

“Apps that make things, not apps that do things”: appropriation and assistive learning technologies.

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This paper describes three initial case studies of software use by teachers to support learners with special educational needs. In each case, the teachers were observed to be appropriating the software in ways that went beyond the intended use of the technologies. Appropriation has been previously explored as a positive process that provides benefits to users, yet these cases suggest that there may be specific benefits of appropriation for teachers in this context, and this is worthy of deeper investigation in the future.

Assistive technologies, education, appropriation, special educational needs

1. INTRODUCTION

Education is considered an essential part of life that all people are entitled to receive, meaning that there is therefore a clear need to explore different methods for enabling this for people facing barriers to education. The United Nations define education as a “human right” (UN Economic and Social Council 1999), while the Convention on the Rights of Persons with Disabilities ensures that “persons with disabilities receive the support required, within the general education system, to facilitate their effective education” (UN General Assembly 2007). Technology may provide a means to provide this support, to ensure that people’s rights are met in a way that can be adapted to specific needs. However, there is a need to explore how the design of software can most effectively support this.

The term Assistive Technology (AT) describes a range of products, where supporting learning and independence is key: e.g. in the first issue of the *Journal of Assistive Technologies*, the editorial proposes that ATs can be split into 3 types by their uses, all related to learning: technology uses to train or rehearse, to assist learning, or to enable learning (Abbott 2007). The UK organisation Becta previously defined AT as: “the software and technology which helps people with disabilities and special needs to overcome the additional barriers they face in communication and learning” (Becta 2003).

1.1. Assistive technologies

One feature of AT which has been frequently noted by researchers is the need to consider the user’s individual needs (e.g. Maor et al. (2011); Alper and Raharinirina (2006)). This goes beyond simply designing for a group of users, e.g. as one review of computer access for disabled people notes, “it is futile, particularly when dealing with a person with severe disabilities, to try to estimate which device, out of the hundreds available, will meet the unique needs of a particular person” (Hoppestad 2007).

In the context of education, there is also a clear need to consider teachers’ requirements from software to support learning. This has already been noted as an area in need of more investigation, e.g. Alper and Raharinirina (2006) suggest the need to involve teachers more in studies conducted with pupils, and to investigate “effective teaching strategies for maintenance and generalization”, while Elliott et al. (2003) note that “successful implementation of assistive technology depends on the ability to satisfy both student needs and educators’ values”. A UNESCO report on innovative practice for ICTs in education for disabled people similarly makes the recommendation that teachers’ knowledge of AT and their attitudes towards it are vital if the learners are to be effectively supported (Watkins 2011).

Another topic that is often raised by researchers is the value of personalisation and individual

support from software, while providing flexibility and adaptability towards users. For example, a noted strength of software to support dyscalculia is in being able to personalise it to users, and for it to be customised by teachers, thereby not aiming to replace teachers but to complement existing learning activities (Laurillard and Baajour 2009). The ability to customise an interface to preferences has been suggested to improve reading ability and perceived ease of reading for dyslexic learners (Gregor et al. 2003). There is also a suggestion that personalised solutions may be particularly beneficial for autistic users (Farr 2010). For use in schools, it has also been suggested that software needs to be not only able to be personalised for individuals, but also adaptable in order to support a range of special educational needs (Fernández-López et al. 2013).

However, what is less well understood is what exactly is meant by this need for adaptability, and just how much flexibility should be supported. This paper aims to explore this by looking at cases where software is deliberately adapted by teachers in ways it was not designed for, to see how this can support their teaching needs and the needs of their pupils.

1.2. Appropriation

Appropriation describes a user's practice of using technology in a way that the designers did not intend. Carroll et al. define it as "the way in which technology is explored, evaluated and adopted or rejected by users", in order to transform it from the 'technology-as-designed' to the 'technology-in-use' (Carroll et al. 2001). Rather than the technology simply being used differently, it can be argued that appropriations "expand the usefulness of technology" (Salovaara, 2009), allowing tools to be used in more suitable ways for users. This process is also important for the acceptance and adoption of technology, as Dix points out: "These improvisations and adaptations around technology are not a sign of failure, things the designer forgot, but show that the technology has been domesticated, that the users understand and are comfortable enough with the technology to use it in their own ways" (Dix 2007).

Salovaara (2009) suggests a model of how appropriation takes place, based on the user's needs, exploration of the device, and the opportunities and constraints provided by the technology. This falls in line with models of creative problem solving: e.g. the Componential Framework of Creativity (Amabile 1983) proposes that people start with a problem, search the immediate environment to generate potential solutions, and test them against their knowledge and understanding of the domain. Similarly, the Geneptore model proposes that creative solutions are found through iteratively generating structures

as possible solutions, and using exploration and interpretation to focus or expand the concept in light of product constraints (Finke et al. 1992). In other words, there is some consensus that new solutions can be found through exploring the opportunities and constraints of a technology, and so arguably the ability to appropriate software may support the users in finding new ways to achieve their aims.

By definition, it can be difficult to design software so it can be used in ways the designer has not imagined. However, Dix (2007) proposes guidelines for designing for appropriation, so designers can support a user's desire to use their software in different ways. These include allowing for interpretation rather than fixed meanings in the system, designing software to support users to perform a task rather than doing it for them, and learning from users so that their appropriation can be viewed as a co-design practice. Akah and Bardzell (2010) also propose guidelines to support appropriation, including allowing users to interpret the device's function and alter its interaction, saying that this will "empower the user to become a maker". Nevertheless the specific value of software which can be appropriated to support teaching and users with special educational needs remains to be seen.

Appropriation is a developing topic in the HCI community at present, as seen for example by frequent workshops at the annual CHI conference (e.g. the 2010 workshop on 'Examining Appropriation', or the 2011 workshop on 'Appropriation and Creative Use'). However, although there is a growing recognition of the value of appropriation, there is a need to investigate how this may be beneficial to specific domains such as education. For teachers, methods which increase engagement could be beneficial, as promoting teachers' positive attitudes towards AT has been noted to be potentially important in ensuring interventions are successful (Watkins 2011).

Therefore, this paper provides an initial exploration of software appropriation to support learning for children with special educational needs. To support this, three case studies are presented here, aiming to show this use of appropriation by teachers at special schools to support learners with different needs and abilities. These case studies are drawn from a series of observations conducted at the schools, as well as interviews with teachers and pupils.

2. CASE 1: AUDIO NOTETAKER

The school where this case study took place is an independent special school for pupils aged 10-19, specialising in supporting pupils with dyslexia and other specific learning difficulties (SpLDs). As part

of a wider AT programme, the school introduced a range of software designed to support dyslexia, including Dragon (voice recognition), Inspiration (mind-mapping), and Read & Write Gold (writing support and text-to-speech). However, the package which was identified as most successful by the teaching staff in interviews was Audio Notetaker.

Audio Notetaker¹ is note-taking software which uses a microphone to create audio notes which are then presented in visual form for browsing and editing. The software was designed for dyslexic students at university to take notes in lectures (e.g. with a dictaphone) and sync them with lecture slides, and is commonly recommended to students for this purpose. However, essentially the functionality of this software is simply that it can link audio with images and typed notes and present them in a structured fashion. From the user's perspective, blocks of audio are separated according to context, and visually presented alongside associated images and/or text.

From interviews and questionnaires conducted with pupils at the school, it was seen that some did indeed use it to take notes, but the most interesting cases of use were how teachers began to independently appropriate this software and use it to support their teaching in a variety of ways that were not initially foreseen by the school or the creators of the software. Three of these uses are presented here.

2.1. Revision notes

One history teacher began using Audio Notetaker to record spoken revision notes, for pupils with literacy difficulties to listen to. Pupils were then asked to add their own pictures to each point of the notes (e.g. from repositories or internet searches), in order to engage with the learning materials and to build personal meaning. As a next stage for pupils who were able, their own written notes could be added alongside each part of the audio, so that the material could be presented in all three media forms simultaneously. This allowed pupils to build their own structured notes, without relying on the need to create extensive written material which proved challenging for many of the pupils.

Though this was a new approach for the teacher and the pupils, it was felt to be successful. The teacher agreed that the addition of personal meaning to the notes was important for their learning, e.g. adding images which reminded them of particular points or events. They noted that it "gets around the idea or the anxiety about having to record everything in a written or typed format", and that they felt it had improved their learning for exams: "the results from the previous year were transformed...

¹Audio Notetaker: http://www.sonocent.com/en/audio_notetaker

Obviously not the skills of inference, and not the skills of interpreting evidence, but the actual knowledge, phenomenal". This allowed the teacher to build a teaching resource which they felt provided benefits to the pupils, through using the software to meet their own needs and the needs of the pupils.

2.2. Creative writing

In a different example, one of the teaching support staff described how they used Audio Notetaker for creative writing tasks for pupils with writing difficulties. Previously, the pupils had only been able to produce simple stories with basic vocabulary as they lacked confidence in their writing abilities. To address this, the teacher created an exercise where a series of pictures were presented using the software. Pupils were then asked to record themselves speaking an accompaniment to each picture, in order to tell a story of their own invention that might link the images.

The staff member interviewed felt that there were clear benefits to this approach, as they found that pupils were building more complex stories, and using vocabulary which the staff had not known they knew. Without the pressures of writing and spelling, it seemed the pupils felt more confident at using more complicated words and phrases and were able to express themselves to a fuller extent. Through using the software in this way, the staff felt they were able to allow pupils to engage in the learning activity in a way that was more suitable to their needs and abilities.

2.3. Homework assignments

In a final example using this software, several teachers at this school began to use Audio Notetaker to set questions for homework assignments. The teachers would write the questions into the text portion of the software, allowing pupils to record spoken answers for each question rather than relying on writing responses. Teachers could then be sent this finished file in order to mark the pupils' work.

A pupil who was interviewed noted that "I think that's really easier, like easy to speak through it and tell you how you feel... sometimes I forget, writing it down and stuff so... when it comes to your mind you know to just speak fluent straight away". In surveys distributed to pupils many also commented on this, e.g. saying "I like to dictate my thoughts and send them by email to my teachers", or "it is a lot easier than writing". For pupils where writing was a particular obstacle to learning, this approach allowed them to produce independent work without focussing on the mechanics of writing, and again express themselves in a way that was suitable to their abilities.

Each of these cases shows teachers presenting information to pupils in a different medium, and allowing pupils to express themselves in a form they were comfortable with. The important point noted from these studies was that none of these were uses the software was intended for, nor were uses the school had initially planned to use the software for, but had arisen due to the teachers' needs and seeing this software as one way in which to potentially support the tasks they were trying to achieve.

It is also perhaps interesting to note that information from uses such as this has since then fed back into the design and marketing of Audio Notetaker, in order to target the tutor market. This shows an example of following the principle of 'learning from appropriation' (Dix 2007), and illustrates how this appropriation may prove useful for designers as well as for users.

3. CASE 2: MADPAD

The school where this case study took place is a state-funded special school for pupils with learning disabilities between the ages of 2-19. Pupils here have a range of special educational needs. Recently, the school has begun to introduce iPads across all classes, with each teacher being given three devices for their class. For consistency across the school, a set of 'core' apps were installed on each device, with teachers also encouraged to explore other apps that supported their own needs. This resulted in teachers discovering apps that could help them to perform particular learning activities, and sharing apps that other teachers then began to use in different ways.

A member of staff was interviewed who had used these apps in their own teaching and who now took on the role of coordinating the devices across the school. Based on their observations of teachers' practice, they noted that there was now a growing preference for "apps that make things, not apps that do things". In other words, they noted that many apps support specific teaching activities (e.g. teaching phonics), and although they did use several of these, they found general purpose apps that allowed them to 'make things' more useful. These could serve a number of purposes, including creating flexible teaching resources and also supporting student work. One app which this member of staff described as being particularly effective was MadPad.

Madpad² is not particularly designed for users with special needs, but allows users to create 'video soundboards' by recording short sounds with a video, which are then displayed in a grid. This is marketed with the slogan "remix your life", showing

users recording short sound loops or sounds from their environment to create a 'jamming' instrument. Essentially however, the functionality of the software from a user's viewpoint is that they can record any short sounds with video associated, which are then displayed in a grid for touch activation.

The staff member interviewed described a number of uses that teachers had discovered for MadPad. For example, they had used it as a communication tool, presenting photos of real-world objects that would be familiar to the pupils, e.g. items found around the classroom, and associating them with the sounds that these objects make. This is similar to communication boards used by Augmentative and Alternative Communication (AAC) tools, several of which the school already used. Although lacking in the functionality of other AAC apps when wishing to communicate full sentences, this solution is considerably cheaper and allows a small choice array to be created, edited and used very quickly which can be advantageous to teachers.

In a similar use, teachers also began to use MadPad for language acquisition activities, such as word building. For example, sound clips of letter sounds can be presented, and then pupils can combine these to form words (e.g. 'cuh', 'ah' and 'tuh' to make 'cat'). One noted advantage of allowing teachers to record the sounds and words themselves was that the pupils would be presented with familiar voices, who would also have the regional intonations that the children would be most familiar with.

A different use that was seen was for teachers to use MadPad with pupils who struggled with speech. Here, the app was used to monitor vocalisations, recording pupils' voices with video of the sound being made (e.g. a phoneme they had difficulty with), and letting them play it back to see how each one sounded and how they made it. This also allowed staff to record the pupils' progress over time, which has been noted as an important aspect in special education, and one which AT is well placed to perform (e.g. Hayes et al. 2010).

Teachers also began to find inventive ways of adapting the software to their requirements. For example, MadPad required a full set of 12 videos to be recorded before it could be used, yet in some situations teachers wished to present a reduced choice array to the pupils. So, teachers held up a black piece of paper to the camera while tapping the desk to make a click when recording the unwanted segments, thus making a 'blank' square appear in the grid. This shows further how teachers were able to adapt the software in ways the designers had not foreseen, to achieve their own teaching aims.

²MadPad: <http://www.smule.com/madpad>

4. CASE 3: PICCOLLAGE

This final case is drawn from a study at the same school as Case 2. In this case, observations were carried out in one of the classes, supported by interviews with the class teacher. As described earlier, each class at this school had been provided with a set of iPads that had a variety of apps installed on them for use by teachers and pupils. The app that was mainly used in this class was PicCollage.

PicCollage³ is also not designed particularly for users with special needs. This is a collage building app, allowing users to create collages of images and text on any topic. Images can be taken using the tablet's camera, imported from a library or found through an internet search, and all objects can be manipulated on the canvas using the touch-screen.

Although PicCollage was used by teachers at the school for a variety of purposes, this teacher used it as part of a language and communication lesson, in which pupils learned about words and letter sounds. At the start of the lesson, pupils reviewed letter shapes and sounds, and were asked questions on this (e.g. 'what letter is this?', 'what sound does it make?' 'can you think of a word that starts with this letter?'). This led into individual activities according to the pupils' abilities: picking a specified letter out of an alphabet (e.g. 'L'), finding simple words in a picture dictionary (e.g. 'leg'), or finding more advanced words in a dictionary (e.g. 'llama'). After this, pupils were divided into three groups, each with an iPad, to continue the lesson using PicCollage.

Using PicCollage on the iPads, each group was given a letter that their group would work on as the subject of their collage. Pupils were then each given individual tasks, based on their own abilities – this included searching for given words beginning with that letter in a dictionary, searching for pictures using PicCollage (e.g. a picture of a king or a key for the letter K) and adding them to the scene, and adding text to the scene (e.g. finding the K on the keyboard and pressing it). In this way, all pupils were engaged with the language activity, with the app being used as a means of searching for the information, in a way that was different from the book-based activities conducted before. While all pupils could work at their individual pace according to their individual abilities, within a group they had a shared resource that they could collaborate on together.

An important question is if this is in fact an example of appropriation. Here, the software is being used almost in its intended manner: users are using it to build collages. However it is not designed as a teaching or learning tool, or for language building: it

could be argued that it is sold as a tool for artistic expression, and the teacher here has clearly not used it in this way, as it is not producing the finished product which is the outcome of the lesson, but the process by which the artefact is put together. It could still be argued that it is the simple and flexible nature of the software that allows the teachers to use it to support their teaching activities and the needs of their pupils – in other words, when functionality is simple, it can be more easily appropriated to meet a wide variety of ultimate end goals.

5. DISCUSSION

Although these are small case studies, they raise an interesting issue in the potential value of software appropriation for teachers. In these three cases, the software is not merely being personalised or used with customised user-generated content – it is the simple and multi-purpose nature of the software that allows teachers to use it beyond its initial purpose in ways that support the individual needs of their pupils. The fact that the design of the software supports appropriation means that it can be used in a variety of ways, to suit different teaching activities and the varied abilities of pupils with different needs.

The teachers interviewed felt that many pieces of educational software are designed to 'do things', e.g. to teach a specific skill. That is not to say that there is no value to these (and both the schools did use applications such as these), but only that flexible tools which 'make things' might be more valuable to these teachers in the long term. This observation also suggests that there may be value in promoting flexible multi-purpose software for use by teachers. In particular, if teachers move towards mobile and tablet solutions where a variety of small apps may be used, a selection of multi-purpose apps may be the most useful approach.

As discussed previously, designing for appropriation is difficult, because designers cannot know how all people are going to use it, particularly users outside the intended target market. It is perhaps the unexpected uses that users find which are often the most memorable. Nevertheless, if appropriation can be shown to be beneficial in the context of AT and learning technologies, then guidelines on designing for appropriation (e.g. Dix 2007) could help to guide the development of educational software that is better suited for supporting learners with special educational needs and their teachers.

In conclusion, this paper has described three case studies where appropriation can be argued to have been beneficial to teachers in supporting learners with special educational needs. This is of course a

³PicCollage: <http://pic-collage.com/>

work in progress, but these initial case studies have identified a particular topic in the context of assistive technologies in education that seems suitable for deeper investigation. The aim is now to explore this further, by conducting more detailed studies of teachers' use of flexible tools and how they may appropriate them in innovative ways that provide new opportunities for themselves and for their pupils.

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