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A return to Teacherbot: Rethinking the Development of Educational Technology at the University of Edinburgh

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1. Introduction

Universities generally rely heavily on third party commercial services for their educational technologies. These commercial services promote these technologies through narratives of solutionism (Morozov 2013), the belief that technology can ‘solve’ all issues. Recent developments in artificial intelligence have led to a surge in new educational technologies and is considered by many to be a tool that can make education both more efficient and highly personalised. Artificial intelligence is often referred to as a technology that can transform ‘traditional’ education where students are passive recipients of information to more dynamic and better forms of education through ‘highly personalized, scalable, and affordable alternative AI [artificial intelligence] solutions’ (Popenici and Kerr 2017, 10). Another take on artificial intelligence is provided by Cukurova, Kent and Luckin (2019, 3033) who see it as a means to support teachers and thereby augment ‘human intelligence to create “super educator minds”’. Whether the focus is on the students or the teachers, in both approaches artificial intelligence is construed as a solution to educational shortcomings or challenges. However, there are alternative approaches to the future of teaching and technology.

This paper draws on research emerging from a project exploring automation in teaching titled Expanding the Teacher Function (2019-current). It draws inspiration from a preceding project, entitled Teacherbot, that explored how teachers “might enact new, resistant ways of playing at the boundaries of the human and machine” (Bayne, 2015: 455). The Teacherbot was a bot on Twitter that MOOC students could interact with. The responses from the Teacherbot would not always make sense or be productive, but the students still found the interactions meaningful because the interactions generated new ideas around the topic. The aggregation of human, code, algorithms, and human-student agency made the automation of the Teacherbot very different from artificial

intelligence applications that are seeking to use collected data to learn more about its users to become more efficient.

The automation we are exploring in this paper does not learn from itself or mimic human intelligence but rather services a particular teacher function. It is pre-programmed in collaboration with the teacher to enact a particular teaching activity. It may perform some rudimentary analysis based on predefined parameters, or it might merely execute a predrafted script, but it does not learn from these experiences. Rather the human teacher learns whether or not this teacher function is providing pedagogical utility and iterates on the automation accordingly. This is very different from how artificial intelligence acts with some independence from the human teacher and learns from datasets, which has generated ideas that it can replace teachers in higher education (Popenici and Kerr 2017).

In response to the market discourses and solutionism around artificial intelligence, we turn the focus to a community-driven approach to identify possibilities for meaningful automation without artificial intelligence. Although artificial intelligence is the form of automation that is most representative of the market discourses of educational technologies, it is merely a subset of automation that is currently garnering the most attention. Automated agents can be seen a broader category of programmed automation to perform a particular teacher function, which includes chatbots (also known as bots) that engage directly in dialogue with either the student or the teacher. Automated agents in general may have capacity for surfacing teacher functions that might broaden the definition of teaching without relying on self-expanding datasets. Whereas artificial intelligence lacks transparency, non-artificial intelligence automated agents are more suitable for working with a community as the complexity of the design is reduced, which enables participants'

agency in the deliberation and adaption. Or, in other words, to move from merely being consumers of instrumental educational technologies to becoming designers of it.

There have been developments in automated agents that are programmed to perform specific functions. These are simpler than artificial intelligence agents and can be produced faster, modified for different purposes and are less ethically problematic. Currently, many of the existing non-artificial intelligence automated agents in education are emerging from existing commercial and educational technology imaginaries (Morozov 2013) emphasizing instrumentalism and efficiency. At the same time, universities are also showing greater interest in the opportunities of non-artificial intelligence automated agents for serving as personal assistants to students (Deakin University), and in the case of the University of Edinburgh, in teaching (Bayne 2015). There are also other universities that have used automated agents in teaching, such as through a QuizBot (Ruan et al. 2019), chatbots as a learning partner (Huang, Hew, and Gonda 2019) and teacherbots in online courses (e.g. Bozkurt, Kilgore, and Crosslin 2018). Other related developments include automated tools in student e-discussions (Mclaren, Scheuer, and Mikšátko 2010).

Automated agents are becoming increasingly common in higher education (Hopkins and Maccabee 2018), but they are predominantly seen and used as means to make teaching more efficient (Hamilton and Friesen 2013). There is a broad enthusiasm for using technology to reach larger numbers of students and reduce costs. Such instrumental uses and measurements of success led Selwyn (2011) to suggest that there is a tendency towards exaggerated and unsubstantiated optimism in educational technology. As such, it is especially the teachers that need to take ownership of such technologies to adapt them to their courses (Schmulian and Coetzee 2018) rather than expecting the implementation of new technologies developed by private companies to

resolve existing issues. However, such an approach requires an alternative vision of technology in higher education (Castañeda and Selwyn 2018), which this project modestly attempts to address.

Echoing Bayne (2015), this paper is rooted in a rejection of binaries of human versus non-human, teacher versus technology, and material versus non-material. Such binaries continue to lend themselves to ‘anthropocentric resistances to the technological “working-over” of teaching, or on equally humanistically oriented promises of, and imperatives for, “enhancement” via technological progress’ (Bayne 2015, 457). Indeed, these binaries have yet to dissipate in the interim between 2015 and now. Rather, they seemingly renew with each new cycle of technology, and these narratives are embedded in broader discourses of digital education that are influenced by visions of the future put forward by political, corporate and media interests (Ross 2017). It is in this technological narrative work that many of these humanistic binaries are reintroduced and reinforced (Keirl 2015). Whereas Bayne’s (2015) insights offered a new way of thinking about meaningful relations between technology and teaching, there is a lack of understanding of how education would be best served by new technologies (Song, Oh, and Rice 2017). In this paper, we seek to move the debate forward by providing insights in the process of developing forms of automated agents in collaboration with teachers, students and staff.

This paper emerges from the Expanding the Teacher function project (2019-2020). The research focused on what the use of automated agents in teaching and learning might entail, which teaching and learning practices it could possibly augment, what sociocultural or organisational practices it might circumvent or disrupt, and ultimately shed light on the impact automated agents may have on the student and teaching experience at the University of Edinburgh. The project has explored widely what teachers, students and staff consider to be part of the teacher function, but also how

automated agents can transform it in ways that are valuable to the people who will be using this technology.

This community-driven approach diverges from the ways in which educational technologies are normally introduced in university contexts. Rather than assuming that educational technologies can be implemented without taking into consideration local contexts, we have used speculative research methods to explore the needs of teachers, students and other staff in this specific institution. In demonstrating selected use cases and their value at the University of Edinburgh that emerged from these methods, and potentially at other universities, this paper makes a case for a community-driven approach to the development, implementation and use of educational technologies in higher education.

2. A sociomaterial approach to automation in teaching

Like its predecessor Teacherbot (Bayne 2015), this paper moves beyond the instrumental and technical-rational positions of automation and towards a new form of teaching where the teacher works in tandem with technologies to broaden the overall teacher function (Bayne and Jandric 2017). A return to the themes of the Teacherbot (Bayne 2015) requires a parallel return to the theoretical positions underpinning its formation, namely sociomateriality. Sociomateriality refers to a broad range of theories that surface the entanglements of human and non-human actors (Fenwick et al, 2011). In this paper, sociomateriality provides capacity for surfacing the constitutive relationships that comprise the teacher function at the University of Edinburgh, and to understand how this function changes ‘dramatically as it pulses through particular situations and discourses, the tools available, technologies, social relations and environmental dynamics’ (Fenwick 2015, 83).

In this way, we can rather look for means of learning ‘new couplings, new coalitions’ (Haraway 2016) – which in this case enables us to rethink the human/non-human teacher binary. Decoupling from humanistic binaries in this way frees us to explore a kind of teaching that is less concerned with identification or a unitary self, and that rather enables dispersion of human and non-human actors and entanglements. The mechanics of humanistic binaries continue to allow digital education to remain a fertile field, where teacher automation emerges a middle ground between technological-promise and technological-threat (Bayne 2015). What remains generative about automated agents in teaching is their capacity to surface these binaries and to gauge their hold on the speculative pedagogical imagination, which makes the sociomaterial turn a valuable perspective.

Yet there have been shifts in the landscapes of teacher automation that beget slight iterations to its theoretical and subsequently methodological foundations. The original Teacherbot was designed to facilitate play across an increasingly instrumental landscape of pedagogic automation (Bayne 2015). This play stimulated activity that proved to be pedagogically generative, which breaks down the humanistic binaries that continue to pervade more conventional approaches to educational technology. By employing a speculative method, Bayne (2015) initiated an investigation of the potential new connections, couplings, and coalitions that may emerge from a playful space where human actors (teachers and students) and non-human actors (Teacherbot) all intertwine. Ross (2017) points out that speculative approaches are aimed at provoking new ways of thinking and to bring particular ideas into focus.

At the same time as the sociomaterial position enables new ways of thinking about relationships between human and non-human actors, it also generates new challenges. For example, contemporary chatbots are becoming increasingly advanced and Sharkey (2016, 287) points out

that if ‘a robot is built to resemble a human being, or at least a being with emotions, those who encounter it may expect it to be able to care for and look after people. However, this appearance is, in some respects, deceptive’. This deception is problematic for many reasons, but particularly in how it is reliant on the human and non-human binary of the teacher. To avoid such deception, we have focused on simpler forms of automated agents that do not attempt to replace or replicate human teachers. Baker (2016, 608) focuses, in a similar way, on developing what he calls ‘stupid tutoring systems’, and makes a case for recognizing that the non-human tutors are not intelligent, but that they are designed in ways that can leverage human intelligence. In this case then, we are focusing on the teacher as designer of this leveraging.

The current project shares the sociocultural critique of essentialist and instrumental arguments of technology adoption that Bayne’s (2015) *Teacherbot* contested, while, at the same time, acknowledging the growing maturity of the technology itself alongside the largely predictable and largely humanistic use cases emerging from said technology in digital education. This combination of technological maturity and predictability suggests two things. First, that critical turn in teaching with technology has yet to take hold or is being mitigated by successive waves of technological introduction. Second, that this predictability is essentially stabilization, which Feenberg and Jandric (2015, 8) argue leads to decline of interest in alternative designs.

Both issues highlight the need for expanding on the work of Bayne (2015) in this successor project to overcome the humanistic positions of enhancement and resistance that are reinvigorated with each subsequent round of educational technology. In response, this paper moves beyond a single *Teacherbot* to explore the ways in which the University of Edinburgh community (teachers, students, and staff) can imagine a range of automated agents that can be embedded into reconfigured teaching practices. This sociomaterial approach enables a reflection on how to

overcome distraction of each new technology and identify how educational technologies need to be incorporated on the users' terms or through the institutional imagination, rather than being imposed as new technologies become available. To emphasise the importance of situating educational technologies in a broader context, we now turn to the University of Edinburgh's approach to digital education as well as the methods for researching the future of automation in higher education.

3. Facilitating a community-driven approach through speculative methods

The exploration of automated agents that frames this paper has emerged directly in response to a broader interest at the University of Edinburgh codified in policy and strategy. The University's 2030 strategy states that 'Improved digital outreach will see us enabling global participation in education' (2019b), which illustrates the growing importance of digital education in key university policies. Similarly, in the University's Learning and Teaching Strategy, there is an explicit commitment to 'the creative use of digital technologies in our teaching and assessment where appropriate whether online, blended or on-campus' (2019a). This is underscored by the University's interest in using the growing portfolio of online learning programmes to innovate new approaches to learning and teaching. Indeed, in policy and strategy 'being digital is portrayed by the institution as inherently positive, requiring transformation from an inferior, pre-digital state' (Fawns 2019, 135). As such, this research exists within the broader and largely digital aspirations of the University.

This transformation is maturing at the University of Edinburgh, whose work is and has been increasingly found in the digital. As of writing, there are over 70 fully online Master's programmes, a large array of open courses with over 2.5 million cumulative participants to date,

and a growing body of critical research exploring the role of the digital in teaching and learning emerging from throughout the University. The Centre for Research in Digital Education has linked a programme of critical, interdisciplinary research to teaching practice at both the University of Edinburgh (many of these online Master's programmes are underpinned by Centre research) and externally (the Centre works with INGOs and commercial organisations to inform their programme and online course design). It should be noted that the Covid19 pandemic has accelerated these efforts even further. As such, the University of Edinburgh represents a particular confluence of institutional policy and strategy, an ongoing and extensive digital development body of work, and a growing and critical research agenda. This is the larger context in which the community-driven approach described in this paper emerged.

This research also builds on several research projects that have explored different aspects of the role of teaching and the teacher function in an increasingly digital educational space at the University of Edinburgh in recent years. The most recent, and the one most explicitly evidencing the claims made in this paper, is the Expanding the Teacher function project (2019-2020), which builds on former projects such as the Teacherbot (Bayne 2015) project and its model 'assemblage of teacher-student-code that might be pedagogically generative' (p. 465). In addition, the research has been influenced by the indicative actions emerging from the Near Future Teaching project (2017-2019), a project at the University of Edinburgh designed to explore and co-design a values-based future for digital education, which led it to call for 'an academic-led programme to scope ways in which transparent, fair, context-sensitive artificial intelligence applications and services could assist and support human-driven teaching' (Bayne and Gallagher 2019, 23). And, finally, the Manifesto for Teaching Online (Bayne and Ross 2016), which is a series of short deliberately interpretable statements designed to stimulate ideas about creative online teaching. The Manifesto

serves ‘to reimagine some of the orthodoxies and unexamined truisms surrounding the field’ (Bayne and Ross 2016) and offers a way to stimulate creative reinterpretations of teaching practice while also considering new technological developments, such as automated agents. In the community-driven approach presented in this paper, statements from the Manifesto serve a liberatory purpose, employed methodologically to present alternatives to commercially driven educational technology imaginaries, and to further speculative approaches.

To explore the potential role of automated agents in the future of teaching at the University of Edinburgh, this research has used a speculative methodology to facilitate a community-driven approach. Speculative methods have been used in social sciences as well as art and design disciplines, but Ross (2017) has made a case for employing such approaches also in digital education research to generate new ideas. She criticises the reliance on evidence-based research to make a case for more action-based speculative methods as a way to work with the ‘not-yetness’ of ‘technologies and practices which are unknown and in flux’ (Ross 2017, 214). An example of using a speculative method to navigate these uncertainties, is Bayne’s (2015) exploration of how new connections, couplings, and coalitions may emerge from a playful space where human actors (teachers and students) and non-human actors (Teacherbot) intertwine.

In our research, the purpose was to develop an in-depth understanding of attitudes towards automated agents and collect a wide number of ideas on how to use automated agents in teaching from university community. Conducting such research with participants requires them to envision the design and use of technologies that do not yet exist, and a central challenge in the data collection was to find the right balance of informing participants about the research without limiting their ideas:

One of the key factors responsible for the success of a speculative design project is the careful management of the speculation; if it strays too far into the future to present implausible concepts or alien technological habitats, the audience will not relate to the proposal resulting in a lack of engagement or connection. In effect, a design speculation requires a bridge to exist between the audience's perception of their world and the fictional element of the concept (Auger 2013, 12).

In response to these issues, the data collection included several workshops across different disciplines and campuses. The workshops were organised as interactive group exercises where the authors would begin by giving a broad overview of emerging trends in educational technology. Demonstrating that artificial intelligence is often promoted as a technology that can provide solutions to the challenges of higher education, we outlined the need for a 'pessimistic approach' in the sense that 'there is no technical formula for overcoming the entrenched social, political, economic and cultural issues that underpin educational "problems"' (Selwyn 2011, 717). This enabled us to alleviate the concerns about automated agents as means to replace teachers or reduce student-teacher interactions, and rather focus on how automated agents in higher education could be helpful, interesting and valuable to the participants.

In addition to workshops, we conducted 15 interviews with students, faculty and staff from different disciplines and schools. The semi-structured interviews encouraged the interviewees to reflect on the potential for use of automated agents, how it would affect teaching, and the challenges as well as ethical issues of making changes to the current educational practices. The interviews were transcribed, and subsequently coded and analysed in NVivo.

The speculative method allows for an additional creative exploration of potential future directions. In this case, that meant having informal discussions with colleagues and people across the university. The combination of a systematic and rigorous approach with a more explorative approach to finding use cases enabled us to explore the not-yetness of automated agents in diverse

spaces and contexts. These different methods generated different perspectives on the challenges of implementing and using automated agents in higher education, which illustrates the importance of taking a community-driven approach to exploring attitudes towards such technologies. At the same time, they generated approximately 85 ideas for use cases.

While some ideas emerged repeatedly throughout the data with slight variations, other ideas surfaced reconfigured narratives of teaching. Some participants proposed ready-made use cases, while others outlined basic ideas that suggested a particular teaching function. The different contributions were generative in the sense that they enabled us to find new areas of teaching where automated agents could be used and provided us materials to work with to develop selected ideas into use cases.

Following this speculative dimension of the research, we coded the interviews and developed a typology of use cases to map the broader range of teaching application at the University of Edinburgh. The themes of the typology emerged in response to the proposed ideas and consisted of categories such as ‘feedback’, ‘personalised learning’, ‘accessing information’, ‘student collaboration’, ‘teacher-student communication’, ‘stimulating thinking’, ‘study support’ and so on. By organizing the proposed use cases into these categories, we began to see how some of the ideas overlapped and could potentially be combined rather than working as separate bots. We then drafted one-page summaries of the most compelling use cases where we highlighted how they expressed the teacher function and their functionality.

We further narrowed these use cases through an evaluation process. These evaluation criteria included an assessment of to what extent each use case was:

- Pedagogically generative. In keeping with the original Teacherbot (2015) project, each idea was evaluated according to its ability to augment an existing aspect of the teacher function, or suggest a new aspect of the teacher function currently unrealised.
- An expression of the University's values. Drawing from the values surfaced during the Near Future Teaching project (2017-2019), each idea was evaluated according to its incorporation of one or more of these institutional values, namely 1: experience over assessment 2: diversity and justice 3: relationships first and 4: participation and flexibility (Bayne and Gallagher 2019, 14–15).
- Potentially positively influencing the student and teaching experience. This evaluation criterion will be further interrogated in subsequent rounds of piloting and redesign.
- Ethical. The project was subjected to institutional ethical review as well as the review of an academic advisory panel. Further, each idea was subjected to an ongoing ethical review by the project team. Based on this ongoing ethical review, adjustments to the project scope were made, such as focusing on automated agents drawing on limited, university-controlled datasets, as opposed to machine learning algorithms and artificial intelligence agents.
- Supportive of the teacher identity as a professional. Each idea was evaluated according to its capacity to support the position of the teacher as a creative, informed, and professional practitioner. Whereas educational technologies often take an essentialist position and place technology at the centre of educational activity and reduce the importance of the teacher to mere facilitator, we assessed to what extent the technology could bolster the teacher's role in higher education. Much of the evidence used to satisfy this evaluation criteria were surfaced in data from the research project, namely a series of narratives around positions

of teaching emerging in response to technological and organisational change (discussed in Gallagher and Breines, Under Review).

- Technologically feasible. Each idea was assessed to consider if it could be developed, implemented, piloted, and redesigned using existing university resources and expertise.

With an emphasis on the institutional imagination around teaching, emotive capacities (values) and pragmatic concerns (feasibility), the criteria speak to a sociomaterial positioning of the teacher function which acknowledges the entanglements of educational technologies in teaching, and how the teacher function changes. These evaluation criteria attempt to capture as many of the discourses, technologies, social relations, and environmental dynamics specific to the University of Edinburgh and does so through a values-led structure. Further recognising the potential impact of automation on the academic labour market (Means 2017), each of the criteria centre around supporting the teacher as an acting professional, which serves to empower a disempowered group in increasingly marketized universities (McGettigan 2013).

Furthering this idea of the teacher function being an assemblage of factors extending beyond the human teacher, the selection of use cases that are to be prototyped took place in close collaboration with our colleagues in the Information Services Group, who not only provided technological expertise (and ultimately acted as the arbiters of feasibility) but performed much of the work of evaluating the alignment of these use cases with institutional policy, data protection, and compliance. This close collaboration between teachers and technologists, then, can be understood as an extension of the broader teacher function being performed at the University of Edinburgh.

Subsequently, an academic sponsor has been chosen for each bot to develop it for specific courses, and each bot is subject to several cycles of feedback from students and staff as well as layers of governance, including an academic advisory committee. Through this collaboration and work with

different actors in the university community, we have begun prototyping the use cases that are suitable for this context and therefore likely to work well at the University of Edinburgh.

4. Use cases emerging from the University

Among the diverse range of use cases that emerged, we here highlight five automated agents that each have potential to reconfigure the teacher function in their own way. The use cases vary in where they would be situated in the education process, but all reflect ideas expressed by research participants of where such technologies may be useful. The following examples are illustrative of diverse possible uses as well as the value of automated agents in higher education.

Use Case #1: Onboarding Bot

Proposed by: College of Science & Engineering

To prepare both students and their teachers for the start of term, this bot is a diagnostic tool for teachers to see what students know before they start studying at university because students come from very different backgrounds. At some point over the summer before students start university, they will be asked to interact with the bot. The bot will assess what they already know and what they need to prepare more before starting university. The bot enables teachers to get a sense of what the level of the students are before the start of term rather than having to figure this out slowly throughout the first term. In this case, the bot creates a connection that can help both teachers and students adapt to each other from early on. This allows for allocating resources to students who need support, for example by offering them join an introductory course once they start to make sure they will be able to keep up in their studies.

Use Case #2: Grouping Bot

Proposed by: College of Medicine & Veterinary Medicine

This bot offers teachers automated assistance around the assembly and disassembly of groups, particularly for online and scaled courses. The bot allows for the rapid construction of groups based around a diverse set of variables. Some of these variables include groups constructed: randomly, based on shared interests, based on roles or experience, based on course and programme performance, and based on a deliberate attempt to promote dialogues around diversity and interdisciplinarity. The bot can additionally be used to select spaces to deploy the groups (separate discussion board threads on an LMS for example), to select roles for the group (randomly assign leader, co-leader, project manager, researcher, etc.), and privacy controls (are the other groups aware of each other, what personal information is being shared to other members in the group).

Use Case #3: Collaboration bot

Proposed by: College of Arts, Humanities & Social Sciences

This bot serves as a conversation starter in groups and is in the spirit of the original Teacherbot (Bayne 2015) project as it is designed to be a playful take on collaboration. It creates surprising, provocative or daft titles or questions based on topics, journal article titles, or input of words and phrases. The phrases do not necessarily make sense but can function as an icebreaker and a non-traditional means to stimulate group working practices. By giving students a tool for starting discussions, the bot brings people together in situations where conventional concepts and topics are thrown together in ways that require participation and discussion to reconstruct and make sense of them. This could be especially pertinent to those trying to develop interdisciplinary collaborative practices in their students.

Use Case #4: Tutorial Bot

Proposed by: College of Arts, Humanities & Social Sciences

This bot would prompt student action prior to a tutorial. This engagement with the bot would give the students a clearer purpose of what they want to cover in the meeting, while tutors would similarly have an idea of what they can expect. The idea would be to enable students and tutors to make effective use of time together during the supervision meeting. Beyond this, the requirement to share an update and projection of activity before the meeting might also have the benefit of challenging to students to reflect more readily on the status of their work and in turn to work in a more organized way. It could be adjusted for any field to facilitate meetings between teachers and BA, MA, PhD students.

Use Case #5: Co-creating knowledge bot

Proposed by: College of Arts, Humanities & Social Sciences

This bot provides a space for students to input alternative sources of knowledge into the curriculum, the syllabus, and any resource collection. Via the bot, students can share resources and research they find relevant and important. These can be from anywhere in the world and the resources can then be used in future or dynamic reading lists or added to repositories of additional sources. This bot provides students with opportunities to contribute to the knowledge construction in the university, which will give them a stronger sense of participation and capacity to influence existing hierarchies of knowledge. By providing this space, the University takes a proactive approach to include marginalized groups and make it a more welcoming space for students of all backgrounds.

These use cases are now being prototyped for further workshops and iteration. Although these five bots are deceptively simple and utilitarian, they represent a university-wide value-laden effort to meaningfully reconfigure the teacher function in ways reflective of core institutional dynamics specific to the University of Edinburgh. The bots highlight that different types of automated agents can be inserted strategically to facilitate teaching and education, suggesting new or reconfigured narratives of teaching. Rather than focusing on creating a more ‘efficient’ university (as is often the justification for automation in higher education), these bots stimulate an environment where teaching and educational practices can be facilitated in ways that are beneficial and useful to teachers, staff and students. Some of the bots can also reduce some of the repetitive administrative tasks for teachers and other university staff, while at the same time being meaningful in advancing teacher-student relations. For example, as use case #4 shows (the bot that helps preparation for supervision), the educational experience being stimulated here is not about reducing the contact time or removing the human-human meetings, but rather about facilitating the preparation for the meeting in ways that are beneficial to the supervisor and student. However, these bots could not have been envisioned without participation of their future users. Close collaboration with academics, staff and students, brings out the centrality of community-led research and development to create bots that are not about replacing teachers, but rather bots that can support and strengthen educational practices.

5. Bots at the University of Edinburgh and beyond

Despite the opportunities that the bots afford and the positivity around them at the University of Edinburgh, there is still a not-yetness (Ross 2017) to them in the sense that they are still in their infancy. Kerry et al. (2009) have provided a useful overview of questions and issues to consider when developing ‘conversational agents’, but the bots still need to be tested in course settings and

we need to understand how they impact teaching and education in the context of the University of Edinburgh. Through an evaluation of these initial tests, we can move on to expand and modify bots to other courses and in some cases to the whole university. In this process we are not seeking to make bots resemble humans and risk deceiving the users about who they are engaging with (Sharkey 2016), but rather make bots that are recognised as such: automated agents that have been designed by teachers, students, and staff to ‘leverage human intelligence’ (Baker, 2016: 608). As a result of this process, we see a transition from the not-yetness of these technologies into pragmatic spaces as the community itself has identified need and gaps where the University itself can benefit and where they would be welcome – if they serve to advance university values and facilitate better educational experiences, rather than adding to teachers’ workloads or undermining their work.

While there is justified scepticism among many academics towards the introduction of automation in higher education (Selwyn 2019), it emerged in this research that teachers, staff and students had nuanced perspectives and ideas relating to automated agents. A crucial reason for their constructive engagement was our insistence that the purpose of these bots was not to replace teachers, but rather on finding new ways to improve teaching. Somewhat surprisingly, many were enthusiastic and eager to use bots when they participated in the process of deliberation, design and adaptation of these technologies advanced in this project. As a result, the use cases the participating community proposed illustrate that they saw this technology as an opportunity to enhance the quality of education.

Automation, then, does not have to be centred around efficiency or artificial intelligence, as simpler bots developed through community-driven approaches offer new and possibly more meaningful educational application. In this sense, we are following Selwyn’s (2011) emphasis on

pessimism in educational technology by avoiding thinking about technology as something that seeks to change people and practices, but rather see it as tools that can facilitate and potentially augment existing practices.

As the bots presented above emerge from a community-driven approach, this paper and its findings illustrate the value of working closely with the people who will be using the technologies. There is currently limited emphasis on working with the users to develop educational technologies, but such approaches to technology are not new. Studies of participatory practices have illustrated that technologies are remade and adapted to local practices (Yoon 2003; 2006), and highlighted that technologies will always be used in different ways in different contexts (see e.g. King, Forsey, and Pegrum 2019; Tenhunen 2018). Engagement with community-driven research from other parts of the world can provide insights into practices that can situate the development of educational technologies in local contexts by and for those tasked with using them: teachers and students. In research on rural Nigerian communities and their use of technology, Okon (2015) suggests a context-driven and highly participatory approach to enable communities to define the parameters of use and meaning of ICT themselves. Bentley et al. (2019) argue that participatory methodologies around community driven technologies develop capacity for specific communities to engage critically with technologies. There are many more examples, especially emerging from the Global South, that point to the value of processes of speculation, deliberation, adaptation, and design. Such research has informed the approaches taken in this project, hence the focus on a single institutional context and its specific orchestration of ‘local practice.’

Our focus on the University of Edinburgh gives us deep insights into the ways in which this university community envision the use of future technologies. While this project enabled temporary community-driven deliberation around new technologies it is becoming clear that such

processes need to be incorporated in university policies and strategies to create space for reflection around new technologies to enable more inclusive practices. This approach also enables a wider thinking about the use of automation in higher education as it demonstrates the significance of a community-driven approach to ensure that new technologies are not merely imposed from above. These findings, then, are valuable beyond this context because they give us a sense of the how technology will be received possibly also in other universities.

6. Conclusion

The original Teacherbot project (2015) explored opportunities for meaningful interactions between students and a bot on Twitter to identify new ways of playfully exploring teaching through human and machine interactions (Bayne 2015). The research presented in this paper attempted to build on the Teacherbot project and explore a further expansion of the teacher function through speculative and participatory methods. Both share the ethos of teacher and student-led experimentation. The use cases that emerged from this project became artefacts of the inclusive research process as well as expressions of the reconfigured teacher function. The community-driven approach to bots seen through a single institutional context offers new insights into the sociomaterial entanglements that educational technologies are generating, particularly around the composite teacher function and the role non-human agents have in performing that function. Sociomateriality in this sense provided capacity for surfacing the discrete elements of the composite teacher function and surfacing the distributed and leveraged human intelligence (Baker, 2016: 608) that extends throughout that teacher function. This surfacing reinforces the entanglements that teaching itself relies on, being ‘not simply about the relationships between humans, but is about the networks of humans and things through which teaching and learning are translated and enacted’ (Fenwick, Edwards, and Sawchuk 2015, 6).

Sociomateriality provides a critical lens to interrogate these teaching ‘networks of humans and things’ alongside an institutional dynamic (Fenwick 2015, 83). As such, the contribution of sociomateriality is twofold: an interrogation of the teacher function responding to a particular technology, and an interrogation of the broader institutional dynamic and its impact on how that teacher function is enacted. Again, such utility allows to look at the teacher function and to further problematise human and non-human teacher binaries. However, such an analysis and development process can only be achieved with time and space dedicated to community-led deliberation, adaptation, and design of emerging educational technologies. Time and autonomous space become the means by which this analysis and community-led designs are induced.

While this research on automation and its role in the teacher function was focused on exploring these dimensions, the combination of community-driven approaches and sociomaterial analysis should not be exclusive to this research as it has the potential to work with every new bit of education technology. What ultimately emerged from this project, beyond the identified use cases, is a community-led participatory research and development process that can be replicated institutionally precisely because it is institutionally born, drawing on core university material: structures, discourses, values, and environmental dynamics.

To take such an approach to the implementation and use of educational technologies, participatory practices of deliberation and adaptation, borrowed from participatory technological design processes largely emerging from the Global South (Gallagher 2019), are critical for all universities grappling with contentious technologies. Each higher education institution needs to provide the resources to identify the most suitable ways to adapt new technologies in accordance with their own values. Such a process is clearly highly time consuming and demanding on institutions as different schools and disciplines have different needs and ideas of how automation may be of use

to them. Moreover, it is an iterative process that cannot be limited to a specific timeframe because it is work that will never be ‘done’. Rather, it is a continuous process of that requires institutions to articulate the sociomaterial assemblages being created or redefined with these new technologies, teaching included, and to define preferable and value-based futures for them.

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The authors declare that they have no conflict of interest.

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