

Time to Rethink the Concepts of Knowledge Dissemination and Transfer in the Educational System? A Systems Theoretical Perspective

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This paper is intended as an invitation to continue reflecting on and discussing the concepts of learning and teaching, including the concept of educational environment and the conditions for knowledge construction in that environment. The key concept is communication, which I link to different environments, including face-to-face (f2f) environments, net-mediated environments and various mixtures of these types of communication environments. Furthermore, I implicate learning resources in the concept of the educational environment. Thus, the main purpose of this paper is to contribute to developing our approach to the nexus between teaching and learning, including the concept of environment and the conditions for knowledge construction. I present a case study, which I analyse using a systems theoretical analytical framework, in order to discuss the relation between learning and the environment, including the idea of the possibility of knowledge transfer and knowledge dissemination. The specific focus is on learning resources in specific programs-on-demand (podcasts) and video-on-demand (vodcasts, from now just podcast) – and the students' approaches to these learning resources and the environment offered. My point of departure is to contribute to scholarly discussion of learning resources and, in particular, of the use of podcasts and students' approaches to these learning resources in concrete educational contexts. Finally, I suggest that we take the opportunity to reflect on the challenging task: how can we organize teaching and environments for learning, including the choice of learning resources, in order to provide each student with the possibility of developing the concrete educational qualifications that are required?

Introduction

The theoretical framework – inspired by systems theory

The paper starts with an introduction to the chosen theoretical framework. The chosen systems theoretical lens has consequences for my approach to the concepts of communication,

teaching and learning, and by extension to the concept of knowledge construction, which I view as a result of learning processes internal to a system. In addition, the chosen theoretical perspective affects my research design, which I therefore describe briefly before presenting the case study and discussing the findings that are relevant to the purpose of the paper. The specific focus is on learning resources in specific programs-on-demand (podcasts) and video-on-demand (vodcasts, from now just podcast) – and the students' approaches to these learning resources and the environment offered. My point of departure is to contribute to scholarly discussion of learning resources and, in particular, of the use of podcasts and students' approaches to these learning resources in concrete educational contexts.^{1–13}

Systems theory understands social systems as systems operating in communication, and psychic systems as systems operating in the mode of consciousness. A psychic system is just one of many systems related to the complex system called an individual.

Systems are characterized as autopoietic, operationally closed, self-referential, and autonomous.¹⁴ The characteristics of these systems have consequences for the way we define learning and teaching, and for how we approach the potential nexus between learning and teaching. In an operationally closed and self-referential system, all operations are internal to the system and, as such, do not leave the system. It also means that such systems are self-governing, self-developing and self-reproducing in an ongoing process, and that they use the outcomes of their own operations as inputs for further reproduction.¹⁴ These characteristics do not imply that a system is autarchic (self-sufficient); on the contrary, systems are dependent on their environments, and thus their operations are self-governed and internal to the specific systems. To maintain themselves systems need nourishment from the environment and systems need to be 'disturbed' by their environment to maintain themselves.

This need for disturbance is the pivotal point and fundamental basis for the discussion of the relation between teaching and learning. It is therefore also fundamental to the discussion of knowledge dissemination, knowledge transfer and knowledge construction. From the perspective of systems theory, teaching is seen as a social event and the social is conceptualized as communication. Learning is here regarded as mental activity that can trigger knowledge construction, and teaching is understood as a specialized and distinctive form of communication intended to give nourishment to the systems' processes of knowledge construction.

The concept of communication is defined as a synthesis of three forms of selection: the selection of information, the selection of utterance made by the utterer, and the selection of understanding made by the addressee. For instance, the teacher or an author selects information and the way the information is presented, and the student selects understanding. This sequence is defined as one communication unit. If the student has the opportunity to pose a question, the roles switch. The student now becomes the utterer who selects information and utterance, and the teacher becomes the addressee who selects understanding. If the teacher and student continue to switch roles, dialogue occurs. If we apply this structure to learning resources, for instance books, oral presentations or podcasts, it becomes clear that they are not in themselves communication; the addressee (the reader/listener) focuses attention on the uttered information and the selection of understanding before one communication unit is realized.

A minimum of two systems is necessary for communication to take place. As a consequence of this definition of communication, it becomes possible to draw an important distinction between presenting and teaching. Presenting something does not entail communication per se if the addressee (for example, a student) fails to link to the uttered information (for example, from the teacher) through his or her own selections of understanding. In other words, the student has to focus on the uttered information and select an understanding before the communication unit can be actualized. We might describe teaching as one-way communication; but it is important to keep in mind that we do not know what has been selected as understood when the one-way communication is actualized. The knowledge construction remains inside the addressee, so to speak. Within the theoretical framework of systems theory, utterer and addressee are conceptualized as ‘black boxes’.¹⁵ They can observe each other but do not have access to each others’ thoughts. Because of the systems theoretical approach, it is reasonable to conclude that communication might be regarded as impossible in principle. But the specific expectations of specific contexts help to construct a horizon of expectations over time.¹⁴ This insight has consequences for the relation between teaching and learning.¹⁶

The first two selections in a communication unit use language (intonation, pauses, gestures, bodily movements, verbal language, etc) as media. Hence, the uttered information can be observed. The third selection, the selection of understanding, cannot be observed because it is an operation internal to the psychic system taking place in mental activities internal to the system.

The special form of communication, which works to change psychic systems (mental constructions), is conceptualized as teaching. While both social systems and psychic systems are, as mentioned above, operationally closed, they can be coupled structurally through communication and a specific theme for the communication. If the students observe the communication in class or in a conference forum and furthermore participate by contributing, we have a social system, i.e. the class, including the teachers, students and maybe other participants, in a context such as a classroom or a weblog, Twitter or Facebook. Teaching, this special form of communication, is understood as a possible facilitator for learning processes and therefore of knowledge construction. But the condition of the possible knowledge construction is not to be predicted, much less shown, by the system characteristics outlined above.

Systems are meaning-based, which means that they operate on the basis of meaning.¹⁷ Meaning actualizes and focuses on something and lets what is not actualized remain as potential options;¹⁸ furthermore, ‘meaning itself operates on two different levels, using consciousness or communication as media’ (Ref. 18, p. 103). In this context, the student is considered to be a psychic system that maintains itself via mental activities, and teaching is considered a social system – a system that maintains itself via communication. Given that the two types of system operate in their own distinct modes (mental activities and communication, respectively), psychic systems and social systems are operationally closed in respect to each other. They are, however, structurally coupled, and thus the systems can ‘disturb’ each other (the concept of perturbation – see Ref. 14, p. 172). They can focus on each other, so to speak, and let the disturbance affect their system-internal operations.

As a consequence, *learning* and *teaching* must each be seen as operationally closed systems that have the potential to be structurally coupled, for example, by the theme of the communication.¹⁹ The consequence of the system characteristics of autopoiesis and operational closure is thus that it is not possible to extrapolate simple causality – no simple causal relation exists between teaching and knowledge construction. In the present theoretical framework, learning resources such as podcasts are not expected to be used as ‘transfer objects’ in the sense that the information offered by the ‘transfer object’ is assumed to be observed and understood as the utterer intends by the students. There is no simple causal relationship between the input provided via a podcast and the output in the form of the students’ individual knowledge constructions.

Systems theory is inspired by the distinction between trivial and non-trivial machines.²⁰ In this paper the term system is used instead of machine.²¹ There are thus two types of systems: trivial systems and non-trivial systems. Trivial systems can be understood in terms of input and output. In that respect they are analytically determinable, independent of previous operations and therefore predictable. Trivial systems can be analysed in terms of causes and effects. These systems are rational, and thus governed by simple causal relationships. A trivial system is like a simple machine that functions predictably, and thus the nexus between input and output is always given per se. If this model is applied to learning, the knowledge presented by a podcast, a book or a lecture is understood to be automatically transferred to the listening or reading addressee.

On the other hand, non-trivial systems are characterized by operations that are dependent on ongoing self-reference and changing inner states. They are analytically indeterminable, unpredictable and dependent on previous operations and their concrete context. If we understand learning as a non-trivial system, we cannot predict the outcome of a student’s listening to a podcast, reading a book or attending a lecture. We have to communicate with the student to get an idea of what understanding of the uttered information the student might have selected. When the focus is on psychic systems operating in mental activities, students and teachers may also be understood as non-trivial systems. If the focus is on social systems, which, as explained above, operate in communication, examples of non-trivial systems include a class, a workplace or a company. All of these systems are unpredictable and highly dependent on their concrete context.

In this paper, therefore, the concept of learning is discussed in terms of individual mental constructions (psychic systems), which result in knowledge constructions. Furthermore, these psychic systems are non-trivial systems. Shannon and Weaver’s concept²² of communication as substance being transferred from one person to another – in other words, the idea that knowledge is a substance that the teacher can transfer to the student – is not compatible with the operation of non-trivial systems. Systems theory, with its focus on non-trivial systems, thus challenges the traditional paradigm according to which teachers transfer knowledge to students through a variety of forms of communication, including lecturing and net-mediated media. The metaphor of transfer cannot be used when the focus is on non-trivial systems. We are never able to predict the outcome of an input, such as an f2f lecture or a podcasted lecture. Every system, students as well as teachers, observes with its own capabilities and perspective, and as a consequence, every system has its own unique way of observing and learning, and hence of constructing knowledge.

To summarize this short presentation of the key characteristics of systems, we may understand psychic and social systems as systems that are operationally closed, self-referential, autonomous, analytically indeterminable, unpredictable and dependent on their previous operations and the concrete context. As a result, the characteristics of trivial systems have no application to the analysis of either students' learning or approaches to the different social systems, from solely f2f to solely net-mediated communication forums, which are offered in an educational setting. In other words every person, every psychic system, observes its environment with its unique observation lens; hence every person constructs his or her unique environment. The only way to get an idea of what knowledge a student has constructed is by means of communication, for instance by asking about why the student has chosen to do so and so, or why the student has pointed out a specific theme as the essential part of a problem.

A Case Study – Focus on the Empirical Findings of Students' Approaches to the Environment and Specific Learning Resources

The case is presented as an example of students' approaches to a concrete environment for learning, organized by the teacher. Thus the case provides a concrete point of departure for the discussion to follow. The environment for learning includes a variety of learning resources and communication forums. This paper focuses on podcasts, one of the learning resources the students were offered by the teacher.

The observed course was organized into problem-based project groups combined with lectures, and the teaching was organized as a mixture of ordinary classroom interactions, group interactions and web-based communication. The project work was described as teaching by the teacher, and the teachers had a variety of roles, from the traditional lecturer, supervisor and guidance counsellor to discussion partner. The students were in their fourth or fifth year at university. The course was a six-month semester during which the students' project work was supported by different categories of podcasts – categories included short instructions (5 minutes), demonstrations (7 minutes) and 45-minute lectures, so-called 'talking head,' along with other net-mediated communication forums.²³

For the purposes of this study, the environment for learning is understood as consisting of communication forums and as social systems that intend to bring about change in students' ongoing knowledge construction. The specific communication forum with its special premises plays an important role; thus, if the communication is fruitful, ongoing, and focused on the theme of the concrete context, it might be viewed as a way of facilitating learning and thereby knowledge construction in relation to the concrete educational qualifications the students require. This applies to the f2f context as well as to the many net-mediated communication forums as well as the combination of forums. But as the case studies show, and the theoretical framework unfolds, it is not possible to predict and organize either the learning or the communication of systems.

Research Design

The case study was based on a consecutive research design inspired by systems theory.^{3,24} The research project made use of a variety of data collection methods, including

observations, individual interviews (students and teachers respectively) and group interviews (students), print-outs of net communication, questions asked in plenum sessions, and final written student evaluations.^{25,26}

The research project in full explored student approaches to a variety of communication forums, including a combination of lectures (ordinary classroom interactions), problem-based self-organized group work, weblogs, and web-based discussion forums and individual guidance. Furthermore, the research project included a variety of learning resources, including books, links, and podcasts, as a ‘one-way’ asynchronous media. Thus, the students did not have the opportunity to ask questions (written or oral) during the presentation of the video. In other words, the context for this part of the learning environment was what we might term ‘dissemination of knowledge’.

The following questions were posed to the students in both the individual interviews and the group interviews:

Which media have you used during the course (e.g., books, links conferences, podcasts etc.)? How?

When and where did you use the different media (e.g. at home, while travelling by train/bus/car, at the university, while jogging)?

What was your experience of the interaction of the different media in respect to how they facilitated your learning processes?

How does the teacher use the different media in lessons?

Do you favour certain media and communication forums? Why? When?

Do you have some suggestions for future courses in which podcasts will be used?

The interviews were interpreted using the following themes in relation to the students’ use of the podcasts made available to them: (1) time and place, (2) social dimension, (3) learning potential, and (4) teaching and approaches to teaching, cf. the theoretical framework.

What Did the Students Tell Us?

The students’ answers to the questions posed have been categorized as described above and the summary is presented below.

Time and Place

The students agreed that the podcasts made available by the teacher were a learning resource, but they did not use them at any place and at any time.

‘Podcast ... never on the bus or the train, I can’t focus.’

‘I prefer to enjoy my run. I do not listen to a podcast when running.’

‘I prefer to sit at home watching a podcast, so I can fast forward and especially rewind and concentrate on the content.’

‘One thing at a time; iPod is good when you bike, run, walk etc., but it’s the music I listen to.’

The students preferred to sit at home when watching a podcast, and the reason given for this preference was that they needed focus on the content of the podcast, which was easier at home in front of the computer with a minimum of disturbance from the environment.

The Social Dimension

The students’ approaches were almost the same when the theme was social aspects.

‘The social dimension is very important. You have to have the opportunity to hear others’ words and the opportunity to ask somebody questions – fellow students, the teacher, assistants or whatever – we need a space for posing our questions.’

‘The group work is a very important place for feedback and discussion about the content of a podcast or a text.’

Furthermore the students pointed out that the social dimension, in the sense of the framing of teaching as classroom-based, was a key factor, which indicates that they have a need to see themselves mirrored in each other, both academically and in other study-related ways.

Learning Potential

When the students focussed on the 45-minute podcast (the ‘talking head’), almost every student saw this category as a problem because of the lack of opportunities to communicate, and consequently the absence of the possibility to verify the selected understanding (the third selection in the communication unit) of the uttered information (the first and the second selection in the communication unit).

‘Especially the talking head shows the gap between one-way communication and what we learn.’

‘Even if I heard the podcast 20 times, I didn’t understand. It doesn’t help me just to hear the same words again and again. I need other words for the same content.’

‘An option when you are preparing for an exam.’

Some of the students were satisfied with the ‘talking head’ podcast because they believed that if they could reproduce the information for the exam they would succeed. Most of the students did not feel comfortable simply reproducing what they had heard without their own understanding as a foundation.

Teaching

Podcasts were seen as a learning resource but not a substitute for teaching.

‘The talking head can’t replace real teaching – in fact, it’s not teaching, like it’s not teaching to read a book.’

‘Maybe it’s ok to replace every other lesson with a podcast lecture, but then we should have the other lessons with max. 12 students participating.’

‘It depends on what the teacher intends with the podcasts. If it’s required like the texts in the syllabus, I will include the podcast.’

‘A podcast lecture is not a qualitative improvement in itself.’

‘The talking head just shows that maybe the time has passed for the lecture as we know it.’

The students saw the podcast media as an eye-opener and a catalyst for a discussion concerning what good teaching can be.

Students’ Approaches to the Three Podcast Categories

The students agreed that the short podcasts (categories 1 and 2) were a potential learning resource.

‘Short podcasts have a future.’

‘It’s a good way to introduce things we have to know how to practice.’

‘Using these at home, you don’t take time away from the lessons.’

But the podcast lecture (category 3) was not seen as a serious learning resource.

‘Forget it, it’s like I’m watching TV – I get passive and inactive.’

‘Talking head is a waste of time.’

However, students with a more relaxed attitude towards their education were more positive:

‘Ok for me. It’s a flexible way for an indolent student.’

‘It’s a very comfortable way of being updated.’

The key concept is communication, and the individual interviews as well as the group interviews show that the students assigned the teacher a central role. The students viewed the possibility of communicating with teachers as well as fellow students, tutors, and other participants as a very important parameter of the environment for learning. And the communication forums in play were both face-to-face communication environments and net-mediated communication environments. The latter cannot stand alone; the students preferred to have the opportunity to meet face-to-face.

The Students Suggest: Develop the Product

On the basis of the interviews, it appears that the students had ideas for new categories of podcasts. In a group interview, the students expressed the following idea for developing category 3, the 45-minute lecture:

‘The streaming of video, that is, the form presented to us, will not be useful until it is further developed. If it were possible to have notes – a system for notes that operates with

the video, and better sound and pictures, and the lecturers performed a little better ... but the medium clearly offers possibilities. The quality should be better ...’

Furthermore, with regard to the ‘short’ podcasts (categories 1 and 2, instructions and demonstrations), the students suggested that the teachers offer panel discussions on topics such as definitions of concepts and subsequent discussion of these based on the various theoretical perspectives applied: ‘If two professors could refer to the texts and define concepts in different ways and discuss what they mean, briefly, ... that is what we need.’

The students also suggested another category of podcast, the ‘documentary’, which is distinct from the other categories in that it focuses on the context:

‘I could imagine using film media on the same terms as documentaries. For instance, that we have to read a text, and then the teacher comes and says, watch this film – it exemplifies what you read for today. You learn an amazing amount by watching TV. And then we could supplement the theories with this kind of film, but it requires a lot of work, and it’s expensive.’

On the basis of these student contributions, we can now expand the three categories covered by the case with two more, which results in five podcast categories for use as reusable objects with the potential to support learning: instructions (3–5 minutes), demonstrations (4–7 minutes), lectures (max. 45 minutes), discussion panel – e.g. professors defining and discussing concepts (3–5 minutes) and documentary (max. 15 minutes).

Conclusion and Invitation to Discussion

Systems theory teaches us that we are not dealing with trivial systems in a teaching/learning context, even when a non-trivial system, e.g. a student or a teacher, manages to act like a trivial system in a specific context in which the person finds it appropriate to act like a trivial system. For example, people may choose to act like trivial systems in classroom contexts or in the workplace, where there are certain expectations regarding the students’ or the staffers’ behaviour. Thus, the familiar ‘one size fits all’ approach to the teaching situation²⁷ is too simplistic and must, according to the system theoretical framework introduced here, be challenged by the approaches based on an understanding of non-trivial systems.

In principle, according to the system theoretical framework presented here, we can never know the learning outcome of a concrete context. This requires us to accept the complexity immanent in every learning and teaching context. Teachers have certain intentions concerning the organization of the environment (communication), but the students, observed as persons and unique psychic systems operating in the mode of consciousness, have their own unique observations and interpretations. Thus, the idea of the transfer of knowledge and the role of knowledge dissemination comes under pressure when a system theoretical approach is applied to these specific dynamics.

It is necessary to make a distinction between dissemination and communication as defined in this paper, and thus between dissemination and the concept of teaching. And it is necessary to point out that communication – the possibility of giving feedback, of answering and asking questions – is the option we have when we try to understand

uttered information. Knowledge construction is related to the individual system; consequently, knowledge cannot be transferred or disseminated from one person to another as a one-to-one relation. Information can be disseminated, given that knowledge is related to a system's internal operations, and the addressee then has the opportunity to use this information and thus construct knowledge. In other words, communication is the key concept and the point of departure for understanding the dynamics of teaching, learning and the use of learning resources, such as the different podcast categories analysed in this paper.

This conclusion is intended as an invitation to a continued discussion about rethinking the concept of environments for learning and its fundamental conditions, and the key question is:

How can we organize teaching (seen as a specific form of communication) and thus environments for learning, including the choice of learning resources, so that each student is given the opportunity to develop the concrete required educational qualifications, when the foundation for practice is that every person is unique and has his or her own specific mental construction – and thus his or her own perspective as an observing system?

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