Coursework wiki

Iteration and convergence

Introduction

Diana Laurillard (1991; 1993; 2002) developed a model of teaching that is known as the Conversational model. This model depicts that learning is based upon "second order" experiences of the world, whereby it is not enough to just have your view and experiences; you also have to examine other's views and arguments to fully learn.

Laurillard considers the learning process as a kind of conversation, and asserts that this process 'must be constituted as a dialogue between teacher and student (or student and student), operating at the level of description of actions in the world'. It does not always have to be the teacher who provides the communication/modelling cycle. It can also be provided in a peer group setting.

Building on social constructivist learning theories of Vygotsky & Piaget and the conversation theory of Pask, Laurillard maintains all complex learning involves:

"…a continuing iterative dialogue between teacher and student, which reveals the participants' conceptions and the variations between them…" (Laurillard, 1993)

Laurillard asserts that effective teaching/learning dialogue depend on:

(1) Discussion between the teacher and the learner

- Teachers' and learners' conception should be mutually accessible
- Both should agree on learning objectives

(2) Adaptation of the learner's actions and of the teacher's constructed environment.

- Teacher must adapt objectives with regards to existing conceptions
- Learners must integrate feedback and link it to his own conceptions

(3) Interaction between the learner and the environment defined by the teacher

- Teacher must "adapt to world", i.e. create an environment adapted to the learning task given to the learner
- Teacher must focus on support for task and give appropriate feedback to the learner.

(4) Reflection of the learner's performance by both teacher and learner

- Teacher should support the learner to revise his conceptions and to adapt the task to learning needs
- Learners should reflect with all stages of the learning process (initial concepts, tasks, objectives, feedback, ...)

The conversational model as shown in the diagram of figure 2.1 depicts the workflow between tutor and student during learning. Certain activities (across the way) are interactive and take place through some medium. Other activities (up and down) are internal to either the student or the teacher.
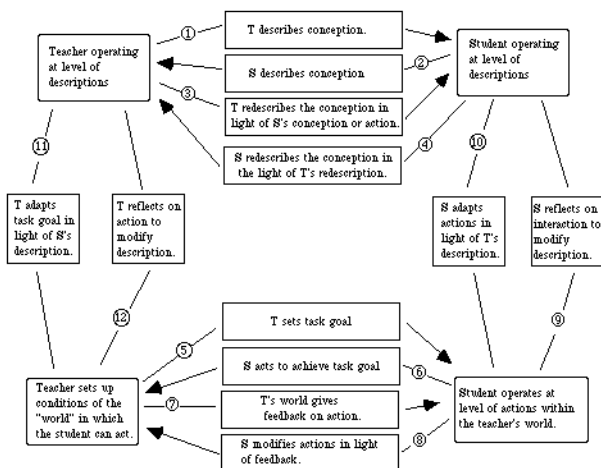
Laurillard's Conversational Model for Effective Education by Johnson & Mathers (1999)
(http://www.dcs.gla.ac.uk/~johnson/papers/function_allocation/function.htm)

The numbers on the diagram represent any of the 12 mathemagenic activities (http://www.psy.gla.ac.uk/~steve/mathemagenic.html) which are elaborations on the four principles of: discussion, adaption, interaction and reflection. The interactions illustrated in the model do not necessarily occur in the linear order given above and the model involves recurrence at several levels. In particular the conversation may shift freely between the conceptual level and the level of actions.

In order for Laurillard's model to be generalisable across more context, Draper (2013) cites 3 deep principles:
1. Equal weight to teacher and learner
2. Feedback and convergence

3. Two aspects to any subject

These principles can enable the linking of topics across a variety of educational principles and theories that do not explicitly mention the Laurillard model itself.

Here we focus specifically on the principles of feedback/iteration and convergence.

Linking to iteration and convergence
One interpretation of linking these principles to the model can be that the up-down cycles are iteration, and that convergence happens across the way.

The idea of iteration is found in the old adage, "Practice makes perfect." In particular, "iterative" is defined as the "process of learning and development that involves cyclical inquiry, enabling multiple opportunities for people to revisit ideas and critically reflect on their implication" (Timperley et al, 2013).

Laurillard says: "the best predictor of quality of output is the number of iterations" (1993). She suggests there is an iterative cycle between concepts and practice. Dissatisfaction with one's outputs (conclusions, answers) can cause one to reflect upon and modulate one's conceptual understanding (1993).

In terms of convergence, teachers and students, or, students and students must converge their ideas and/or understanding of a certain topic. Laurillard (1993) believes that full understanding comes from a student's understanding converging with the teacher's knowledge. This is because Laurillard sees the teacher as expert, and so this convergence is the same as fully converging with the material itself.

In order for convergence to occur, students need feedback on their understanding from the teacher. The teacher knows the learner's grasp on the topic. As both the student and teacher produce versions of their understanding they must be related and the learner's version slowly converges to demonstrate full understanding and knowledge of the topic.

Research investigating both teachers' and students' perceptions is important in terms of convergence and the process of learning. This is because divergence and convergence between student and teacher perceptions have proven to be usable variables in investigating teaching-learning processes (Brekelmans & Wubbels, 1991).

Different Levels of Conversation

For optimal learning Laurillard encourages on-going teacher-learner interaction and the negotiation of views of the subject-matter which unfolds between them in such a way as to modify the learner's perceptions. Learning is seen as an active process that is dependent upon this interaction.

In Laurillard's model, the pattern of the conversation should be as follows:

The Teacher can set the task goal

- The Teacher can describe her conception of the subject (or that aspect of it being taught)
- The Learner can describe his conception of it
- The Teacher can re-describe in the light of the Learner's conception or action
- The Learner can re-describe in the light of the Teacher's re-description or Learner's action
- The Teacher can adapt the task goal in the light of the Learner's description or action.

And so on....

This involves the following features of the teaching -learning system:

- The Learner can act to achieve the task goal
- The Teacher can "set up the world" (i.e. control the learning environment) to give intrinsic feedback on actions
- The Learner can modify his action in the light of feedback
- The Learner can modify his action in the light of the Teacher's description or his (the Learner's) re-description
- The Learner can reflect on interaction to modify re-description
- The Teacher can reflect on the Learner's action to modify re-description

(James Atherson, 2003)

So effectively, the learning that takes place through the conversation between the teacher and the learner is operating at two levels:

- At the top level of the diagram the teacher and student are engaged in a conversation about the concept or theory. They are articulating and exchanging their representations of the subject matter and in light of the convergence of views, are re-defining their representations and the way that they present them to each other. The process about what you are talking about is one of reflection, and through conversing and iteration adaption occurs when you modify what you are doing in light of the discussion.
- At the lower level of the diagram the teacher is providing the experimental setting where the student can engage in goal oriented behaviour. The experimental environment that the teacher is trying to provide can include tutorials, classroom settings, practical tasks etc.

Different types of Convergence

There are three types of convergence worth examining within Laurillard's conversational framework:

- Interaction between teacher and learner: The constant interaction that unfolds within the model between the teacher and the student means that both of them re-examine and re-define their representations of the concept they are being discussed. The teacher altering the way in which they convey their knowledge in light of the interpretation that the learner has of the original knowledge presented. The learner re-describes in light of the teacher's re-description and so on. The iteration aspect of this model can be seen here.

- Interaction between experience and theory: As well as convergence between the knowledge of concepts and theories being relayed back and forth between the teacher and learner, there is also an interaction between the theory being discussed and the task that the learner completes in order to learn more about the theory. Here different types of knowledge are coming together and merging to form a whole representation. An example of this would be a trainee doctor applying all the theory of the body they had learned to diagnose a patient. In this way the learner is interacting with themselves and the different conceptual and experiential knowledge that they have.
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- Interaction between peers: Laurillard doesn't express how beneficial other peers can be in the process of learning, and she mainly focuses on the interaction between the teacher and the learner. The idea in this model is that the teacher passes on truths as they are "experts" in the field, however there can be many different dynamics to learning other than just from a teacher. We can learn from interacting with our peers, converging different types of representations that we form with them.

The importance of peer interaction

Chi, Roy and Hausamann's (2008) study evaluating novel learning environments gives evidence to the process of peer interaction being a valuable learning tool. As well as finding that human tutoring was extremely effective, they also found that students who watched a recording of others being tutored and discussed this with another peer learned just as effectively as those in the original tutoring session who were taught individually in some subjects such as physics.

Chi et al explain this surprising success of those who watched the video collaboratively as having to become active constructers of ideas and knowledge through interaction, rather than just being passive subjects. Collaboratively observing combines the benefits of tutoring and observing, leading to optimal learning conditions. Here the same processes of interaction that underlie the Laurillard's conversational framework could be taking place with peers describing and re-describing conceptual descriptions, learning through action and completing tasks with one another, and reflecting on their actions and modifying them together. In peer interaction there is no "expert" so to speak as there is in the case of the learner and the teacher. However it is interesting that observing second hand tutoring collaboratively can be just as beneficial tool for learning as one on one tutoring.

Chi et al's results support the literature suggesting that interacting with a tutor is better than watching and overhearing, which is in line with Laurillard's conversational framework. However the results from this study imply that it might not be in the interaction with the tutor that is important for learning but the act of interacting in itself.

(http://wayvs.com/wp-content/uploads/2014/02/Yoda.gif)

Iteration

Iteration (the act of repetition), is the back-and forth-going process towards learning in Laurillard's conversational model (represented by the arrows between the four components). Ideally, learning would follow these circles and a learner would repeatedly go through the material, getting closer and closer to learning every time. However, as the process is often imperfect or interrupted, it is rarely possible to reach the theoretically complete form of iteration with all the four components and processes involved.

The idea of repetition as a basis of learning derives from memory research – repetition consolidates the memories as the neural networks involved are more exposed (long-term potentiation in a cellular level [Martinez & Derrick, 1996]). A few every-day examples of repetition as a way to learning are revision for exams, learning a new language; vocabulary is obtained by continuous repetition, or sports learning; acquiring a new motor skill usually requires practicing it multiple times and getting slowly closer to the ideal performance.

In Laurillard's model convergence and iteration can be seen as two closely intertwined processes: in order for iteration to be effective, student and teacher need to converge (see definition of Mastery learning below). However, the process works to the other direction as well, as iteration circles are likely to enhance the convergence of a teacher and a student.

Iteration in educational settings

Iteration is sometimes used as a specific procedure in education – a technique called mastery learning (Block & Burns, 1976) utilises iteration as one of its basic tenets. The idea of mastery learning is to create an individual learning path for each student; the teacher sets learning goals and regular assessments of students' achievements are organised to identify possible gaps. If a student has not achieved a certain goal, they are presented with alternative exercises to fill in the gaps in their knowledge. The repetition is done in different routes and from different angles but this is a prime example of iteration.

This leads to an important point – iteration is not an interchangeable term with trial-error learning. As presented above in the context of mastery learning, it should be noted iteration covers more complex and sophisticated learning methods, and does not always involve an error. For example, approaching the same topic repeatedly but from multiple angles is iteration. This links Laurillard to deep and surface learning – different methods of iteration demonstrate different approaches to learning; mere repetition would lead to surface learning whereas iteration by approaching the same thing from different perspectives would enhance the depth of learning.

Other ways of learning - is iteration the whole story?

It seems iteration is the fundamental basis of learning. However, some controversial arguments have been put forward, especially in terms of episodic memory: repetition does not always enhance recall (Peterson & Mulligan, 2012). In their experiment Peterson and Mulligan made participants study cue-target pairs and perform a recall test. Participants who had studied the pairs twice recalled fewer of them as opposed to participants who had studied the list only once. Their further studies tested the same principles under a variety of different conditions and the results fell in line with the initial finding; this pattern of iteration actually hindering learning is called negative repetition effect. In the context of episodic learning it seems multiple repetitions may interfere with the sequence and confuse the learner, as opposed to learning the sequence only once. More examples for this can be found in false memories research (Roediger & McDermott, 1995) – repeating makes the memory encoding mix up with previously acquired information.

Therefore, even though in most of the cases iteration is crucial for learning, one-off learning should not be ignored – as discussed above, for example episodic memory learning might be disrupted by repetition. Another possible point of criticism towards iteration is that it might make us fixate on one point and prevent from seeing the whole picture. This is usually the argument behind the critiques of mastery learning: it is often suggested its training strategies are rigid and mechanistic, and concentrate too much on students achieving one learning goal (Block & Burns, 1976). However it should be noted that this is heavily dependent on the type of iteration used; mere repetition will not provide a comprehensive understanding of the topic but iteration through multiple routes will.

Iteration and feedback

Feedback plays a very important role in iteration – it is not necessary to get feedback for a mere repetition, but to maximise the impact of iteration and find alternative ways of examining the learning material, feedback is crucial. If given in a right form and also interpreted correctly (Draper, 2009b), it potentially directs learners' attention to the gaps, how to overcome them and thus makes the iteration process more efficient. Furthermore, for an efficient learning process, the type of feedback and type of iteration should converge; as Laurillard (1993) stated: ". . . it is not just getting feedback that is important, but also being able to use it" (p. 61).

Crosslinks

Problems facing University and how the Conversational Framework can help solve them

Universities of today are facing challenges from the knowledge society that threatens to make them obsolete as institutions and left behind. For over a decade there has been pressure put on universities and third level institutions to expand across higher education as the knowledge society needs more graduates. The knowledge society is ever growing and is now posing as a competitor to traditional higher education institutions as they are developing the means to provide facilities whereby individuals can acquire the immediate skills and knowledge that those industries need, independently of universities (Laurillard, 2002). In light of the development of training by the knowledge industries, questions are being raised as to whether a university degree can really be justified given its ever increasing costs and student's subsequent accumulation of debts.

Universities seem to be falling short of constructing curriculum that balance expert knowledge and practitioner knowledge simultaneously. Research has suggested that they abandon the widely used transmission model of learning and should focus on teaching the practice of high level skills as if they do not do so, this is left up to the knowledge industries and universities will become redundant (Laurillard, 2002). It has been

suggested that Universities are behind in teaching useful practices to students as they are not giving equal weight to their research objectives and their teaching ones. Universities receive more recognition these days from publishing research findings, and so this had led to an unequal distribution of resources for research and teaching, with teaching losing out.

Academics need to move away from the standard transmission model of teaching and invest as much time and research into their teaching as their research. They need to adopt a teaching model that integrates *reflection through interaction,* and is more like coaching than teaching, going back and forth between this said reflection and interaction (Laurillard, 2002). Academics are reflexive in their research methods, so why haven't they transferred this approach when it comes to teaching? It is time to introduce interaction and convergence into university models of teaching by repeatedly going back and forth between reflection and action.

All the new technologies available to us have been incorporated into the teaching methods employed by universities, but unfortunately this has not been carried out in the most progressive way. The academic world has incorporated new technologies such as the web and word processing into the traditional transmission model of learning that is not an interactive or iterative model, and is not sufficient in keeping up with the knowledge industries. The extensive range of new technologies available needs to be incorporated into a teaching approach that transforms academics themselves into reflective practitioners whilst they teach.

This method of teaching through reflection and action is in line with Laurillard's conversational framework (Laurillard, 1993). Like Wenger's (1998) account of a learning community emphasizing the importance of both the individual and the community's engagement for acquisition of knowledge, Laurillard's model of conversational framework gives equal weight to the teacher and student. The conversational framework can provide a structure against which we can specify what digital technologies should be doing instead of passive models of teaching and learning. Since the interplay between theory and practise is essential for making the abstract morph into something more concrete, technologies should exploit iterative dialogue between teacher and student, with constant feedback given. Technologies designed for teaching should be communicative and adaptive, transforming the learning experience into one that fits better into the requirements of the digital age that we now live in (Laurillard, 2002).

Technology was designed as a tool that could be accessed by the masses and so this more elaborate and communicative kind of learning can be offered to students on a mass basis also. Let's hope the transmission model of learning is abandoned in favor of models such as the conversational framework that will equip us for our future careers. If not the digital age will leave us behind and we will not have a place in it.

Applying the model using media

Technology is becoming more prominent in teaching than ever before. Laurillard's 1993 book "Rethinking University Teaching" has led the way in looking at how Learning Technology could be employed to promote more effective and varied teaching styles. Modern learning is much about media as well as teacher-student interaction. Can media fulfil Laurillard's model? Her review of media asserts that currently only tutoring systems and a combination of tutorials and simulations can claim to address the entire learning process as specified in her model.

Technology can be used to structure peer feedback and so increase cycles of **iterations.** The technology itself could provide feedback to students to again increase iterations and automate hints and tips in relation to student actions. It can add speed to response, iteration intrinsic feedback and can orchestrate peer interaction. These can all increase the likelihood of **convergence** (whether student-teacher, student-student or student-theory). (Mor, 2009).

Laurillard then considers the properties of different media and the forms of learning experience they support. She identifies five media forms which cover all the 12 activities identified in the model. They are: **narrative, interactive, communicative, adaptive and productive**. Laurillard also observes that each of the media forms can be combined to produce better coverage (Britain & Liber, 04). These can be mapped to different kinds of learning experience, the delivery method and the media forms utilised:

Learning Experience	Method/technologies	Media Forms
attending, apprehending	print, TV, video, DVD	narrative
investigating, exploring	library, CD, DVD, Web resources	interactive
discussing, debating	seminar, online conference	communicative
experimenting, practising	laboratory, field trip, simulation	adaptive
articulating, expressing	essay, product, animation, model	productive

Five principal media forms with the learning experiences they support and the methods used to deliver them (Laurillard 2002)

For an interactive diagram click here!!! (http://www2.smumn.edu/deptpages/~instructTech/lol/laurillard/)

Many studies have compared some form of computer-based learning with traditional classroom settings, and findings have generally supported that computer formats can be as effective, or in some cases more effective, than traditional classroom presentations (Russell, 1999). Some of the research focuses on online supplements to traditional classes, rather than entire online courses (Schulz and Dahale, 1999). One study comparing computer based and traditional lecture versions of the same material revealed that students performed equally well after both types of instruction, but preferred traditional presentations (Dewhurst and Williams, 1998). Twigg (2001) recommends using strong assessments, a variety of interactive materials and activities, individualized study plans, built-in continuous assessment, and varied human interaction to improve the quality of online courses.

Hannon et al's (2002) carried out a study investigating distance learning on a public health course for graduate and professional students. Their findings indicate that online courses can be an effective method of teaching. However, there are some pitfalls unique to the learning distance environment. Students want (and expect) quick and detailed responses to their questions and concerns, as well as timely, qualitative feedback on their work. These findings support Laurillard's Conversational Framework as well; students in distance learning courses apparently expect active interaction with their teachers. Students who felt that these expectations were met tended to be positive about the course and distance learning in general.

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