology and computer science, and focused largely on quantitative methods that seek the measurement and prediction of behaviour from data traces related to educational activity.

Aims and Objectives

This paper will outline an ongoing project that is seeking to generate interdisciplinary perspectives on the design of IoT in education, by attempting to bring together critical studies of contemporary networked technologies (for example Beer 2009; Kitchin & Dodge 2011; Williamson 2017b), active participation from teachers and students in higher education, and technical design expertise. For this purpose, this project draws on 'speculative methods', which can bring 'concepts of critical design, speculative design and design fiction from the social sciences and from fields of art, design and human computer interaction to bear on digital education research' (Ross 2016, p215). This methodology has been utilised specifically to encourage alternative forms of technology design, that resist 'solutionist' approaches: those that recast 'all complex social situations either as neatly defined problems with definite, computable solutions or as transparent and self-evident processes that can be easily optimised' (Morozov 2013, p5). Central to this research is therefore the surfacing, through practical design and modelling, IoT technologies that, rather than 'solve' predefined educational 'problems', embody key issues perceived and experienced by students and teachers engaging with this area. The methods in this project also draw from notions of networked surveillance, such as the 'surveillant assemblage' (Haggerty & Ericson 2000), as well as important work that has explored forms of resistance to increasing data capture, in particular the notion of 'obfuscation' as a way of counteracting surveillance practices through an ethics of 'concealment or evasion' (Brunton & Nissenbaum 2013, p164). As described below, this project is currently undertaking these methods at The University of Edinburgh in the UK, with the aim of generating, not only insights relating to the challenges that students and teachers perceive in the domain of IoT, but also alternative technology designs that offer creative visions for the future 'smart' campus.

Outcomes and Findings

This paper will describe outcomes and findings from two key phases of the project: firstly, the development of preliminary IoT provocations to stimulate the co-design aspects of the project; and secondly, two co-design workshops with staff and students undertaken at the University of Edinburgh in the UK. The preliminary technologies developed for this project include a range of bespoke, small-scale hardware and software devices arranged to demonstrate a number of functions and applications generally assumed within the scope of IoT. These include: campus motion and sound-level sensors; live public PC login feeds from across the campus; collated social media feeds from distance students; wearable smart watches configured to receive feed data; a smart phone app with interactive functions that can respond to feed notifications; and a web-based interface to visualise the range of data feeds. Importantly, the specific arrangement of these devices was produced to practically demonstrate some of the issues arising from the collection, analysis and presentation of educational data with IoT technology. These include the tracking of both anonymous and identifiable student (and staff) data, the 'ambient awareness' (Thompson 2008) of distant activity, and the ability to respond to network activity in limited ways.

The second stage involves a series of co-design workshops with students and staff, intended to elicit critical responses to IoT technologies in higher education in the form of speculative designs: models, outlines, or actual devices (working or not). The first workshop involved teaching staff, and took place in November 2017. The themes of 'presence' and 'community' were palpable in the responses from staff. Designs involved connecting distance students with those on campus, particularly where more social aspects of university life were involved, and where visual cues to emotional states or dispositions were not apparent. The speculative designs produced in this workshop begin to surface two critical insights for the emerging understanding of IoT technology in education: firstly, key issues and questions for teachers (and students), enacted in practical models of IoT systems that can demonstrate potential functions and effects; and secondly, creative alternatives to established design cultures of efficiency and 'solutionism', that work to surface and 'problematize' IoT applications. Grounded in the theme of 'surveillance', the second workshop, scheduled for February 2018, will involve both

campus-based and ‘distance’ students studying at the University of Edinburgh, and will be focused on understanding the kinds of student ‘community’ made possible through IoT technologies, in an era where students ‘attend’ the university but not necessarily the campus itself (Bayne et al. 2014). Students will be able to experiment with the preliminary devices and arrangements, before engaging in focused group design sessions to evaluate the technology and design alternatives or additions. Input from a selected group of ‘distance’ students will involve the generation of data ‘off-campus’, and synchronous communication in the session. Drawing on these designs, this presentation will conclude with, not only the key challenges that students and teachers perceive in the networked futures of higher education, but also creative visions for alternative technologies that can approximate new ways of connecting the humans and ‘things’ involved in education.

References

- Asseo, I., Johnson, M., Nilsson, B., Chalapathy, N., and Costello, T.J. (2016). The Internet of Things: Riding the Wave in Higher Education. *Educause Review*. June 27th. Available: <https://er.educause.edu/articles/2016/6/the-internet-of-things-riding-the-wave-in-higher-education>
- Adams Becker, S., Cummins, M., Davis, A., Freeman, A., Hall, Giesinger, C., and Ananthanarayanan, V. (2017). *NMC Horizon Report: 2017 Higher Education Edition*. Austin, Texas: The New Media Consortium.
- Bayne, S., Gallagher, M.S. & Lamb, J., (2014). Being “at” university: the social topologies of distance students. *Higher Education*, 67(5), pp.569–583. Available at: <http://link.springer.com/10.1007/s10734-013-9662-4>
- Beer, D. 2009. “Power through the Algorithm? Participatory Web Cultures and the Technological Unconscious.” *New Media & Society* 11 (6): 985–1002. doi:10.1177/1461444809336551
- Brunton, F., & Nissenbaum, H. (2013). Political and ethical perspectives on data obfuscation. In M. Hildebrandt & K. De Vries (Eds.), *Privacy, due process and the computational turn* (pp. 164–188). New York: Routledge.
- Di Mitri, D., Scheffel, M., Drachsler, H., Börner, D., Ternier, S. (2016). Learning Pulse: Using Wearable Biosensors and Learning Analytics to Investigate and Predict Learning Success in Self-regulated Learning. *Proceedings of the Learning Analytics and Knowledge (LAK16) conference, 25th-29th April, Edinburgh, UK.*
- Gasevic, Dragan, Shane Dawson, and George Siemens. (2015). “Let’s Not Forget Learning Analytics Are about Learning.” *Tech Trends* 59 (1): 64–71
- Kitchin, R. & Dodge, M. (2011). *Code/Space: software and everyday life*. MIT Press.
- Lu, Y., Zhang, S., Zhang, Z., Xiao, W, and Yu, S. (2017). A Framework for Learning Analytics Using Commodity Wearable Devices. *Sensors*, 17, 1382; doi:10.3390
- Marcus SpechtEynon, R. (2015) The quantified self for learning: critical questions for education. *Learning, Media, and Technology*. 40 (4) 407-411
- Morozov, E. (2013). *To save everything click here: Technology, solutionism and the urge to fix problems that don’t exist*. London : Penguin
- Haggerty, K. D., & Ericson, R. V. (2000). The surveillant assemblage. *British Journal of Sociology*, 51(4), 605–22
- Johnson, L., Adams Becker, S., Estrada, V., and Freeman, A. (2015). *NMC Horizon Report: 2015 Higher Education Edition*. Austin, Texas: The New Media Consortium.
- Johnson, L., Adams Becker, S., Cummins, M., Estrada, V., Freeman, A., and Hall, C. (2016). *NMC Horizon Report: 2016 Higher Education Edition*. Austin, Texas: The New Media Consortium.
- Koren, I. and Klamma, R. (2017). Community Learning Analytics with Industry 4.0 and Wearable Sensor Data. In D. Beck et al. (Eds.): *iLRN 2017, CCIS 725*, pp. 142–151. DOI: 10.1007/978-3-319-60633-0 12
- Ross J. (2017). Speculative method in digital education research. *Learning, Media and Technology*. 42(2):214-229
- Thompson, C. (2008). Brave New World of Digital Intimacy. *The New York Times*. Available: http://www.nytimes.com/2008/09/07/magazine/07awareness-t.html?_r=2&pagewanted=1
- Williamson, B. (2015). Algorithmic skin: health-tracking technologies, personal analytics and the biopedagogies of digitized health and physical education, *Sport Education and Society*, 20 (1), pp. 133-151.
- Williamson, B. (2017a). Computing brains: learning algorithms and neurocomputation in the smart city, *Information Communication and Society*, 20 (1), pp. 81-99.
- Williamson, B. (2017b). *Big Data and Education: The digital future of learning, policy and practice*. London: Sage
- Ziewitz, M. (2016). Governing Algorithms: Myth, Mess, and Methods. *Science, Technology, & Human Values* 41 (1): 3–16. doi:10.1177/0162243915608948

Acknowledgements

This project has been funded by the Challenge Investment Fund at The University of Edinburgh

Dr Jeremy Knox
The University of Edinburgh
jeremy.knox@ed.ac.uk

Jeremy Knox is a Lecturer in Digital Education at the University of Edinburgh, and a core member of the Centre for Research in Digital Education (<http://www.de.ed.ac.uk/>). His research interests include critical posthumanism, data studies and algorithm studies, and the implications of such thinking for education and educational research, with a specific focus on the digital. Jeremy has published numerous critical perspectives on open education, and is the author of the recent book [Posthumanism and the Massive Open Online Course: Contaminating the Subject of Global Education](#) with Routledge.