Chapter 2
Personalised Learning?
New Insights into Fostering Learning Capacity

by
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Sanna Järvelä reviews research evidence and clarified key questions relating to personalisation. She concludes that personalisation of learning has become imperative. By this, she does not mean individualised learning nor the opposite of social learning but as an approach in educational policy and practice whereby every student matters, equalising opportunities through learning skills and motivation to learn. She examines seven critical dimensions: i) development of key skills which are often domain-specific; ii) levelling the educational playing field through guidance for improvement of students' learning skills and motivation; iii) encouragement of learning through "motivational scaffolding"; iv) collaboration in knowledge-building; v) development of new models of assessment; vi) use of technology as a personal cognitive and social tool; vii) the new role of teachers in better integration of education within the learning society.

The rapidly changing educational, vocational and leisure activities of modern society present lifelong adaptive challenges for humankind. From early childhood, individuals encounter masses of complex, symbolic information and diverse cultural products. They are also constantly called upon to renew their social relations, forcing them to confront considerable novelty and ambiguity. Such environments place a heavy burden on the individual's adaptive capacity and resources. Learning is at the core of this process.

Successfully meeting the learning challenges of today's knowledge- and competence-oriented society demands disciplined study and problem

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solving from the earliest years. At work, there is continuous need to improve quality, creativity and performance in knowledge-intensive settings. In the home and community, people face a wide range of choices that can only be effectively resolved through learning. At the same time, new information and communication technologies are generating more open and flexible ways of learning.

In this general context, personalised learning is a potential approach to meeting future educational needs and may provide new alternatives that foster learning capacity among individual learners (Bentley and Miller, 2004). However, when thinking about personalising learning, care must be taken to remain realistic in terms of the individual's ability to be a competent, adaptive, active, goal-oriented and motivated learner. It is also important to take into account the scope of the social and collaborative processes of learning communities. This chapter investigates the power of personalised learning systems along seven critical dimensions:

- Development of key skills which are often domain-specific.
- Levelling the educational playing field through guidance for improvement of students' learning skills and motivation.
- Encouragement of learning through a "motivational scaffolding".
- Collaboration in knowledge-building.
- Development of new models of assessment.
- Use of technology as a personal cognitive and social tool.
- Teachers' new role in better integration of education within the learning society.

Development of key skills

What kind of knowledge will future learning and work situations require? To what extent should domain-specific competencies be personalised? Depending on the characteristics of the learning domains, some tasks and environments support individual work, while others will support a community of learners working on the same task. Mastering the characteristics of these tasks requires a sound knowledge base that must be constructed in light of the tasks and the competencies of the pertinent field of knowledge.

Recent advancements in social-focused analyses of learning have complemented individual-focused studies of human learning (Anderson *et al.*, 2000). Overall the results highlight the social construction of knowledge and the control processes involved in learning partnerships, particularly when it comes to shared cognition and regulation. In light of these studies, it has become clear that education systems need to consider the development of personalised expertise and the skills needed to build distributed expertise.

Knowledge construction and knowledge sharing form the core processes of learning. Both of these processes need to be connected to the development of higher order knowledge and skills, which should be seen as key organisers for how and what kinds of knowledge become relevant and shared. Higher order skills are understood here as the ability to evaluate, classify, make inferences, define problems and reflect (Brandsford and Stein, 1993). This implies the ability to sort out facts, conceptual arguments and assumptions embedded in the presented information and knowledge. Reading and producing text, models, graphs and multimedia in different genres are key elements in the development of advanced knowledge that require higher order skills (Brown, 1997). Higher order skills need to be perceived both as skills people have developed through their practical activities, and as skills that must be developed in order to master different types of practices. Both of these skills must be acquired to respond to the learning challenges of humankind. Through personalised learning, students are taught to use conceptual and factual knowledge in purposeful activities in authentic environments.

Levelling the playing field

Analytical skills, thinking skills, and learning strategies should be taught in schools. Teaching analytical thinking means encouraging students to analyse, critique, judge, compare and contrast, evaluate and assess – but also to continue creative and practical thinking.

Researchers agree that frequent and deliberate use of learning strategies is related to academic achievement (Boekarts, Pintrich and Zeidner, 2000). Earlier studies have shown that a selection of appropriate strategies can empower learning. Strategic learners have the following qualities: they are better aware of themselves as learners, they employ different knowledge acquisition strategies, they understand the specifics of task qualifications, they connect prior knowledge content to new knowledge and the possible contexts where knowledge could be useful, and they engage in meta-cognitive activities while learning.

In addition to the development of thinking skills, Sternberg (2003) has proposed going beyond conventional notions of expertise and strategic learning in order to teach children not only to think well, but also wisely. His approach differs from conventional teaching, which emphasises the development of an expert knowledge base primarily through the application of memory and analytical skills. His theory of successful intelligence (Sternberg and Grigorenko, 2000) extends the basis of developing expertise by integrating teaching for creative and practical skills with teaching for strategic learning. It should be noted, nevertheless, that students can become content experts without using their expertise in the search for a common good. An augmented conception of expertise might also take into account the extent to which knowledge is put to wise and intelligent use for collective well-being.

Motivating learners

Humans have the capacity to learn throughout their lives in diverse contexts. Students should be provided with “motivated learning schemas” and equal opportunities to work in different learning environments, thus enabling them to participate in the type of learning activities that promote learning and understanding (Volet and Järvelä, 2001).

Traditionally, school learning has trained students to achieve explicitly delineated goals. Emphasis can be placed on other types of learning situations that teach students to appreciate the value of what they are doing and learning. Furthermore, learning situations might be developed that involve lifelong learning, or, at the very least, sustained engagement in particular interest areas that often lead to the development of expertise (Brophy, 1999). Personalised learning can increase the value of learning. How learners may come to value particular learning domains or activities, and how teachers or parents might stimulate the development of such values are two core issues that must be explained. Motivationally effective teachers make school learning experiences meaningful for students in two fundamental ways: cognitively, by enabling students to learn and understand content, and motivationally, by allowing them to appreciate its value, particularly its potential applications in their lives outside of school.

When developing a personalised learning approach, the focus should be not only on how to strengthen students’ self-regulation skills (*e.g.* set learning goals and train students to achieve them), but also how to show them the value of learning in order to understand. A broader question is: how can people be motivated to build up competence and anticipate future needs both in local communities and in society at large in order to prevent segregation and exclusion?

Collaborative knowledge-building

One of the essential requirements in the rapidly changing society is to prepare learners to participate in socially organised activities. A pure focus on individual cognition may set the stage for a shared, interactive and social construction of knowledge. It is crucial to recognise that new learning environments in school and the work-place are often based on collaborative and shared expertise. These environments work under the presumption that learners are capable to work as team members and share their opinions and ideas.

Collaborative learning and knowledge building is one of the most meaningful ways to support individual learning mechanisms (Bereiter and Scardamalia, 1989). Studies of collaborative learning (Dillenbourg, 1999) have shown that it is effective if the students engage in rich interactions. Through this process learners arrive at complex and conceptual understanding rather than simple answers. This leads to the question: how could the collaborative process in personalised learning be regulated in order to favour the emergence of these types of interactions? For example, how can technology be designed to enhance personalised learning environments in ways that increase the possibility that such rich interactions occur?

New pedagogical models, tools and practices that support collaborative learning are being developed as a response to the increased need for sharing and constructing new perspectives, exploiting distributed expertise and increasing reciprocal understanding. Recently, educational researchers have worked towards developing pedagogical models for collaborative learning, such as inquiry approaches or problem-based learning. Research results show that these kinds of learning models generally indicate that inquiry learning fosters productive task-related interaction and enhances student motivation in general (Blumenfeld *et al.*, 1991; Hakkarainen, Lipponen and Järvelä, 2002). Other studies of student learning in computer supported environments that apply socio-constructivist pedagogical models report similar findings on more enduing adaptive tendencies (Cognition and Technology Group at Vanderbild, 1992; Hickey, Moore and Pellegrino, 2001).

However, it is crucial to note that there are also variations in the quality of the learning processes among students: some students have major difficulties in engaging in research-like working procedures with technology, and their learning processes may be more regressive than progressive (Krajcik *et al.*, 1998; Veermans and Järvelä, 2004). Even though the learning results seem promising, more research and implementation of these learning models are needed. A few examples of these pedagogical models – progressive inquiry, problem-based and project-based – help clarify the need both for further research and the implications for personalised learning.

Progressive inquiry

The instructional design of progressive inquiry promotes processes of advancing and constructing knowledge, which are characteristic of scientific inquiry. It guides students to generate their own research problems and intuitive theories and to search for explanatory information (Hakkarainen and Sintonen, 2002). Participating students share all elements of inquiry in order to foster their understanding.

A process of inquiry can be divided into different phases, each of which has its own specific objective and function in the process. Accordingly, every phase has a special dimension from the motivational point of view. The starting point of the process of inquiry is creating context for a study project in order to help students understand why the issues in question are important and worthwhile. They then become personally committed to solving the problems under investigation. This phase should arouse intrinsic motivation and understanding of the value of learning (Brophy, 1999). An essential aspect of inquiry is to set up questions or problems that guide the process of inquiry. Questions that arise from the students' own need to understand have a special value. Further, the questions should be in explanation-seeking rather than fact-oriented form in order to direct the process towards deeper understanding (Scardamalia and Bereiter, 1994). By creating a working theory of their own, students can systematically use their background knowledge and make inferences to extend their understanding. This phase enables students to be more involved in the process, because they can feel that they are contributors to knowledge (Cognition and Technology Group at Vanderbilt, 1992). The phase of searching and sharing new information helps students to become aware of their inadequate presuppositions or background information. This phase requires students to comment on each other's notes and encourages collaboration (Dillenbourg, 1999). A critical condition for progress is that students focus on improving their theory by generating and setting up subordinate questions. These questions will lead students towards deepening the process of inquiry (Hakkarainen and Sintonen, 2002).

Problem-based learning (PBL)

This learning method is a collaborative, case-centred, and learner-directed method of instruction, where problem formulation, knowledge application, self-directed learning, abstraction and reflection are seen as essential components (Koschmann *et al.*, 1996). These components arise from constructivist propositions, which can also be seen as instructional principles: all learning activities should be anchored to a larger task or problem, the learner should be engaged in scientific activities which present the same "type" of cognitive challenges as an authentic learning environment, and the learning environment should support and challenge the learner's thinking (Savery and Duffy, 1996). The learning environment of PBL and the task should be designed in a way that they reflect the complexity of the environment. When conducting inquiry around a task, the learner should be given ownership of the process she or he uses to develop a solution. Teachers still have a role in guiding the process. They ensure, for example, that a particular problem solving or critical thinking methodology will be used or that particular content domains will be "learned". As in other collaborative learning methods, PBL students are encouraged to test their ideas against alternative views and within alternative contexts.

There are many strategies for implementing PBL, but usually the general scenario is the same (Barrows, 1986; Savery and Duffy, 1996). The students are divided into groups of four to five, and each group has a facilitator. Then these groups are presented a problem that they are supposed to study and solve. Based on the knowledge the students have, they try to generate hypothesis of the problem by discussing with each other. After clarifying the problem, the students engage in self-directed learning to gather information from many different sources. After this individual studying phase, the students meet again in their groups. They evaluate the information they found to gather the essential pieces needed to solve the problem. This social negotiation of meaning is an important part of the learning process. The students begin to work on the problem and again, re-conceptualise their problem to more specific sub-problems. At the end of the process usually peer- and self-evaluation is used. This kind of PBL cycle takes some time, for example, in medical education it takes from one to three weeks to conduct the PBL cycle.

Project-based learning

Project-based learning can be seen as a way to promote high-level learning by engaging students in real scientific work. They learn by undertaking complex, challenging and authentic projects. To carry out the constructivist theory of learning, the main aim is that students actively construct knowledge by working with and using ideas (Blumenfeld *et al.*, 1991). In a project, students engage in a complex process of inquiry and design. The result is an artefact, based on the students' knowledge, which can be critiqued and shared. The public display of the artefact can motivate student involvement. The risk of this kind of project is that it results in a focus on task-completion. Often in such projects, the final artefact is central rather than the knowledge produced during the course of its creation. For example, if students make a poster; there is emphasis on task-completion.

At the same time, as students are choosing the topic of their project, they are also studying many skills and forms of knowledge that are tacit or deeply embedded within a practice. It has been argued that in this model of collaborative learning, the projects provide the best opportunity for students to understand these embedded or non-decomposable skills and knowledge (Guzdial, 1998). In the past, project-based learning has been used with science subject matters. Writing specifically about science learning, Krajcik *et al.* (1998) proposed some features the learning process should include:

- A driving question, encompassing worthwhile content.
- Investigations that allow students to ask and refine questions.
- Artefacts that allow students to learn concepts.
- Collaboration among students, teachers, and others in the learning community.
- Technology that supports student data-gathering, analysis, communicating and document preparation.

To sum up, project-based learning environments encourage learning by doing and are crucial to personalised learning. These environments create opportunities for students to explore and solve world problems in the classroom. Content and process become inseparable during the discovery and inquiry phase of learning. Thus students remain constantly engaged in the investigation of the problem. They identify gaps in their knowledge, search for and analyse the information needed to solve problems, and develop their own solutions. This approach to learning differs greatly from "typical" school classrooms in which students spend most of their time listening to lectures, or learning facts from texts and completing problems in the end of a textbook chapter.

New methods of assessment

The core questions dealing with assessment in personalised learning environments are:

- What do learners understand about their studies?
- How can learners generate information about how much they have learned and how their knowledge is changing?
- What should be evaluated?

- What is the relation between formal and non-formal education in terms of assessment?

Personalised learning requires new modes of assessment, such as authentic assessment, performance assessment, or (digital) portfolios. By expanding the range of abilities measured and ways of making the measurements, other intellectual strengths that might not have been apparent through conventional testing can be found and students' own self-beliefs of learning strengthened.

Effective teachers see assessment opportunities in ongoing classroom learning situations. They continually attempt to learn about students' thinking and understanding and make it relevant for current tasks. They do a great deal of on-line monitoring of both group work and individual performance, and attempt to link current activities to other parts of the curriculum and to student daily life experiences (Brandsford, Brown and Cocking, 2000).

Finding new methods of assessment becomes essential when information and communication technology play more central roles in studying and learning (Sinko and Lehtinen, 1999). Conventional standardised measurements for assessing learning are not always relevant when students are working with technology-based learning environments. For example, it is not possible to measure on the individual level the way that students work as a team to create new knowledge and solve joint problems. New methods need to be developed to measure, for example, how a student's capacity to participate in the activities has increased or how his inquiry-making has changed.

Using technology

How can technology be used to advance personalised learning needs in different life-wide contexts? How can collaborative learning activities be developed in different learning environments, including virtual ones? For personalised learning to succeed, it will be important to develop models that use technology to support individual and social learning activities. Multidisciplinary collaboration between technology developers and educational designers need to find ways to apply virtual spaces, simulations, game-technology or mobile applications to learning.

Many European countries have made efforts to use information and communication technology (ICT) in education. For example, the Finnish strategy says: "In developing the use of information and communication technologies in education, the objective is to shift the focus from hardware to pedagogic renewal and help increasing numbers of pupils to learn increasingly demanding information structures and problem-solving skills. In education, the emphasis lies on high-quality contact education, communality, interaction, open and flexible expression, and the use of distributed expertise through networks." (Information Strategy for Education and Research 2000-2004, Ministry of Education in Finland)

The core message of this strategy is that our rapidly changing society necessitates new forms of participation. Modern working environments involving intensive collaboration, expertise sharing, and social knowledge construction are permanent, and therefore contribute to setting new norms for educational standards. The pressure to develop responsive pedagogical practices is evident. Within this quest, pedagogical approaches that seek to utilise advanced technical infrastructures to foster higher-level processes of inquiry-based interaction have been considered most plausible (Strijbos, Kirschner and Martens, 2004; Wasson, Ludvigsen and Hoppe, 2003). By combining the ideas of collaborative learning and networked technology, these approaches aim at turning classrooms of students into communities of learners and learning situations into challenging and interesting projects with authentic problems. Such inquiry activities provide a valuable context for learners to acquire, clarify, and apply an understanding of concepts in different domains.

Based on research and practical experience, the following principles are the best arguments for implementing ICT in learning:

- ICT can increase authenticity and interest.
- ICT can build virtual communities among different schools, collaborating teams, and teachers.
- ICT can help to share perspectives among students with different expertise; proving peer support and "benchmarking practices" in different fields.
- ICT facilitates the use of technology-supported inquiry approaches and problem-based models for increasing learning-to-learn skills.
- ICT provides innovative ways (for example, mobile tools) of integrating "just-in-time" support and interaction in different learning contexts.

One of the trends of the future will be the use of mobile devices and wireless networks for education. Mobile phone use is widespread today, and, increasingly, students and young people also use handheld computers and other mobile devices. This leads us to conclude that the pedagogical use of wireless devices will be one future challenge. Roschelle and Pea (2002) suggest that future classrooms are likely to be organised around Wireless Internet Learning Devices (WILD) that resemble graphing calculators or

Palm handhelds, connected by short-range wireless networking. WILD learning will have physical advantages that are different from today's computer lab or classrooms with many students sharing a single computer. According to Roschelle and Pea, these differing advantages may lead to learning activities that deviate significantly from today's images for computer- and technology-based learning activities. The main reason for the pedagogical use of mobile devices is a) to enhance collaborative learning through cognitive interaction using mobile applications and cultural artefacts; and b) interaction among the student both inside and outside of the schools and classrooms as well as knowledge building communities.

In spite of record development of technology, recent evaluative studies of the role of information and communication technology in teaching and learning (*e.g.* Hakkarainen, Lipponen and Järvelä, 2002; Niemivirta and Järvelä, 2003; Khaili and Shashaani, 1994) do not show significantly better results for technology versus non-technology mediated learning. However, there seems to be considerable payoff from the indirect impact of using ICT on part of the overall learning environment. First, enriching schools, classrooms, and offices with technology has made teachers and students change old habits and create more innovative pedagogical models. Second, the prevalence of Internet access, wireless networks, and virtual universities and schools has led to an increased collaboration among teachers, students, and administrators. Third, the results of the longitudinal empirical studies as well as case studies in different computer-enriched learning projects tell us that ICT is particularly effective for lifelong learning because it facilitates progressive motivational experiences and more advanced study strategies among the students.

There has been a systematic effort by the European Union and individual nations to implement educational use of ICTs. However, there are still many challenges to overcome if learning- and education-use of ICT is not accessible to the majority (Lehtinen, Sinko and Hakkarainen, 2001). Issues such as a shortage of high-quality digital learning materials and insufficient pedagogical and technical support are still very real. Furthermore, teacher training needs to be improved and better focused. Also, a sufficient level of research and development of high-level learning environments must be sustained in order to improve the implementation of promising practices. Personalised learning offers a potential framework to further develop these practices in pedagogical development and educational policy.

New roles for teachers

Teachers and trainers are likely to encounter transitional problems when implementing personalised learning that are parallel to those of learners as they move from conventional to new, open, and less-structured learning environments. New learning environments require complex instructional design. Teachers will need to reconsider communication and collaboration skills. They will have to develop new pedagogical reflective thinking in mentoring learning, mediating values and social skills, as well as systematically evaluating students' and teacher's own activities. What is the teacher's role and expertise as mentor in collaborative- and socially-shared learning? What kind of new teacher training contents, models and methods can be used for implementing learning innovations? How should teachers be encouraged to create a new teaching and learning culture in schools and in open learning environments? How should the growth of teachers as lifelong learners be supported in the future? How can teachers facilitate partnerships for promoting life-wide learning in a civil society?

Teachers are key to personalised learning. In order to teach in a manner consistent with new theories of learning, teachers require their own extensive learning opportunities. What is known about learning applies to teachers as much as to their students. Research evidence indicates that the most successful professional development activities for teachers are those that are extended over time and encourage the development of teachers' learning communities (Brandsford, Brown and Cocking, 2000). These kinds of activities are accomplished by creating opportunities for shared expertise and discourse around shared texts and data about student learning and by focussing on shared decision making. Teachers' learning communities also allow for different backgrounds and variations in readiness to learn.

Conclusion

To sum up, the main arguments from the point of view of learning theory for personalising learning and fostering learning capacities are:

- Personalising learning can improve conditions for the development of expertise in the knowledge society. Collaborative efforts and networked forms of expertise are increasingly needed in the future knowledge society.
- Personalising learning increases student interest and engagement in learning activities. If students are able to develop their personal learning and individual expertise in the areas in which they either feel incompetent or in need to increase their existing expertise then their

individual interest in learning can be enhanced. Curiosity and creativity can be inspired by personalised learning.

- Personalising learning can contribute to better learning results if students learn with the aim of developing: develop better learning strategies, learning to learn skills, technological capacities for individual and social learning activities, and create learning communities with collaborative learning models.
- Personalising learning can take contextual conditions into account. There is a variety of learning contexts in European countries, from urban areas to rural and remote areas. Different values and cultural features can be respected if the individual person and his/her needs are deemed important.
- Personalising learning can potentially improve the use of technology in education. When technology is seen as an intelligent tool for supporting individual learning as well as collaborative learning among different individuals there are multiple ways to expand learning potential in every student.

Personalisation of learning has become imperative. This does not mean that purely individualised learning, nor is it the opposite of social learning. Personalised learning can be seen as an approach in educational policy and practice whereby every student matters. It equalises learning opportunities in terms of learning skills and motivation to learn.

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