Higher Education (HE), Information Communication Technology (ICT) and Learning: ICT for replication OR innovation?

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Abstract

There is growing consensus that Higher Education (HE) institutions need reforms in order to meet the challenges of the Knowledge Society and its citizens[1]. As part of the ongoing examination of HE the role of teaching and learning is under scrutiny. In particular there is a strong emphasis on developing new ICT related pedagogy [2]. However in accepting that ICT provides opportunities for bringing HE less ‘conventional’ learning experiences, we must remember that “the model of good learning remains the same as it has done for centuries: we learn by doing and making, being guided gets us there quicker than guessing our way, we need delight, passion and a sense of audience to engage us with some sense of progress to stoke our self esteem”[3].

This paper examines three ICT tools being used in HE, namely Virtual Learning Environments (VLE), wireless laptop computers and robotics and asks whether ICT is being used to replicate what we already do or to innovate in manners to address issues raised in [1]. The use of VLEs in HE is rapidly becoming the norm while the spread of wireless technology is not far behind. The use of robotics, as described here, is a different approach to using ICT to support collaborative, constructionist learning. The analysis of all three technologies draws heavily on the authors’ experience over four years running an MSc in the area of Technology and Learning.

Models for online courses in HE include the Content + Support, Wrap-around and an Integrated Model [4]. Of these, the “Content + Support” is predominant in the Irish HE scene. Whilst affording advantages in terms of flexibility of time and place, sharing of resources etc., [5], it is very akin to traditional teaching – a static body of content, supplemented by tutorials and low online interaction [4]. This paper looks at how threaded-discussions within a VLE can be used to support higher order thinking (HOT).

One of the many ‘justifications’ that supports the inclination towards wireless laptop computers can be found in the distinction made by the German philosopher Martin Heidegger between things “present-at-hand” and “ready-at-hand”. While technology remains ‘imprisoned’ in computer labs and physically segregated from the learning environment the prospect of its utilisation in learning processes remains somewhat hindered. The authors recount their experiences of students having laptops “ready-at-hand”.

A less conventional, but we would argue, very beneficial way of using ICT in HE is through the use of programmable robotics [6]. This, when set in a constructionist paradigm, enables students to create and program artefacts which “can be shown, discussed, examined, probed and admired”. In effect, they exercise Knowledge Age Skills developing what Papert calls “an object to think with”[7]. The authors’ experience with this approach is recounted.

In conclusion this paper argues that we must look beyond the use of ICT in HE to support what we already do and progress to more creative ways of employing ICT for teaching-learning in HE.
Introduction

There is growing consensus that HE institutions need reforms in order to meet the challenges of the Knowledge Society and its citizens[1]. As part of the ongoing examination of HE the role of teaching and learning is under scrutiny. In particular there is a strong emphasis on developing new ICT related pedagogy [2]. However in accepting that ICT provides opportunities to bring to HE less ‘conventional’ learning experiences, we must remember that “the model of good learning remains the same as it has done for centuries: we learn by doing and making, being guided gets us there quicker than guessing our way, we need delight, passion and a sense of audience to engage us with some sense of progress to stoke our self esteem” [3].

This paper examines three ICT tools used in HE, VLEs, wireless laptop computers and robotics and asks whether ICT is being used to replicate what we already do or to innovate in order to address issues raised in [1]: ensuring quality learning for all, proving opportunities for adults’ continuous learning, financing lifelong learning and reacting to the increasing diversity of student populations and addressing teacher shortages.

The use of VLEs in HE is becoming the norm while the spread of wireless technology is not far behind. The use of robotics, as described here, is a different approach to using ICT to support collaborative, constructionist learning. The analysis of all three technologies draws heavily on the authors’ experience over four years running an MSc in the area of Technology and Learning.

This document is structured in five sections. The first section, presents pedagogical principles that inform the uses of ICT in HE advocated for here. The second, provides a definition of VLE. It highlights the most commonly adopted model in HE and discusses an example of how threaded-discussions within a VLE can promote higher-order-thinking (HOT). The third section, addresses the concepts of mobility and flexibility afforded by the integration of wireless laptops in teaching-learning processes at HE. The experience of learners with technology “ready-at-hand” is exposed and discussed. The fourth section, presents a less conventional use of programmable robotics in a constructionist paradigm at HE [6]. The authors’ experience with this approach, engaging students in the construction of artefacts that “can be shown, discussed, examined, probed and admired” [7], is recounted. The final section, highlights the need to look beyond the use of ICT in HE to support what we already do and progress to more creative ways of employing ICT for teaching-learning. Thus, it advocates for innovation rather than for replication.

Good Learning: Doing, Making, Being guided, Delight, Passion, Sense of Audience and Progress

Recent literature on ICT in learning emphasizes the imperative need to develop new methodologies and approaches to teaching-learning with ICT [1, 8, 9]. Not denying the manifest necessity for change in HE, these authors are not the sole to argue that the transformation is not one that leads to the development of new ICT methodologies but rather one of re-discovering and re-implementing good old learning methodology with the aid of ICT [3, 4, 10].

Tracking back the origins of ‘good learning’ would be a most interesting exercise nonetheless outside the scope of this paper. Instead, we propose to set this section within the context of the most significant shift in learning methodologies in recent times (from content to process) [4, 9, 11], and draw a parallel with the shift in terminology adopted to describe society (from Information to Knowledge Society). Thus, with current abundance of information, the role of the teacher is no longer that of the ‘sage on the stage’ imparting information but rather that of the ‘guide at the side’ facilitating the acquisition of transferable skills. Therefore, the emphasis is on students’ acquisition of synthesis, analysis and evaluation skills in order to engage with information to construct knowledge.
Against this background, a briefly outline of ‘old’ theoretical concepts informing our definition of ‘good learning’, doing, making, being guided, delight, passion, sense of audience and progress, will be presented.

Learning by doing and making has been the object of study of many theorists. For instance, Piaget emphasizes the learner’s doing to the extend of portraying learning as “the shock of our thoughts coming in contact with that of others” through interactions [12]. Likewise, Bruner within the context of Discovery learning and the specific instance of prime numbers, highlights the need for students to engage in doing (laying out handfuls of beans in completed rows and columns) and having a “construction that can be visualised” [13]. With the advent of ICT in the learning scene, authors like Jonassen [14] and Papert [15, 16], have incorporated doing and making to learning with technology. The aim is not that of changing learning but rather return to its essence by providing ICT tools that provide instances for real/deeper learning to occur.

Being guided is a proposition widely associated to Vygotsky. His conceptualisation of the Zone of Proximal Development (ZPD) is a mechanism to facilitate learning and get learners there ‘quicker’[17]. Similarly, Juwah [18] expanding on scaffolding needed in online courses classifies it into: conceptual (guidance on what to consider), metacognition (guidance on how to consider a problem), procedural (guidance on how to utilise information) and strategic (guidance on analysing and approaching a problem with strategy).

Sense of audience, indeed an audience, is what Piaget argues brings about the ‘shock of learning’ aforementioned. This view is supported and expanded upon by others [19-21] who discuss the benefits of making thoughts and feelings public. Papert, agreeing with the previous, accentuates the contribution of an artefact which “can be shown, discussed, examined, probed and admired” [7].

Delight, passion and sense of progress represent the most intimate processes of learning. Although well researched, the authors refer to the authority of the readers who have experienced them.

**Virtual Learning Environments (VLEs): Technology “Present-at-hand”?**

Models for on-line courses in HE include the Content + Support, Wrap-around and an Integrated Model [4]. Of these the Content + Support is predominant in the Irish HE scene. Whilst affording advantages in terms of flexibility of time and place, sharing of resources etc., [5], it is very akin to traditional teaching – a static body of content, supplemented by tutorials and low online interaction [4].

The adoption of VLEs in HE is significant with some institutions implementing more than one system [22, 23]. Technically, a VLE is software based on client-server architecture. VLEs are characterised by the integration of tools and resources that facilitate the management, administration, coordination, development and distribution of learning activities. Furthermore, they facilitate communication and collaboration among participants [24]. The main functions of VLEs can be categorised into access and content management, resources and materials, communication and user tracking.

The object of this section is not the undeniable efficiency gain of VLEs (automating existing processes) but rather their potential to innovate by enhancing teaching-learning processes. In particular, to present the use of asynchronous discussion tools within a social-constructivist
framework to promote HOT through discourse, extend face-to-face initiated discussion to a VLE\(^{1}\) and enable students in high-level use of asynchronous discussion formats.

To achieve the aforementioned objectives, pre-requisites and perspectives were identified. These include students’ familiarity with VLEs, awareness of the benefits of the activity, acknowledgement of the relevance of the social aspects in a community of learners and appreciation of the fundamentally different nature of discourse through an asynchronous text-based system and traditional face-to-face. Noting that the course under discussion is face-to-face and the VLE was not the sole point of contact, unlike in distance education, is important.

The model adopted for the use of the discussion board was that of E-Moderating [25] which discusses five levels of adoption within a hierarchy: Access and Motivation; Online Socialization; Information Exchange; Knowledge Construction; and Development.

Initial threads were based on Socialisation and used to familiarise students with the system. The appearance of additional threads demonstrated that students were advancing into Information Exchange by sharing resources and links. The tutor’s role in this development was limited to peer-interaction and encouragement nonetheless, to facilitate HOT a different strategy was adopted.

Subsequent to a face-to-face discussion on uses of Computer Mediated Communication (CMC), students were encouraged to continue the discussion through the online forum. To ensure participation each student had to respond to the tutor’s initial post, and to another student’s. Active tutor-moderation informed on principles and strategies by [25, 26] was enacted. While accepting the compulsory nature of this exercise could have led to lower level discussion, it was considered vital to ensure students’ participation. In dead, it made them reflect on and formalise their initial scepticism “I’m really curious how many will post here, as (the tutor) made it nearly obligatory. I don’t like that”.

Throughout the debate students exhibited reasoned reflection, “Nobody knows the complete truth, but together we work out a better understanding for each of us....we really construct knowledge”; “Isn’t it ironic, the first knowledge we construct is on knowledge construction?”; “At least for one discussion we are getting to the next level (Knowledge Construction)!!!!!!”. Additionally students gained in confidence with presence “I used to be a 'lurker'; checking everything out and having an opinion but too shy to express it. I’ve found this arena a nice place to test out the nature of this communication and have since posted on other boards”.

Interestingly, the discussion caused many students to reflect on the course as a whole and analyse the reasoning behind the tutor’s actions “Would we have proceeded in due course to the next level - if we 'evolved' through three stages without prompting would the process have continued naturally on its own? Has (the tutor) despaired of us and felt we need a push?”

**Ubiquitous Technology: Technology “Ready-at-hand”**

A ‘justifications’, among many, to emphasise the implementation of wireless laptops or portable mobile devices as learning tools is found on the distinction made by Martin Heidegger between things “present-at-hand” (present but not available for work) and things “ready-at-hand” (available, within one’s reach and utilised). The previous, a reflection of the predominant computer-lab model in Irish HE the latter, a step forwards the adoption of ICT as a learning tool.

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\(^{1}\) The particular VLE used was WebCT.
The reflections of students with technology “ready-at-hand” (lightweight portable devices), in and out of class, undertaking a MSc in IT in Education corroborate the above: “no problem working weekends…I was not depending on labs to be open”; “the major advantage is that my work is always with me and more importantly is always ready to go”; “no time wasted travelling to and from the computer lab”, “I never left home without it (laptop)...it’s a permanent addition to my bag and should never be left behind”. Nonetheless, in the ‘mobile arena’, technology “present-at-hand” abounds: “One disadvantage, carrying the laptop, mine was not as sleek as they can be so it could be cumbersome to carry”; “my laptop was very heavy. I was not interested in carrying it around at all…I rarely brought it”.

On how they facilitate autonomous, learner-centred approaches a student reflected: “Having the huge range of online resources available at my finger-tips I think made it easier to solve my own problems and hence make progress more quickly rather than waiting for someone in the department to get back to me - after all there are far fewer people in this building than there are people and answers online”.

Bringing to the fore the intrinsic flexibility and unity of learning processes, by eliminating ‘artificial’ divisions such as lecture, tutorial, seminar, practical, was facilitated by “ready-at-hand” technology: “It makes for a more free flowing experience. You can action ideas straight away...you can research, communicate, download, upload, program...”; “I could look up topics on the Web as they were introduced, and annotate the slides in ways that wouldn’t be possible on paper”; “I found it very useful for looking up things that I didn’t understand while the lecture was on”. Even when unaware of its benefits students suggest them: “It didn’t have a major effect on how I approached learning only made it easier...I was more willing to try out examples/tutorials on subjects I was learning”.

On the physical location where learning occurs students commented: “I love my laptop...I can move it to any space I want to work in”; “The ability to bring your work anywhere...from back of a Dublin bound train”; “I have used this machine more than any other I ever used before in my four years as an undergrad computer scientist... at home...on the train...in the library...”. The confinement of learning to a physical location/institution is an ever disappearing reality. In acknowledging that a central site is core to the learning process in terms of community building, the prevalent view on the design, planning and provision of the facilities must be reviewed. The influence of ‘clicks on bricks’, highlight that ‘bricks and clicks’ cannot longer continue to be distinct budgetary lines [9]. In order to maximise resources and investments we need flexible non-predetermined environments so that the lecture theatre can become the computer lab and vice-versa. In fact, the concept of ‘hybrid learning environments’ is one that we propose.

**Programmable Robotics: A “Ready-at-hand” “Object to Think With”**

A less conventional use of ICT in HE is programmable, Lego, robotics [6]. When set within a constructionist paradigm it enables students to create and program ‘objects to think with’ [15], thus rooting the learning experience in making, sense of progress and audience.

Constructionism, ICT-enabled making, argues that “the construction that takes place in the head often happens especially felicitably when it is supported by construction of a more public sort in the world” [16], by way of creating a product that “can be shown, discussed, examined, probed and admired” [7]. The constructionist “cycle of internalisation of what is outside, then externalisation of what is inside and so on” [7] incorporates two complementary ways of thinking: the abstract and the concrete. While the construction of an artefact produces understanding through interpretation, understanding produces artefacts through the construction of a tangible representation of that same understanding.
The use of programmable robotics at HE with technical students is not unusual. The unconventional nature of the approach presented here does not lay on the technology neither on the programming, but rather on the objectives underpinning the learning experience. Thus, the overarching aim is building understanding about constructionism as applied to learning-teaching processes through a first person experience. In addition, students engage in reflection on their own ICT-enabled learning experience.

The module consists of four four-hours sessions during which students are briefly introduced to the technology, provided with their own kit and asked to dive into the seas of constructionism by firstly, building a cart; secondly, collaboratively completing tasks of increasing difficulty; thirdly, completing an assignment: build an "object to think with" that interacts with its environment and digitally express your reflections on the process as a learning experience; and finally, publicly demonstrating their artefact. Examples of artefacts are a robot that teaches concepts of probability, a coin sorter, and a robot-dance teacher to mention but a few.

The process is entirely aim at promoting and developing skills of synthesis, analysis and evaluation with a strong emphasis on meta-cognition. The following students’ reflections provide a snapshot of the experience.

On making, students’ associated the experience with “going back to my childhood and playing”; “working in a tactile fashion was something that I quite liked”. The challenge at this stage was knowing “what I was going to do with this enormous box of Lego”. But as for its validity at post-graduate level, students were “very sceptical that it could be a learning experience”.

On doing, students became aware of their learning preferences and reflected: “The first session I was in a team of three and I became very aware that different people have different approaches to things. I became pointedly aware that I was stuck in a particular place…I was not a dive in and see what happens kind of person I would like to suss it out first and then see does it work”.

On being guided, as well as the facilitation of the lecturer, the students reported on peer “I was able to sit back and let someone do it in their way” and family scaffolding “My eldest 16 year old son offered to give me a hand”. When in need of further help “basics for me that were not on the program” participants also “went the traditional route and I went into the library”. The guidance provided by the software itself and immediate feedback of cart when the programme was run were also pointed out, “I did find the whole programming side of it quite intuitive, the blocks, it is a very easy interface to use.” ; “programming, testing, reviewing, coping on to what was wrong having a go off it again”.

On delight and passion, sense of audience and progress, “It was a great sense of achievement as others have said when it was finished and it actually worked and I certainly think my logical thinking skills improved and I could hear them being oiled up and the rust beginning to disintegrate.”; “I am one of the non-programming types and I am so intimidated by all the wonderful stuff I am seeing”.

**Discussion and Conclusion**

The pervious sections provide a brief discussion and definition of learning processes the authors adhere to. Moreover, they recount the experiences of a group of lifelong learners (students and lectures) for whom ICT is a learning tool. This section, analyses the previous considering the educational areas in need of urgent action to meet the demands of the Knowledge Society. Thus, ensuring quality learning for all, proving opportunities for adults' continuous learning, financing
lifelong learning, reacting to the increasing diversity of student populations and addressing teacher shortages [1].

Starting by what ICT will not assist with, it will not contribute to the shortage of teachers. Common misconceptions of online learning as a means to lower costs and higher numbers has lead to poor replications of traditional teaching: transfer of content online. Nonetheless, quality online learning to promote Knowledge Society skills, as the VLE experience exposed here, raises demands on teaching staff with longer hours and increased student interaction [9, 23].

ICT will neither provide quality learning for all, by its mere existence it will not replace content-based by process-based instruction. Good/quality learning will come about by practice informed in good learning principles, this paper outlines but a few. Technology “ready-at-hand” will enable learners and teachers alike to return to the essence of learning and to free themselves from the artificial constraints imposed by highly structured educational systems. It will enable learners to engage in knowledge construction process as the ones presented here.

Technology, in particular technology “ready-at-hand” does provide opportunities for adults’ continuous learning and lifelong learning. The experiences discussed here ratify so; people with full-time occupations and commitment to continuous learning learn anywhere/anytime in a more efficient and often more felicitous manner when adopting ICT as a learning tool.

Financing of learning, in particular the design, planning and provision of facilities should already by influenced by technology “ready-at-hand”. Wireless portable devices allow for the design of non-dedicated flexible learning spaces and resources. Thus, desks and chairs should not hijack learning spaces neither should technology be “present-at-hand”, imprisoned behind bricks and mortar. Hybrid learning spaces are a solution to financing issues in relation to clicks and bricks.

Recapitulating, this paper only aims to add to the ongoing dialogue on the imperative changes HE must undertake in order to meet the Knowledge Society requirements. It exposes the authors’ experiences and vision in terms of the adoption of ICT as a “ready-at-hand” learning tool. In addition, this document hopes to propose possible avenues in the integration of ICT in learning process. In doing so it intends to contribute to the ‘electric-shock treatment’ Donald J. Johnston, Secretary General of the OECD, suggests is necessary before reforms are even considered [1]. It is the authors’ contention that we must look beyond the use of ICT in HE to support what we already do and progress to more creative ways of employing ICT for teaching and learning.

References: