Is Learning Social? In which senses?

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Introduction

The question as to whether or not learning is social and in what senses can be answered through investigation of the literature in the area. The use of various techniques in attempting to increase the social aspects of learning, such as group discussion, can help to structure learning and enhance learners' abilities to develop ideas and grasp concepts (Weimer, 2011). By using techniques such as these and employing social constructivist methods, it seems that learning can be considered social in several senses, as will be discussed through this document.

> **"What the child is able to do in collaboration today he will be able to do independently tomorrow"** (Vygotsky, 1987, p. 211).

Key Paper

This key paper by [Chi et al. (2008)](#) encompasses many of the themes evoked by the question: *Is learning social?* For example; tutoring, the role and value of teachers, scaffolding (contingent tutoring), feedback, constructivism, deep learning (vs shallow), peer interaction and self-explanation.

- *Aim:* The paper seeks to understand why human tutoring is so effective within a relatively novel learning environment.
- *Methods*: Alternative learning environments were compared; one-on-one tutoring, observing tutoring individually, collaborating without observing, studying alone.
- *Results*: Learners who had individual tutoring were able to solve physics problems just as effectively as learners who observed collaborative tutoring.
- *Conclusions:* By observing collaborative learning, students benefit from tutoring and collaborating. Students are encouraged to become both active and constructive observers through social interactions with peers.

Summary

In answer to the question "is learning social?" the current document would answer *yes*, in the following ways:

The theory of social constructivism can be seen to encapsulate the notion of learning as social through the emphasis it places on interaction with peers in order to learn and gain knowledge. Peer discussion is inherently social as students learn through negotiating with peers and synthesizing ideas, whilst feedback is essential to effective learning, and when done with peers, benefits both the individual giving and receiving feedback.

Two Neo-Vygotskian notions which exemplify maximised learning through social processes are scaffolding and peer interaction. Scaffolding provides a framework for the teacher to interactively support a student based on their individual needs. Equally, peer interaction denotes that learning is maximised when alternate conceptions of an idea are offered within a group setting. Alongside this, the belief that learning is social can be seen to cross-link with various other learning theories such as Perry's Scheme of Cognitive Development, the Laurillard Model and the use of modern technology in learning.
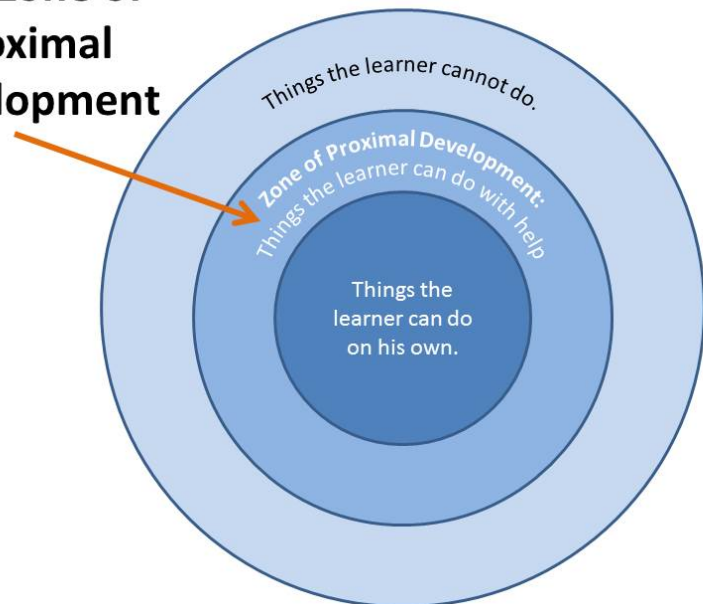
Social Constructivism

The basis of social constructivism lies in Lev Vygotsky's constructivist theories. Two major branches of constructivist viewpoint exist, in the form of cognitive constructivism and social constructivism. Jonassen (1994) provided an overview of the general characteristics of constructivist learning, and how the cognitive and social aspects are both similar and different:

1. Constructivist learning environments provide multiple representations of reality.

2. Multiple representations avoid oversimplification and represent the complexity of the real world.

3. Constructivist learning environments emphasize knowledge construction inserted of knowledge reproduction.

4. Constructivist learning environments emphasize authentic tasks in a meaningful context rather than abstract instruction out of context.

5. Constructivist learning environments provide learning environments such as real-world settings or case-based learning instead of predetermined sequences of instruction.

6. Constructivist learning environments encourage thoughtful reflection on experience.

7. Constructivist learning environments "enable context- and content- dependent knowledge construction."

8. Constructivist learning environments support "collaborative construction of knowledge through social negotiation, not competition among learners for recognition."

The eight characteristics as laid out by Jonassen incorporate both social and cognitive aspects, however the level of emphasis that each branch of the theory would place on each characteristic could be seen to differ. For example, the final point, relating to collaboration and social interaction can be seen to be of greater importance to social constructivism than cognitive. In this sense it is suggested that the social aspects of learning are of great importance, in that our ability to gain new knowledge is aided through a sharing of information and collaboration with others.

Social constructivism can be seen to have originated through Vygotsky's increased emphasis on the social aspects of learning in Piagetian theory (Chen, n.d.). Social constructivism can be seen to root in assumptions regarding learning, knowledge and reality (Kim, 2001), where aspects of life such as knowledge are viewed as emanating from individuals themselves, having been created through social and cultural interactions and norms (Kim, 2001; Ernest, 1999). It is claimed that in order for learning to be most effective, educators must be able to incorporate both cognitive and social constructivist techniques within the classroom environment (Powell & Kalina, 2009).

The Zone of Proximal Development

Things the learner cannot do.

Zone of Proximal Development:
Things the learner can do with help

Things the learner can do on his own.

Social constructivism refers to the conception of ideas and thoughts through interaction with peers and the teacher – thereby learning in a social sense (Powell & Kalina, 2009).
In terms of the extent to which learning can be seen to be social, social constructivism would suggest that it is to a high degree. If learning via interaction is an effective means of transferring and imparting information and knowledge, then the social aspects of learning cannot be ignored.
Teachers may incorporate this into teaching through use of group work and peer collaboration in which it is important for the students to learn from others' points of view and different cultural backgrounds (University College Dublin, n.d.). Vygotsky introduced the idea of social constructivism as a result of the Zone of Proximal Development, which describes what a learner can achieve both with and without help (Vygostky, 1987), as he recognised children learned better when working with an adult or more able peer, even though they were not

necessarily being helped. The Zone of Proximal Development can be elaborated upon through this short video.

In this sense, he determined that learning with others had the potential to be substantially more effective than learning alone (Vygotsky, 1987).

Evidence in support of theory

The social constructivist view is echoed by Chi, et al (2008) in their investigation into the impact of observing another individual learning, finding that when an individual observed tutoring with a peer, they learned more than from watching alone. Watching with a peer that they also collaborated with resulted in the greatest level of learning, compounding the notion that learning can be viewed as a social activity (Chi, Roy & Hausmann, 2008).

Another study which provides evidence for the ZPD is the "Dolls House Study" by Freund (1990). The study was interested in exploring whether children learn more effectively by themselves – in accordance with Piaget's concept of discovery learning, or with guidance or scaffolding from their mothers – in line with Vygotsky's ZPD. The task was for children, between the ages of three and four, to help a puppet decide which furniture should go in each room in a dolls house. Freund began by taking a baseline measure of what each child knew already about the location of furniture. The children then all worked on a similar task, either alone (discovery learning), or with their mother (scaffolding/guided learning). The results showed that children who were assisted by their mothers performed better than children who worked alone. These results suggest that learning is most effective when it is done interpersonally rather than independently.

Criticism of theory

A criticism of Vygotsky's ZPD, is that although he does mention peers, he refers to "more able peers", suggesting that an asymmetric intelligence must be in place (Fernandez, Wegerif, Mercer, and Rojas-Drummond, 2001). However, this does not always need to be the case, for example, researchers have found that successful learning can occur in collaborative situations between students of a similar level of ability (Littleton and Light, 1999; Cowrie and van der Aalsvort, 2000). Thus learning can also occur as a result of symmetrical exchanges.

Scaffolding

One Neo-Vygotskian view, which exemplifies learning as an interactive social process is contingent tutoring otherwise known as scaffolding. Bruner based the concept of scaffolding upon Vygotsky's (1978) notion of the zone of proximal development, which denotes that individuals can support learners with tasks they cannot accomplish on their own.

Scaffolding involves (Sawyer, 2005):
1. Organising participation in activities that address basic human needs for a sense of safety as well as belonging.
2. Making the structure of the domain visible and socialising participants for dispositions and habits of mind necessary for expert-like practice.
3. Helping novices understand possible trajectories for competence as well as the relevance of the domain to the learners.
4. Providing timely and flexible feedback.

Scaffolding is the term used to describe the support that promotes deep learning. It is the support system that enables learners to carry out different activities (Wood, Bruner, & Ross, 1976). The support is tailored to individual ability and performance. The best form of scaffolding requires active participation from the learner; it is therefore rooted in social constructionist theory. Scaffolding can be built up or removed according to the individual needs of the learner; it can be built up when a learner is struggling and removed when they have achieved their goal.

Whereas coaching encompasses all the many ways in which a teacher can promote learning scaffolding refers to, more narrowly, the direct social relationship between the teacher and the learner to foster specific learner success. Scaffolding enables learners to carry out tasks beyond their capabilities.

For example, scaffolding can take the following forms:
- *Suggestions or help*; see Palinscar & Brown's (1984) reciprocal teaching .

- *Physical support*; see Scardamalia & Bereiter's (1994) use of flash cards to facilitate writing or the use of short skis to teach downhill skiing (Burton, Brown, & Fischer, 1984).

Computer-based scaffolding

More recently, the notion of scaffolding has been extended from teacher-student interaction to computer-student interaction. For example, computer-based scaffolding could:

- Do many low level chores such as arithmetic calculations while the learner concentrates on higher level tasks and deciding what to do.
- Provide of a framework via which the learner can receive guidance on which task to complete next and the order of task completion.

One concern regarding the emergence of computer-based scaffolding is that it can be applied in a far broader setting than the narrow tradition student-teacher dynamic and therefore risks becoming 'watered down' (Sawyer, 2005). Moreover, there is concern that the software employed in computer-based scaffolding, in comparison to a teacher, lacks the appropriate mechanisms to identify when fading is appropriate and necessary.

Peer interaction

A further neo-Vygotskian notion, which exemplifies learning as a social process, is peer interaction. Within the context of group learning, peer interaction denotes that learning is maximised when alternation conceptions of an idea are offered (Howe et al. 1992). Research concerning the benefits of peer interaction draw inspiration from the notion that children do not come to primary school as a "blank slate". Moreover, given that in school contexts, information is presented in group format, the composition and interaction of the group can not be ignored as part of the social learning process.

The dynamics of peer interaction for learning can be drawn back to Piagetian theory. According to Piaget (Forman & Kraker, 1985) development is driven by equilibration; a stable thought pattern concerning the way of the world. When this equilibration is challenged (for

example by competing views of different peers within an interactive setting) a state of disequilibration occurs. The ensued state of dissatisfaction causes learners to change and adapt. According to the remit of Piagetian theory therefore, the presence of a competing view can enhance learning. Demonstrating, therefore, that learning is inextricably social.

In a study by Howe et al. (1992) it was established that the process of private conflict resolution, prompted by peer interaction, maximised learning in long term. Howe et al. (1992) compared the ability of two groups of children aged 8 to 12 in their ability to understand motion down an incline, they found learning was maximised in the group that contained alternative conceptions in comparison to similar conceptions. Notably, maximised learning was only evident four weeks after discussion, not immediately after, which was a result of independent thought and study preceding the initial confusion caused by peer interaction.

Mazur's peer instruction (PI) is one form of peer interaction, which exemplifies learning as social. Mazur devised the notion of PI to combat the arguably static nature of traditional lecture style classroom learning. PI is a student centred approach that actively engages students in their own learning.

Nothing clarifies ideas better than explaining them to others.

- Mazur Group

This key paper by Mazur and Crouch (2001) summarises peer instruction. Essentially, the paper demonstrates that learning improves with peer instruction. PI modifies the traditional lecture format to include questions designed to engage students and uncover difficulties with materials.

PI aims, unlike traditional learning, to engage *every* student rather than a select highly motivated few.

Peer Instruction unfolds in the following way:

1. Instructor briefly presents a set of ideas.
2. Understanding is tested using a Conep Test, for example the image below.
3. Students are given one or two minutes to formulate ideas individually and report to the teacher.

4. Students discuss their ideas with their peers, persuasive discussion in favour of their idea is encouraged.
5. A poll is then taken for the second time, after discussion.

What do you think? 2D kinematics

A battleship simultaneously fires two shells at enemy ships. If the shells follow the parabolic trajectories shown, which ship gets hit first?
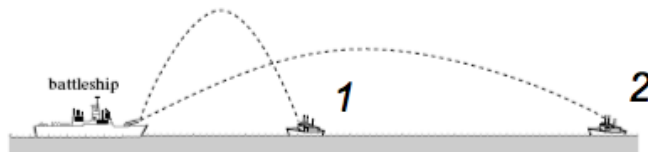
A) Ship *1*
B) both at the same time
C) Ship *2*
D) need more information

Please watch this short video clip for an example of Peer Instruction at Avanti's learning centre in Kanpur, India.

Please also see the diagram below for diagrammatic representation of PI:
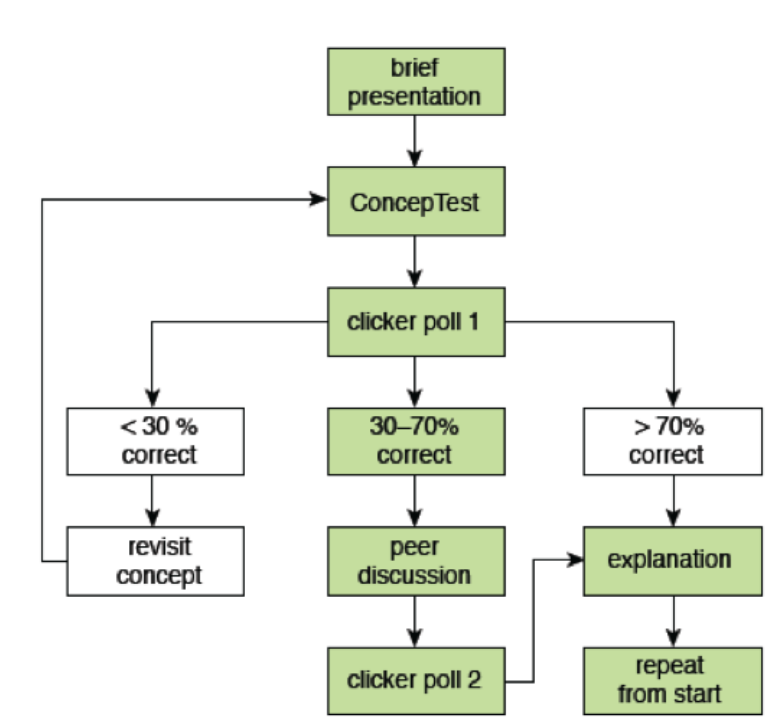
This method of instruction, exemplifies how learning can not only be classified as *social* but that students can flourish when learning is treated as a social process in comparison to the often static traditional teaching methods.

Peer Interaction in modern and diverse settings

Peer interaction can take place in both formal and informal settings; this video provides an example of peer interaction within a diverse hip hop program for young people from Chicago.

Furthermore, Professor Sugata Mitra from the Institute of Educational Technology at the University of Newcastle was commissioned $1 million by TED in 2013 in recognition of his research which demonstrated that children in small groups can learn to use computers and the internet on their own in a public space.

See his TED talk which outlines his rather unique ideas, which undeniably demonstrate learning as a social process. According to Mitra, children can achieve phenomenal educational feats in groups which they cannot achieve alone.

The majority of Mitra's work builds upon the 1999 "Hole in the Wall" experiment (see image below).

In this experiment, a computer was embedded in the wall of an Indian slum in Kalkaji, Delhi, which enabled children to access it for free without instruction. Here are a couple of quotes that demonstrate the effect of the "Hole in the Wall" computer experiment:

"children will learn to do what they want to learn to do"

"groups of children can learn to use computers and the internet on their own irrespective of who or where they are"

Notably, Mitra found that after just four hours of seeing a computer for the first time, groups of children were able to regard their own voice and play it back. Mitra believes his experiments demonstrate a self-organising system; where the system structure appears without explicit intervention from the outside system. Accordingly, each self-organising system displays *emergence*; the appearance of a property not previously observed as a functional characteristic of the system. Mitra's work exemplifies learning as social in a unique and technologically influenced setting.

Peer Discussion

Discussion is one of the three fundamental learning activities identified by Francis Bacon (1625) and elaborated on by Samuel Johnson (1753). The use of peer discussion in an educational setting is rooted in theories of social constructivism. That is, discussion promotes learning because it encourages students to make sense of information through negotiating ideas with their peers. Considerable research shows that discussion plays a crucial role in student's learning by testing their viewpoints, synthesizing the ideas of others, and generating a deeper understanding of the material (Reznitskaya, Anderson, and Kuo; Weber, Maher, Powell, and Lee, 2008; Corden, 2001; Nystrand, 1996).

Discussion is a crucial component in peer instruction (PI) which involves students conversing with their peers about concepts. Crouch and Mazur (2001) found that after discussion, significantly more students answered a conceptual question correctly compared to prior to discussion. Similarly, Smith et al (2009) found that when students answered a conceptual question independently, discussed it with their peers, and then re-answered, the number of correct answers increased significantly and so did students' confidence in their responses. Therefore, these results suggest learning is most effective after discussion with peers.

However, it could be the case that students are not necessarily learning from discussion, but are simply choosing the answer given by more knowledgeable peers (Smith et al., 2009). Therefore, Smith et al (2009) investigated which of these explanations accounted for the increase in correct answers following discussion by using an additional question for students to answer individually to test their understanding. They discovered that peer discussion enhanced learning, even if nobody in the group originally knew the answer. This finding supports a social constructionist view of learning as opposed to a "transmissionist" view, as rather than it being the case that more knowledgeable students are giving their peers the answer, the students are reaching an understanding themselves through the social processes of discussion and debate.

There are various ways educators can incorporate discussion into their lessons. One way, which has already been mentioned, is through PI. Another approach is through class-wide

discussion (CWD). Whilst PI begins with independent thinking and is followed by peer discussion, CWD begins with peer discussion and ends with CWD (Nicol and Boyle, 2003). Nicol and Boyle (2003) were interested in which type of discussion was best for learning and under what circumstances. In general, students preferred to start with independent thinking and continue with peer discussion because it forced them to think about the problem and form their own reasoning meaning. This meant they were less likely to be passive, swayed by dominant peers or absent-mindedly accept their answer. Students expressed that they were more likely to engage in discourse in order to justify and defend their ideas, and finally they felt it was more useful in identifying gaps in their understanding. However, it was not always the case that students felt it was beneficial to start with individual response. When the questions are very difficult, beginning with peer discussion allows a pooling of ideas which may help students to embark on the problem.

A summary of the pros and cons of peer discussion for learning as identified by Nicol and Boyle (2003).

Positives	Negatives
Detailed Reflection on Problem	Dominating Student
Explore Different Perspectives	Can Lead to Confusion
Alternative Problem Solving Methods	Anxiety Provoking
A Form of "Scaffolding"	Time Consuming
Peers' Language more Accessible	

Feedback

To begin with, it may be helpful to watch this brief video by Dylan Wiliam who is the Deputy Director and Professor of Educational Assessment at the Institute of Education at University of London. He summarises the importance of feedback for learning and reflects on some important aspects of feedback including task- versus ego-centred feedback and Dweck's idea that ability is 'incremental' rather than fixed and the implication this has on students learning.

Types of effective feedback

Elective feedback

Elective feedback refers to feedback where students ask the marker for comments on particular aspects of their work. There are several reasons why it is beneficial for learning:

- it encourages students to be pro-active in their learning, and is likely to develop the important learning skill of self-regulation
- urging the students to think about what they want feedback on, means the learner is more likely to attend to and use the feedback
- receiving positive feedback on a particular aspect – in standard marking students would not get positive feedback
- it reduces the amount of time staff spent giving feedback and targets the points where students want feedback

See Bloxham and Campbell's (2010) article about creating dialogue between tutor and student by using interaction cover sheets and the effect this had on student's learning.

See also, the University of Edinburgh's "enhancing feedback" website on elective feedback and case study examples.

Reciprocal peer critiquing

For a quick summary of the importance of peer assessment/feedback for learning, you might find it useful to watch this short video by Dylan Wiliam.

The general principle behind reciprocal peer critique is that in order for students to perform well on a task, they must understand the assessment criteria and an effective way to do this is to have students exercise the criteria in a different way by getting them to apply the criteria to their peers' work (Sadler, 1989). See this web page for a summary of the potential benefits for receiving and providing peer feedback.

Potential drawbacks:

- large classes
    - Can be done in a lecture group of 90 students for short passages by swapping them with their neighbour
    - software to manage it, for example see [Aropa Peer](#)

Morrow (2006) found strong support for the usefulness of RPC according to student opinion. However, whilst the students valued a number of aspects about giving and receiving feedback, what they found most useful was simply the opportunity to read another student's work as it allowed them to consider alternative ways of approaching their work.

Principles of good feedback

Good feedback practice is arguably anything which encourages students' to self-regulate their own work performance. Nicol and Macfarlane-Dick (2006) have synthesised the research of feedback to identify the following seven principles to make for effective feedback and learning:

1. makes clear what good performance is (learning objectives, goals, criteria)
2. encourages the development of self-assessment or reflection in learning
3. provides students with a high quality of information about their learning
4. encourages dialogue between teachers and peers about learning
5. promotes self-esteem and motivational beliefs
6. enables students to bridge the gap between current and optimal performance
7. provides teachers with necessary information to shape teaching

See [this article](#) to read about the reasoning behind each principle in terms of self-assessment and techniques educators can use to foster self-assessment.

When is feedback ineffective for learning?

Regardless of these principles of good quality feedback practice, feedback will have no use whatsoever unless it is actually used by students. For feedback to be effective and useful, students have to properly process it and this does not appear to be something done naturally. In order to ensure learners process the feedback [prompt questions](#) and [feedback visas](#) are

effective methods designed to prompt the learners to engage with the feedback. Also see here for a presentation on this, and here for a relevant blog.

Furthermore, effectiveness depends on the form of feedback. For example, Chi et al., (2008) found that whenever the tutor gave feedback in the form of giving students the correct answer learning actually decreased, but when he got students to produce explanations for themselves, learning increased.

Cross links with other theories

The idea of learning in a social sense has multiple cross links with other theories throughout educational literature. As learning can in some senses be seen to be inherently social, for example through the importance of learning from others as well as with them, it is possible to identify several areas in which the sociality of learning can also be seen to apply.

Perry's Scheme of Cognitive Development

Perry's scheme of cognitive development focuses on the differences between learning unquestionable truths vs. debatable but evidenced ideas, through journeying through 9 different stages of intellectual cognitive development in higher education students (Rapaport, 2013). The model is based on a study of Harvard students, claiming that universities have an obligation to students to support them in their development through their cognitive view of knowledge. While the Perry model may focus predominantly on the development of the individual, it can in some sense be seen to link to the idea of learning as being social. Despite the fact that the crux of the model may be seen to be a progression from reliance on an authoritative figure as a guide in learning, to greater autonomy and ability to think critically around topics, there is no mention that this process should be solitary. In fact, links can be made between the Perry scheme and deep vs. shallow learning, where deep learning can be thought to be enhanced through discussion and interaction with peers in a learning community (Akyol & Garrison, 2011). In this sense, it can be said that Perry's model may in fact cross link with social learning theory, given that aspects of what the scheme proposes may be enhanced through learning in a social sense. For example, where students may

progress from regurgitating facts to expressing their own opinions and ideas, discussion and interaction with others may serve to enhance and develop this way of thinking and working.

The Laurillard Model

The Laurillard model can be said to discuss active learning, focussing on the interaction between teachers, learners, peers, the self and the outside world (Laurillard, Charlton, Craft, Dimakopoulos, Ljubojevic, Magoulas…& Whittlestone, 2013). In this sense, the model can be seen to relate to the notion of learning as social, as a large amount of emphasis is placed on the role of individuals out with the learner themselves. However, the model comprises several elements, and so is not necessarily fundamentally social in nature. It can be argued that it may fail to fully grasp the importance of peer interaction, with a greater emphasis placed on the student-teacher interaction, as can be seen through Laurillard's diagram of activities for teaching and learning (Laurillard, 1993):
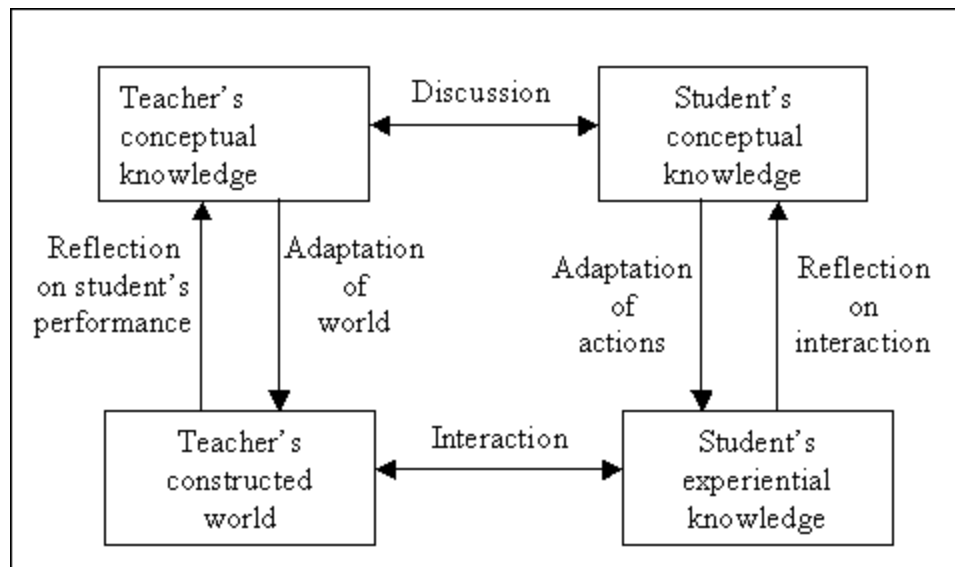
Source: adapted from Laurillard (1993), p. 103, Figure II.1. (Ping, 2003)

In this sense, the model may seem to regard learning as less social, as the learning community that it creates contains only the learner and the teacher, while other models of social learning may be seen to incorporate peer and collaborative learning to a higher degree.

Modern technology in learning

The increasing prevalence of modern technology and social networking has become an integral aspect of Higher Education communities (Yu, Tian, Vogel & Kwok, 2010), creating a new online aspect of social learning within such communities (Hwang, Kessler & Francesco, 2004). Arguably, the use of online social networking platforms has allowed for a new sense of social learning, in which learning is largely self-initiated and self-governed by the individual themselves, yet also depends on input from others in order to advance knowledge and understanding (Yu, et al., 2010). This highlights an aspect of cross linking, as the notion of learning as social can be seen to link with the idea of learning through technology usage. The use of technology in education is becoming more important, with it being claimed that teachers and students alike require effective computer based means by which to manage and assess collaborative learning (Strijbos, 2010). While it may not seem hugely important, it has been claimed that today's generation, accustomed to online means of learning and interaction, through use of Wikis, Facebook and YouTube, for example, find traditional learning methods less effective (Bosch, 2009). In addition to this, use of Facebook in assisting learning has been found to have positive effects on learning as well as the building of social groups, allowing individuals to feel part of a larger learning community (Bosch, 2009; Yu, et al., 2010). In this sense, it can be argued that social learning links strongly to use of technology in learning and teaching.

Annotated Reference List

Au, K. H. (1998). Social constructivism and the school literacy learning of students of diverse backgrounds. *Journal of Literacy Research, 30*(2), 297-319. **doi:10.1080/10862969809548000** - paper discusses the means by which social constructivist techniques may be of use in helping to improve the literacy abilities in learning environments where children are of a broad range of cultural backgrounds and ability levels.

Coll, C., Rochera, M. J., & de Gispert, I. (2014). Supporting online collaborative learning in small groups: Teacher feedback on learning content, academic task and social

participation. Computers & Education, 75, 53-64. This paper investigates feedback in small online groups and shows that timing is critical to the impact of feedback and that both the focus and type of feedback must accommodate the needs of the group.

Dolan, P., Leat, D., Mazzoli Smith, L., Mitra, S., Todd, L., & Wall, K. (2013). **Self-organised learning environments (SOLEs) in an English school: an example of transformative pedagogy?**. *Online Education Research Journal, 3*(11).This paper by Mitre offers an innovative approach to social learning via "Self-Organised Learning Environments" (SOLEs) which allow groups of students across the world to learn to use a computer. It draws upon the aforementioned "Hole in the Wall" study but within a classroom setting rather than a slum.

Haney, J. J., & McArthur, J. (2002). **Four case studies of prospective science teachers' beliefs concerning constructivist teaching practices**. *Science Education, 86*(6), 783-802. doi:10.1002/sce.10038 - paper includes 4 case studies of prospective teachers, investigating their views towards constructivist teaching methods. Concludes that at least 2 varieties of beliefs exist in relation to constructivism, these being central beliefs and peripheral beliefs. Provides an interesting viewpoint of to what extent personal feelings impact upon teaching styles.

Smith, M. K., Wood, W. B., Krauter, K., & Knight, J. K. (2011). **Combining peer discussion with instructor explanation increases student learning from in-class concept questions**. *CBE-Life Sciences Education, 10*(1), 55-63. This paper compared the effectiveness of peer discussion, instructor explanation, or a combination of them both, and showed that a combination of peer discussion followed by instructor explanation improved student performance significantly compared to either approach alone.

Wood, D., Wood, H., & Middleton, D. (1978). **An experimental evaluation of four face-to-face teaching strategies**. *International journal of behavioral development, 1*(2), 131-147. This paper is one of three seminal papers produced by Wood which form the groundwork for contingent tutoring or scaffolding. The paper tests four different strategies for how to master a difficult construction task. The type of tutoring enlisted was able to predict how well children performed on a task after instruction.

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