

1. Understanding e-learning

Ideas in student learning

E-learning is defined by the Institute of IT Training as *'the delivery of learning with the assistance of interactive, electronic technology, whether offline or online'*. 'Electronic technology' at the present time includes the internet technologies such as email, web pages and conferencing, along with computer-based learning tools and resources, computer-based assessment tools, and computer-based management systems such as virtual learning environments.

Most staff in tertiary education, however, would be unhappy with the notion of learning as *'delivery'*. While the IITT definition may be adequate within their focus on professional training, a more sophisticated model of learning is needed if we are to develop an adequate understanding of how *'electronic technology'* can best be used to help adults achieve their learning goals.

Three key ideas in student learning have gained currency in recent decades: constructivism, communities of practice (or social constructivism), and learner differences (sometimes called 'learning styles'). These are explored below, along with their implications for learning with electronic technologies.

Constructivism

Constructivism originated in the ideas of Jean Piaget to account for the way in which children acquire cognitive abilities in an apparently regular order. Piaget theorised that children are engaged in actively constructing theories about how the world around them works. These theories or mental models are gradually enriched by new information. Sometimes, however, new information cannot be accommodated within existing models and an entirely new model needs to be built. These moments create sudden 'paradigm shifts' or very rapid changes in cognitive capacity.

There are currently many different versions of 'constructivism' in use. Most learning theorists would agree with the quotes to the right and with these three key ideas.

Mental models

Learners do not acquire information simply by reproducing it internally, but by trying to fit it into their existing frameworks of understanding. If their current frameworks cannot accommodate the new information they will actively try to develop new ones.

Notice that the 'mental models' is a theory about how *all* people learn, *all* the time. It is not a description of a certain kind of learning, e.g. 'deep' as opposed to 'surface' learning. Piaget would deny that the human mind *ever* simply reproduces information as a computer does when it copies files from one place to another. However, it is certainly the case that learners can be motivated to change their models of the world more or less profoundly. New information may simply be accommodated in existing schemes of thought, or it may be used to make paradigm shifts and leaps of understanding.

Scaffolding

'Paradigm shifting' can lead to very rapid learning, but is also a risky process because it means abandoning old ways of viewing the world in favour of new and perhaps untried models. The notion of scaffolding is useful, because it describes how new models of the world can be introduced to students gradually, and in a way that lessens the risk. Most teachers intuitively introduce new ideas in a progressive way, using small steps to challenge students' existing theories and to help structure the new mental models that they will need.

Constructivism is the idea that a student is an active learner who constructs a personal base of knowledge and understanding. In other words, the student does more than just 'discuss' a topic. The student actually does something: that is, creates a product for delivery to the teacher, classmates or others. Requiring students to do something not only provides the opportunity to create something that might be useful to others, but also presumably increases the depth of learning by the student who produces the deliverable.

Klemm & Snell (1997)

Rather than behaviours or skills as the goal of instruction, concept development and deep understanding are the foci (...). Learning from this perspective is viewed as a self-regulatory process of struggling with the conflict between existing personal models of the world and discrepant new insights, constructing new representations and models of reality as a human meaning-making venture with culturally developed tools and symbols, and further negotiating such meaning through cooperative social activity, discourse, and debate.

Fosnot (1996)

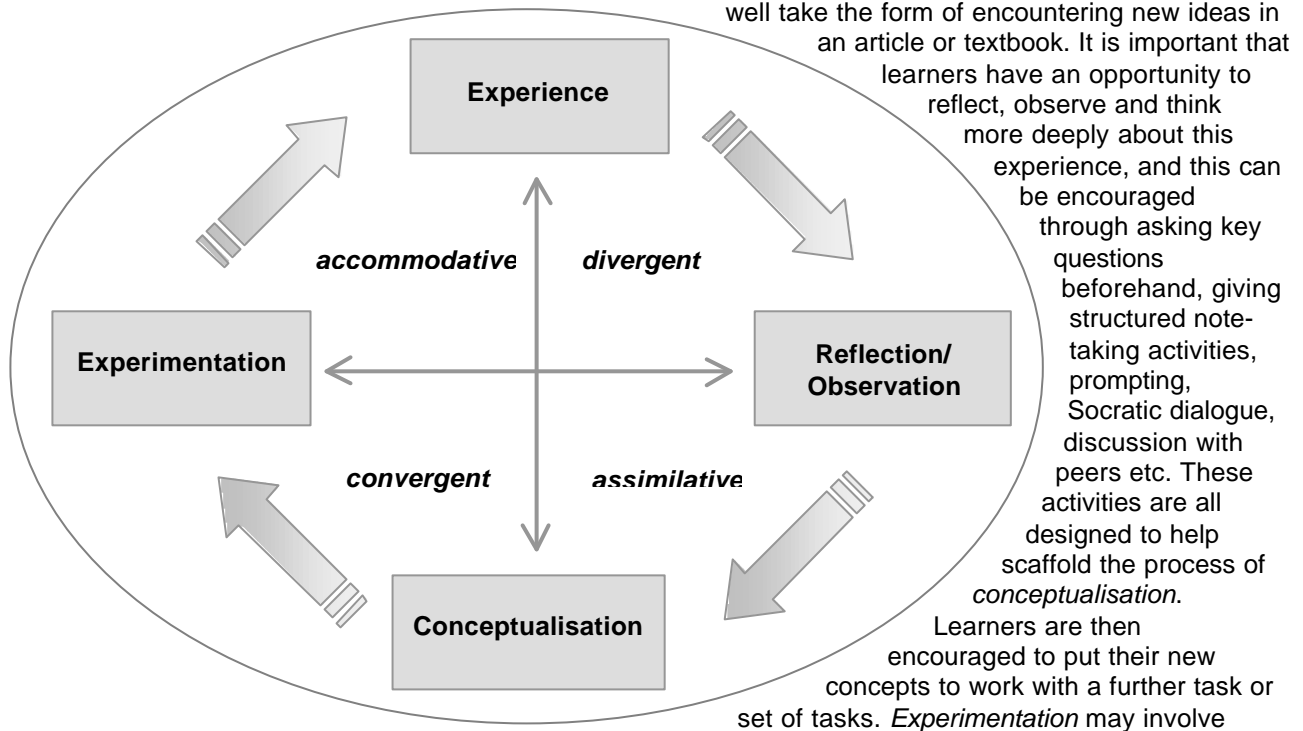
Information design

One way of interpreting the need for scaffolding is to attend to the way in which information is presented to students – its graphical or other forms of representation, its ordering, and the way in which students can navigate around the informational text. Theories about how information design affects student learning are extremely important in the design of learning materials (often called instructional design). However, many educational theorists and practitioners believe that the process of interaction between learners, their peers, and their teacher is at least as important in scaffolding learning as the way in which learning materials are presented.

Activity

All constructivist thinkers would agree that learning only takes place when the learner is engaged in some activity. This does not mean they must continually leap up from their desks to encounter the ‘real world’ that exists beyond the classroom (though at times this can be helpful!). It does mean that intellectual activity is required.

The Kolb Learning Cycle (see below) is a useful way of thinking about active learning. A learning *experience* may take place on a field trip or in an laboratory, but can equally well take the form of encountering new ideas in an article or textbook. It is important that



learners have an opportunity to reflect, observe and think more deeply about this experience, and this can be encouraged through asking key questions beforehand, giving structured note-taking activities, prompting, Socratic dialogue, discussion with peers etc. These activities are all designed to help scaffold the process of *conceptualisation*.

Learners are then encouraged to put their new concepts to work with a further task or set of tasks. *Experimentation* may involve

laboratory work in the traditional empirical sense, but is far more likely to involve testing out new concepts by re-presenting them, perhaps in the form of an assignment, a project, a web page, or an oral presentation to the rest of the class. What matters here is that there are opportunities for learners to receive feedback on their new mental models.

Practical approaches that have evolved from constructivist theory include problem based learning, experiential learning, work-based learning and action learning. All of these involve some version of the learning cycle and the notion of meaningful activity as the basis of learning.

Social constructivism/Communities of practice

One influential form of constructivism originated with a Russian psychologist called Lev Vygotsky. Followers of Vygotsky note that a problem with individual constructivist theories like those of Piaget and Kolb is that they fail to take account of the fact that learning takes place in specific social contexts. Learners are not – or not only – objective scientists setting out to test their ideas through experimentation. They are also social beings, trying to make sense of the learning situation, to meet (or perhaps to challenge) the expectations of their tutor and peers, and to feel valued as a person.

Social constructivists are therefore always interested to know how learners have the opportunity to negotiate the meaning of their learning with their tutor and their peers. This does not mean just that there are ‘opportunities for discussion’ but that the learning experience is built around social interaction and shared tasks. Some of the following ideas are important in this approach.

Communities of practice

The idea of communities of practice originated with Lave and Wenger. A community of practice is any group of people – large or small – with shared goals, understandings, values, rules and practices. The legal profession, for example, is one community of practice. Law students are not simply learning lists of case histories, but are learning to behave like a member of the legal profession. They are acquiring new identities as lawyers. Much smaller groups such as student project groups can be seen as communities of practice in microcosm, evolving their own rules of behaviour, divisions of labour, and ways of talking about the problem at hand.

The notion of communities of practice has been widely used to analyse and research online learning. This may be because in the face to face classroom, many of the shared assumptions and rules are taken for granted. For example, the teacher may be marked out as an expert and a particularly important member of the group by standing at the front while the rest of the class sits facing forwards. Rules such as 'don't speak while the tutor is speaking' or 'try to answer the question when the tutor looks your way' may seem too obvious to be spelled out. This is not the case with learning online.

Participation

Like constructivists, social constructivists see learning as requiring activity, but they would say that the activity must involve a sense of a shared goal and a shared understanding of what it means. This does not mean that all learning takes place in groups – though collaborative learning is very important in this approach. It does mean that there is a notion of the wider social significance of what is being practiced and learned, as for example in the case of the law student who is becoming a member of the legal community. The legal community is not actually present in the classroom, but it is notionally present in the form of its various languages, texts, practices and rules, and these are a significant aspect of the learning context.

Learners enrolled in e-learning courses that are delivered entirely at a distance will have a very different sense of their 'learning community' from students who can meet other members of their peer group and institution face to face. Establishing a sense of online community, and of participation, is therefore of primary importance in supporting e-learners.

Shared meanings

Some theorists are happier with the notion of shared meanings than the notion of mental models. After all, it is impossible to access or compare 'mental models' directly. However, it is usually possible to find out whether you have a shared understanding of a particular issue when you try to discuss or act upon it with other people. Shared, participatory activity is seen as essential to participation and therefore to learning. This does not necessarily mean that students' existing ideas are given the same status as the 'official' ideas of the tutor, the text book or the experts. It means that there is a process of negotiation around shared tasks, during which the role of these 'official' ideas can become clearer. One outcome may be that the learner takes on board these ideas and practices, and becomes committed to them. Another may be that the learner continues to challenge the new ideas, but from a more informed perspective.

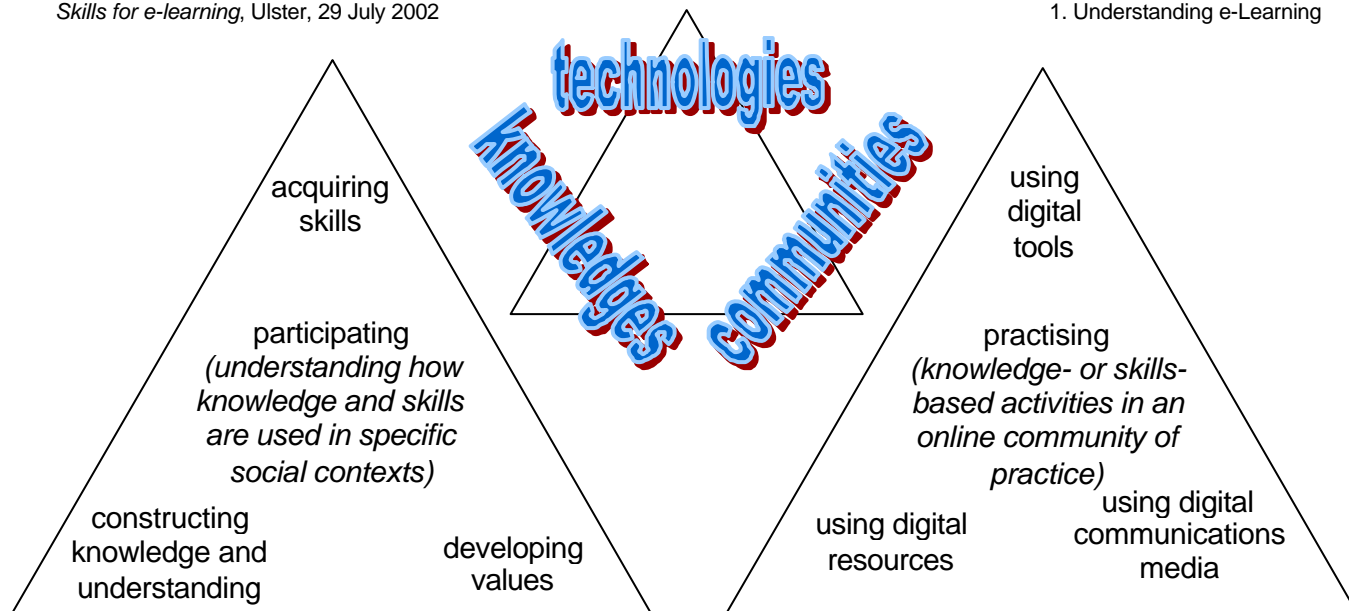
Dialogue

Again, dialogue is not to be confused with 'discussion'. Dialogue (from the Greek meaning 'other', not 'two' as is commonly supposed) involved an encounter between different frameworks or sets of ideas. Ideally a third idea or synthesis emerges from the process. Typically a dialogue takes place between a learner and a teacher, or a learner and a peer, leading to a shared understanding of the matter at hand. However, it can also take place between a learner and a set text, a hypertext, or an interactive document. This depends on the learner having the skills to read interactively and being prepared to criticise ideas presented by tutors or learning materials.

Translating learning theory into e-learning practice

The following diagrams (see over) show a simplistic outline of the learning process that takes into account many of the issues discussed above. Learning is seen as involving three processes – acquiring *skills*, constructing *knowledge* or concepts, and developing *values*. These correspond roughly with the use of *technologies* (understood not only as involving computer-based technologies but a wide range of tools including reading and writing); the use of *knowledge resources*; and the negotiation of shared meanings and values as a member of a learning *community*. In an online or e-learning environment the same processes will take place but will now involve using specifically computer-based tools, accessing digital knowledge resources, and participating in computer-mediated or online communities.

Looked at from a technical point of view these processes might seem to be separate. In practice, however, they are always integrated into shared knowledge- or skills-based activities in an online community of practice.



Learning processes

E-learning practices

Increasingly e-learning is also taken to mean using computer-based systems to manage the whole learning process. Virtual learning environments, for example, allow students to be allocated to seminar and discussion groups (*communications*), given access to specific digital *tools* and *resources*, and assessed online. Managed learning environments operate at the level of the institution rather than the course or programme, allowing integrated management of student records, assessment outcomes, library resources, information gateways, timetabling and other information systems. These higher level systems, however, are largely administrative in their impact. Effective e-learning within these systems still demands attention to how electronic tools, resources and communications media are *used* for specific learning *activities* or forms of participation.

Learner differences

So far the learning theories discussed have tended to deal with aspects of learning that are common to all, but in practice it is the differences among learners that demand the greatest ingenuity and flexibility on the part of teachers. Learners have never been a homogeneous group, but as participation in tertiary education is extended to a larger proportion of the population, and as new forms of participation become available (such as online learning, open and distance learning, continuing education, work-based learning and so on) it becomes even more important to be aware of learner differences.

Honey and Mumford's learning styles classification (based on Kolb's learning cycle)

- **Activists like to engage quickly in practical or conceptual activity, tend to learn from their mistakes**
- **Reflectors like time to reflect and make considered responses to new information**
- **Pragmatists like opportunities to try out what they have learned and understand its practical relevance**
- **Theorists like to explore conceptual structures and interact at a conceptual level**

There is, however, considerable controversy about the now widespread notion of 'learning styles'. Most diagnostic tests are based on learners' self-reports and prove to be much less consistent in practice than their developers would like to believe. 'Learning styles' are particularly suspect when they are used to mean fixed psychological categories that individuals are powerless to change. It seems more likely that individuals have access to a range of learning styles to suit different demands, and that they can learn to extend their range given sufficient exposure to alternative resources and appropriate encouragement.

Prosser and Trigwell (1992) talk about 'approach to learning' rather than learning style. This is dependent on a number of factors including prior experience of learning, features of the learning

situation, and how the learner perceives or makes sense of the learning situation.

Two of the most commonly used learning styles inventories are summarised in these two boxes. The OtiS handbook on e-learning (see references) looks at these and others in greater depth. The main issue with learner differences, however, is understanding how to accommodate them. With the increasing emphasis on access and inclusion in adult education, it is more important than ever to ensure that learners are not marginalised by particular forms of representation, activities or styles of interaction. With ever larger classes, however, it is harder to individualise provision for particular learners.

The VARK inventory refers to the mode of information/communication preferred by the learner

- **Visual learners work best with graphical representations**
- **Aural learners work best with the spoken word, and may be musical**
- **Read/write learners work best with written texts**
- **Kinesthetic learners work best when they can practice physical skills**

Multiple representations of learning content provide one means of ensuring that a range of possible learning approaches are accommodated. This means including graphs, diagrams, animations and simulations and other forms of non-textual content where possible. It also means being aware of how students with poor writing (or typing!) skills may be excluded in asynchronous discussion environments which are heavily biased towards text. Another possibility is ensuring that learners have a range of different possible routes through a particular task or set of materials. Collaborative work can help students play to their own strengths and weaknesses while being exposed to alternative approaches by their peers.

Supporting e-learning

Having identified some theoretical issues, and drawn an outline model of the learning process, there remains the difficult question of how teachers and other educational professionals can actually support students in their learning.

One particularly influential textbook on the transition to online learning is Diana Laurillard's (1993) *Rethinking University Teaching*. Her conversational model of student learning is more complex than the one outlined here, but her account of the practical implications for teaching strategies is useful and relevant.

A teaching strategy must address students'

- Conceptions of the topic – including their misconceptions
- Representational skills – students must be able to practice representing their knowledge of the subject area, in whatever symbolic systems are appropriate, and interpreting and manipulating the representations of others.
- Epistemological beliefs – students' meta-awareness of how knowledge in their subject area is arrived at and represented, their conceptions about (their own) learning processes, and their ethical awareness.

(Adapted from Laurillard p.47)

Laurillard also offers a way of thinking about different aspects of the learning process in terms of student and tutor roles. This can be particularly helpful in an online learning environment where cues about appropriate behaviour are lacking, and there is no physical classroom or timetable to structure interactions. It is also useful to think about the online dialogue in terms of the learning process – i.e. what learners seem to be doing at the time – rather than in terms of your own plan for teaching. In practice many aspects of learning will be happening at once, so it is better to be responsive than to insist on keeping different aspects of the learning process separate, however convenient this might seem!

Aspects of the learning process	Student's role	Teacher's role
Apprehending structure	Look for structure Discern topic goal	Explain phenomena Clarify structure Negotiate topic goal
Integrating parts	Translate and interpret forms of representation Relate goal to structure of discourse	Offer mappings Ask about internal relations

Acting on descriptions	Derive implications, solve problems, test hypotheses etc to produce descriptions	Elicit descriptions Compare descriptions Highlight inconsistencies
Using feedback	Link teacher's redescription to relation between action and goal to produce new description	Provide redescription Elicit new description Support linking process
Reflecting on goal-action-feedback cycle	Engage with goal Relate to actions and feedback	Prompt reflection Support reflection on goal-action-feedback

(Adapted from Laurillard p. 86)

Note that Laurillard's is essentially a cognitive model. Her 'aspects of the learning process' are particularly useful for understanding how the learner constructs new forms of knowledge, and how the teacher can support or scaffold this process. They are also useful for understanding the acquisition of skills, particularly the general cognitive skills of learning. They are less appropriate for understanding how learners develop their roles, values and identities through participation in meaningful communities of practice.

Finally, Laurillard writes about different categories of educational media, or as we might now call them, different learning technologies. Although her book is now nearly ten years old, it is still possible to apply her classification system to the technologies available today. This is because her ideas are based on fundamental theories about how students learn, rather than on the particular methods of teaching that were available at the time of writing.

In fact most of these categories can be applied to most technologies, depending on how they are being used. It might be interesting to think about how an asynchronous text-based discussion forum could be used in ways which were alternatively discursive, adaptive, interactive, reflective and descriptive.

Discursive	Both teacher's and students' conceptions are accessible to each other Both topic and task goals can be negotiable Students can act on, generate and receive feedback on descriptions Teacher can reflect on students' actions and descriptions and adjust their own descriptions to be more meaningful to the student
Adaptive (by teacher)	Teacher can use the relationship between their own and student's conceptions to determine task goals for the continuing dialogue (in the light of previous interactions)
Interactive (at the level of actions)	Students can act to achieve task goal Students receive meaningful intrinsic feedback on their actions relating to the nature of the task goal (i.e. something in 'the world' must change observably).
Reflective	Teacher can support the process by which students link feedback on their actions to the topic goal i.e. link experience to descriptions of experience Pace of learning can be controlled by the student, taking time for reflection when appropriate

Based on Laurillard p. 100

To this we would probably want to add:

Descriptive	Teacher's conception is presented in a way which takes account of students' learning approaches, styles and prior conceptions (including likely misconceptions) Different representations of the same topic are available. Students have flexible access to representations.
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In practice, most e-learning still takes place in a hybrid learning environment, with face to face teaching as an alternative. This means you can play to the strengths of the different scenarios.

e-Learning activities

The basic message of the theories examined so far has been the importance of activity and interactivity, whether learners are operating in a face to face or in an electronic learning environment. This final section looks at how to design learning activities that go beyond the basic web-page-and-discussion-forum approach to e-learning.

There are important differences between e-learning in an open and distance learning paradigm – i.e. where there is a minimum of face to face contact with tutors and peers – and e-learning in an enhanced classroom model, where much of the interaction still takes place off-line. In particular, open access learning can provide great flexibility to individuals at the expense of working closely with a cohort. At the furthest extreme, allowing learners to work through materials at their own pace obviously limits the value of interaction with peers – who will be working at a different pace – and the possibility of collaborative activities. Research has found that learners who prefer this approach are often impatient of discussion and collaboration which they see as an extra burden with little pay-off.

An asynchronous discussion forum, in which activities and discussion topics are set on a weekly or fortnightly basis, allows for a cohort to progress together through a course, benefiting from peer discussion and collaboration, but contributing at times that suit their personal schedule. This approach can be used in either the open and distance learning or the enhanced classroom paradigm. Particularly in the latter case you will need to be very clear about:

- why the activities are taking place online (from the learners' point of view!)
- what the specific learning benefits are
- how the online activities will be assessed
- how the online activities will be integrated with the rest of the course.

Returning to the categories derived from Laurillard, it is possible to divide e-learning activities into discussion, task-based activities, feedback/reflection, and description.

Discussion

Informal discussion rarely engages learners with the actual course, though it can be useful as an icebreaker and to build a sense of community among groups that rarely meet face to face. Most e-learning practitioners set aside a separate area such as a 'café' or 'common room' for this kind of interaction. Tutors are sometimes excluded from these areas.

For effective engagement and participation, it is important to structure discussion around a specific topic (preferably controversial) and/or make sure it has a tangible end result such as a web page summary. Learners can also be encouraged to select their own topics for discussion. The LTSN Generic Centre handout number 3 on Computer Mediated Conferencing offers a wide range of suggestions for structuring online discussions to achieve specific learning outcomes. There are a range of digital communications media besides text-based conferencing, including video, audio and data conferencing, which you could also consider.

As outlined above, the purpose of discussion in learning is to enable the negotiation of shared meanings, and for learners to challenge their own and others' understanding. This is most effective when discussion takes place around tasks with shared goals. Even if learners are pursuing these tasks individually, they can be encouraged to discuss their approach and evaluate it against the work of others.

Task-based activities

Task-based activities typically encourage learners to research a topic area in more depth, practice skills, and/or to re-present aspects of the topic area in a new form such as a web page, a multimedia presentation, the solution to a problem, or a written report. If carried out collaboratively, many such activities can incorporate discussion. Work in progress can be shared and commented on, hypotheses can be constructed and challenged, references can be shared, and research tasks can be allocated to different team members according to their strengths.

Facilitating discussion in online environments requires a specific group of skills which overlap with, but are not the same as, the general skills of supporting learners (see for example the list of activities under 'Teachers' Role' in the table on page 5).

In Salmon's five-stage model, as well as supporting the explicitly educational activities of exchanging information, constructing knowledge and personal development, the e-moderator supports learners in

- ***gaining access to the learning environment***
- ***being motivated to participate***
- ***becoming socialised as a member of the online group.***

Once learners are confident participants with the tutor acting as facilitator, they can be encouraged to take on aspects of the facilitation role themselves, for example:

- ***summarising and synthesising discussion points***
- ***providing references to new information***
- ***asking questions and challenging***
- ***clarifying contributions of others***
- ***introducing new ideas***

Making these functions explicit helps learners to take responsibility for their own and others' learning.

Activities which make a virtue of the online environment include

- collaborative web-based research
- practicing the use of computer-based tools (e.g. databases)
- exploring digital models or simulations

In problem-based learning approaches, learners determine their own task-based activities within the requirements of the problem to be addressed.

Feedback/reflection

A frequent objection to the use of online discussion is the amount of tutor time that is taken up in giving feedback. If feedback is given immediately to every contribution, there is a danger of the discussion process degenerating into a multitude of two-way exchanges between the tutor and each individual student. For this reason it is important to allow learners to develop their own skills of facilitation and response. This may have to be done explicitly, for example by asking learners to take turns facilitating the discussion in their small groups. Some induction in the skills of online participation and facilitation may be needed.

Learners can also be involved in providing feedback on task-related activities. One very practical use of the online medium is to enable sharing and review of one another's work. This not only reduces the burden of formative assessment on the tutor but is a valuable learning experience in its own right.

Learners can be encouraged to self-assess through the use of online logs and diaries, and pro-formas that prompt reflection on their learning process. Facilities for students to maintain online portfolios and learning logs are increasingly available in managed and virtual learning environments.

The ideal online activities are those which generate intrinsic feedback – for example the exploration of simulations and micro-worlds. In all other cases you will need to think about how learners will know whether they have achieved the task set for them, and what alternative approaches they might have taken. If you are using assessment software to set formative tasks and tests, then you should expect to spend as long devising useful feedback as you spend on setting the actual questions. (Here we are concerned with feedback as part of the learning process, i.e. formative assessment, and not with summative testing at the end.)

Description

Finally, e-learners will need access to information resources. As discussed in the section on constructivism, care needs to be taken to ensure that these resources are structured (a) so as to effectively scaffold learning and (b) to take account of alternative access needs and learning approaches. Where possible, different representations of the same topic area should be available, and students should be able to choose their own route through complex materials.

The area of instructional design is a complex one. More information about designing effective e-learning materials is available in other briefings from TechLearn and ALT.

Conclusions

E-learning offers a number of challenges. These include:

- the sheer volume of information resources available
- new tools for management of information
- new media for dialogue and sharing ideas
- changes in the nature of scholarly argument and representation
- changes to the nature of learning institutions through centralisation of information services
- increasing learner autonomy (at least potentially)
- new forms of inequality

At the same time, a good grasp of current thinking about how people learn can help us to understand the new learning environments and provide pointers for their effective use.