

# The many faces of interaction

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VERIFIABLE CPD PAPER

## IN BRIEF

- Explores how people in general, and teachers and students in particular, interact with ICT when learning.
- Describes the ICT-human interfaces that currently occur in education.
- Describes the use of mobile technology and portable digital assistants in a clinic to help in decision making and administration.
- The interactive opportunities for developing e-portfolios using social software are highlighted.

During the process of learning teachers and/or students interact with each other on a personal level. However, in e-learning the process is achieved through the intermediary of an information and communication technology (ICT) system or service. Descriptions of these ICT-human interface devices are given in this paper. Successful interaction depends not just on personal relationships, but also on understanding and the ability to use computers and communications equipment effectively. Interactivity, when using ICT, may as a result be different from that in a traditional classroom. The computer is the main man-machine interface and modulates people's ability to interact. Newer, mobile technology will extend the ability to interact in terms of time and place, as is illustrated by the use of portable digital assistants for dental teaching in clinics. The paper concludes that it is very important that both teachers and students should understand how to interact optimally with current and future ICT systems and devices.

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## INTRODUCTION

Previous papers in this series have suggested that, in a successful e-learning scenario, interactivity is a vital ingredient. There is always an important relationship between all those involved in the teaching and learning process, even if that relationship is mediated by a machine. In many respects it is the bedrock of education, for as Mason<sup>1</sup> observes – 'Interaction between learners and teachers has continuously been shown to provide cognitive benefits, as well as to assist in the effective and motivational aspects of learning'.<sup>1</sup>

However, it cannot be assumed that interactivity is purely concerned with personal relationships. In e-learning most of the relationships will be

mediated through ICT systems and services, in a situation that depends on the often-criticised man-machine interface.

Interactivity obviously exists in a traditional classroom setting and it is face-to-face and personal. Teachers teach and ask questions, students learn, give answers and interact amongst themselves. Some would see this as the strength of the traditional pedagogical methodology and its apparent lack as a weakness of its e-learning counterpart. However, writing about online university degree programmes at a university in the United States, Cannings and Tolley (2000)<sup>2</sup> state: 'online encourages a degree of community of practice and the level of reflection well beyond that found in students who participate in graduate school by attending weekly face-to-face classes'.<sup>2</sup> Their reason for this claim is the ongoing value of education which they characterise as 'the continuation of the dialogue in between any official synchronous online classes or occasional face-to-face meetings... a sort of 24/7 (twenty-four hours a day, seven days a week) type of presence that has not existed in education before'.<sup>2</sup>

Four types of communications have been delineated.<sup>3</sup> They are:

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- Teacher-to-student group
- Teacher-to-individual student
- Student-to-teacher
- Student-to-student.

The author also states that 'it is customary... to distinguish between "public" modes of interaction such as bulletin boards, emails or "open" chat environments; and "private" one-to-one exchanges such as individually addressed email messages'. The author then claims that the traditional classroom favours the teacher-student group model in which the limited opportunities for communications between teacher and an individual student are compromised by a 'lack of privacy and confidentiality'.

Student-to-student communication is also limited by constraints of 'time and place at which this type of interaction can take place.' There are both differences and similarities between the interaction inherent in face-to-face situations when compared with those mediated through ICT systems. It has been pointed out that: 'Even people we "know" in other circumstances may not interact with us in the same way within computer-mediated contexts. It is possible to change your identity online, and even your gender.<sup>13</sup> Furthermore, electronic learning spaces often encompass a greater range of participants than is customary within traditional classrooms.<sup>4</sup>

Further comments describe the way we represent ourselves in the physical world as including 'aspects of our appearance, our voices, our facial expressions, our clothes and other possessions, our chosen companions, and so on.'<sup>14</sup> On the other hand, 'where the self is revealed solely through electronic mediated text this richness of information is obviously not available.'<sup>14</sup> This observation does not take account of visual ICT media such as videoconferencing, where these personal traits and accoutrements can be seen and experienced, albeit at a distance.

Experience with videoconferencing suggests that any initial reservations about such a teaching method are quickly dispelled. In a report on the use of video in the delivery of continuing professional development for dentists, it was observed that 'students in the larger lecture group did... feel camera shy at first,

but as the presenter moved amongst the audience with a microphone, the discussion improved.'<sup>15</sup> It was also noted that 'The students were obviously interested and concentrated well. An attention span of more than 16 minutes was timed which compares well with the face-to-face lecture span of 9 minutes.'<sup>15</sup>

Some will argue that web-based distance learning causes persistent frustrations that inhibit educational opportunities,<sup>6</sup> such as:

- Too many emails, not all of which are read
- Difficulties interacting with technology and the web
- Lack of feedback and help from tutors.

This is a situation that has to be addressed by both teachers and learners through course design, training and support, all subjects which will be covered in future papers in this series.

### TALKING TO TECHNOLOGY

Although there may be a debate about the nature of relationships within e-learning, there is no doubt that both teachers and students have to interact with technology. The use of pen and paper – perhaps the historic technologies – may well appear simple, but are they, in reality, any different from the use of a computer? We might be more at ease reading a book rather than reading off a screen, but this may well be a cultural and generational factor, ie older people may be likely to be happier in a paper-based world than younger generations who have grown up with ICT.

For both teachers and students the ICT system that they most frequently interact with is the computer, although the use of internet-connected mobile devices is becoming pervasive. It may seem less natural and more complicated than putting pen to paper; as they have to have confidence in their abilities to use the intermediaries – the keyboard, screen and mouse. The importance of these man-machine interfaces is demonstrated in the words: 'At a more practical level, even factors such as the lack of expertise at keyboarding can have a marked effect on choice of words and structure of sentences, giving an "impression" of

the writer which might be significantly at odds with that obtained during a face-to-face conversation.'<sup>4</sup>

There is still debate as to whether or not the QWERTY keyboard is the best method of inputting text into a computer. Since 1874, this has formed the normal model for no better reason than it was the optimum arrangement to reduce typebar clashes on the first – manual – typewriters. Now it is the 'universal user interface.'<sup>7</sup>

The only other mode of inputting that has been tried is voice recognition. This has to some extent been the 'holy grail' of the ICT industry; much has been promised, but delivery has been difficult with the user having to 'train' the system, often talking like a robot to ensure accuracy of recognition. However, a voice response system in a call centre can be satisfactorily responsive to simple words like 'yes' and 'no' and numbers.

Voice or speech recognition is the ability of a machine or program to receive and interpret dictation, or to understand and carry out spoken commands. The human voice's analogue signals have to be converted into digital signals; to decipher these a computer has to have a digital database, ie a vocabulary of words and syllables, and a fast method of comparing this data with the incoming signals. The size of this vocabulary depends upon the computer's RAM (random access memory) capacity and the best systems have all words, syllables etc stored in the RAM rather than having to search the hard disk for some of the matches.

Nevertheless, total accuracy cannot be guaranteed. Extraneous noises such as coughs and barking dogs can lead to false input and there are problems with similarly sounding words such as 'here' and 'hear'. Despite these drawbacks voice recognition has some applications, notably as a security device for authorising access to banking services, and to buildings. Other uses have mainly been for 'repetitive data entry operations. This includes dictation of medical notes and case histories in the health sector, for which there is a *burgeoning market* (our italics).'<sup>8</sup>

Given that it enables hands-free operation of computers and other ICT systems and, in time, mobile equipment such as personal digital assistants and increas-



**Fig. 1** Touch screen smart phone with the functionality of a PDA and mobile communications with internet connectivity



**Fig. 2** Dental student interacting with flat screen monitor and keyboard in combination with more traditional media such as books

ingly smartphones (Fig. 1), chairside applications in both dental education and practice can be foreseen. Notwithstanding this, the question of whether voice recognition will replace the QWERTY keyboard as the main method of computer inputting remains open to doubt, particularly in the short and medium-term.

### OF MICE AND SCREENS

The ubiquitous mouse, in conjunction with the graphical user interface (GUI),

has made the control of and access to software programmes far more user-friendly than in the days when users had to remember the correct 'F' number. Similarly to the use of the QWERTY keyboard, it is the best option until voice recognition becomes more pervasive and user-friendly. Then this may well take over the control functions that are currently the preserve of the mouse.

The mouse has two functions, which are:

- Controlling the computer
- Controlling the software programmes on the computer.

A typical PC mouse system has the following parts:

- Sensors (eg opto-mechanical movement detectors)
- A mouse controller which reads the state of sensors and records the current mouse position
- A communication link
- A data interface
- A driver
- Software.

When information changes, the mouse controller sends a packet of data to the computer data interface controller. The mouse driver in the computer receives the data packet and decodes the information and directs the application software or operating systems.

Recent mouse developments are offering different data transmission techniques to reduce desk top cable clutter. Wireless – also used for keyboards – laser and even optical versions are now available, as are Bluetooth® models which can operate over longer distances.\*

e-Learners spend a considerable amount of time staring at a screen, with the potential danger of eye-strain. Fortunately, most modern screens have eliminated the annoying 'flicker' and with larger screen sizes and much improved text and pictorial display and background, user experience is much improved. In addition, monitor filters, such as privacy and antiglare filters, help to decrease computer screen glare and reduce viewing from the side.

Despite emanating from television, the more common computer display technology is the CRT (cathode ray tube), distinguished by its bulky importance.<sup>9</sup> Newer techniques such as liquid crystal display have led to the development of flat screens, which are rapidly replacing the CRT versions (Fig. 2). They also take up less space on a desk.

\*Bluetooth® is a short-range wireless specification that allows radio connection between devices including computers, printers, headsets and mobile phones as well as mice, within a 10-metre range of each other. Up to seven compatible devices can communicate simultaneously using Bluetooth.

A number of standards have been introduced for the resolution offered by monitors. These started with VGA (video graphics array), since when various versions have been developed to improve the screen resolution. VGA had a resolution of 640 × 480 pixels\* whereas the latest – UXGA (ultra-extended graphics array) offers up to 1,600 × 1,200 pixels.

The resolution of a screen is expressed as the number of pixels arrayed horizontally and vertically; thus, as stated above, the UXGA standard has a resolution of up to 1,600 × 1,200 depending on the number of colours displayed. Obviously the higher the resolution, the better the quality of the picture, but the perception of this naturally depends on the user's visual acuity with or without glasses.

Screen sizes are normally measured in inches diagonally from one corner to the other; the key factor in choosing a monitor is the viewable area, not necessarily the quoted screen size. It is also worth noting that the size of the viewable area affects the resolution. A low resolution on a larger screen will produce a fuzzy image, so large-size screens should have a higher resolution.

## APPEARANCE MATTERS

It may not be generally known that it is possible to change the settings of the interfaces to suit personal preferences and situations. This is particularly useful for disabled people, although altering the touch and feel of the computer can improve the man-machine interface for all users. As one website observes: 'Every computer user is an individual... Yet the computer we may spend many hours on each day is set up to meet the needs of an amorphous average person.'<sup>8</sup>

The website goes on to list typical changes that can be made to make the screen, keyboard and mouse more suitable for the user.<sup>9</sup> Included in the list are:

1. Making the text easier to see on the screen by imposing a preferred text size on any website visited
2. Changing the screen background colour or reversing text out of a black background

\*A pixel is the basic unit of programmable colour on a computer display.



Fig. 3 Screenshot of Second Life avatar page

3. In Microsoft's Windows XP there is a feature that makes locating the mouse much easier. The standard mouse pointer, the website advises, 'isn't very easy to see and many people find that they can't spot where it is located, or they lose it as they move it across the screen.'

## LOCATION, LOCATION, LOCATION

The other question that e-learning poses is where does the interaction take place? By its very nature it is unlikely to take place on a single site where everybody is co-located. More likely it will take place as various forms in cyberspace – virtual classrooms, bulletin boards, chatrooms and videoconferencing sessions. These impersonal methods may appear to lack the interactive advantages of a face-to-face situation. However, one opinion based on personal experience is that this possible downside 'has been partly overcome by the availability of chatrooms, emails and bulletin boards.'<sup>10</sup> In fact, research has shown that 'shrinking violets, who in normal circumstances rarely open up, often blossom in the Internet gardens.'<sup>11</sup>

In support of this, one commentator makes the point that 'online discussion can potentially be more engaging, more inclusive and perhaps more democratic than in face-to-face situations. Shy, less verbally articulate, slight of voice or slower responders can spend time

considering their responses before submitting them and have equal access when being displayed online.'<sup>12</sup>

This is supported by an evaluation of online learning amongst undergraduates in which it was suggested that 'cyberspace provided an easier mode for expressing one's feelings about a learning experience generally, and about online learning in particular.'<sup>13</sup>

## MOBILE INTERACTION

We have placed our emphasis on the computer as the main method for interfacing. However, the penetration and application of mobile technology means that the location may not have a desk. Evidence of this comes from a trial at a UK dental school, the aim of which was to evaluate the use of PDAs amongst undergraduate students. In this trial the point of interaction was at the chairside.<sup>14</sup>

The dental school's academic network was linked to a secure encrypted wireless network which connected to the PDAs. This allowed students to access a virtual learning environment (VLE) and, through it, appropriate teaching resources and material. These included text-based documents featuring teaching notes, illustrative images and textural extracts, PowerPoint presentations, PDF documents, instructional images, simple animations such as clinical procedures or patient safety/emergency procedures, and viewable webcasts. The WebCT

interface enabled students to send emails, post notes to a bulletin board and enter personal or clinical details.

As the PDA is a mobile device, all the interaction can take place at the chair-side, allowing the students to receive guidance while undertaking clinical practice. This also has major implications with the introduction of electronic patient records (EPRs) for these too can be accessed, consulted and updated via the mobile device.

The PDA proved to be a highly acceptable mode of access to online education; their small size and mobility enabled students to use them in a variety of learning activities such as note-taking, downloading materials and receiving ICT-based information. Positive responses from students, even those with limited ICT experience, and the time saved in record-keeping and note-taking indicate that a PDA-based approach to mobile computing is highly applicable in healthcare environments.

A mobile solution is also being sought in the completion of e-portfolios on- and offline using the 'm-portfolio'<sup>15</sup> The interactive potential of e-portfolios – the new digital identity – is discussed below.

## A MORE CONNECTED FUTURE

There is now an emerging literature on the socio-cognitive interactions and their assessment that will allow further evaluation of this new and clearly acceptable way of mobile interaction.<sup>16</sup> The authors make no distinction between technology and people but explore the dynamic interaction between those who are advancing 'knowing'. This 'conversational' process has a snowball effect between those in the dialogue as they grow their understanding within their own context.<sup>17</sup> With mobile learning there are new relationships between traditional and mobile learning in which global conversation has a central role. This is especially important as the new, more connected Web 2.0 facilitates such mobile communications.<sup>18</sup> The emergence of more social software such as 'Facebook', 'YouTube' and 'Second Life' is providing new interactive domains. The latter (<http://secondlife.com>) creates 3D personalised worlds where the players choose embodiments of themselves

(avatars) (Fig. 3).<sup>19</sup> Emerging immersive worlds will inevitably offer ever-new opportunities for interacting with people and places where the only limitation is the bandwidth, the software and the user's own imagination.

Furthermore, the development of haptic devices (gloves or jigs) will enable even more senses to be involved in this interaction. Virtual reality is discussed later in this series, but one key issue is the disorientation that can occur when using these devices. Motion sickness can also occur as part of this disorientation and this is well documented in 3D viewing.<sup>20</sup> However, whether it is pen and paper media or a human interface device of a computer mediating the interaction, once this interface becomes automatic or unconscious, the communication can occur freely. Assistive technology\* will inevitably help those users with disabilities and the world will become an ever smaller place.<sup>21</sup>

## REWINDING THE STORY

e-Portfolios are the latest, somewhat poorly-defined concept that has captured the imagination of educationalists. One general definition suggests that 'an e-portfolio is an electronic space for learners to store their work – to share with others and to show to teachers (and, sometimes) employers.'<sup>22</sup> Another, in the healthcare context states 'the ePortfolio is a purposeful collection of information and digital artefacts that demonstrates development or evidences learning outcomes, skills or competencies.'<sup>23</sup>

The potential to create a portfolio offers an interactive process, that allows the learner to 'collect, select, reflect, connect and project and present'.<sup>24</sup> Projection in this sense is the direction of the next steps to be taken and presentation of the e-portfolio can be submitted for assessment purposes.

Creating a personally-owned learning record through the use of multiple

media can now benefit from interactive social software such as blogging, wikis, podcasting and multimedia tools. 'E-portfolios help you to become the person you are to be.'<sup>25</sup> Even though there are challenges in interoperability between the many systems available, there is no doubt that interactive, student-focused log books will become essential in reassuring future employers and patients that the professional has a well thought-out and proven track record.

## CONCLUSION

For the successful use of ICT in dental education, it is essential that the importance of the factors influencing interactions between teachers, students and the different forms of ICT are understood and that the lessons that have been learned in this area are applied.

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\*Assistive technology (AT) is a generic term that includes assistive, adaptive and rehabilitative devices and the process used in selecting, locating and using them. AT promotes greater independence for people with disabilities by enabling them to perform tasks that they were formerly unable to accomplish, or had great difficulty accomplishing, by providing enhancements to or changed methods of interacting with the technology needed to accomplish such tasks.<sup>21</sup>

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