

A new kind of societal knowledge creation?

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What research is and how it preferably is conducted is a contested issue. As far as I can judge, the critical attitudes towards mainstream research are more fundamental today than some decades ago. A similar debate is also taking place about education and its relation to research, economic growth, and broader societal movements. This symposium is connected with those issues, as can be seen from the two expressions that indicate the theme of the symposium: "Education and society: center, periphery and marginalisation" and "Scientists in dialogue with the society". My contribution to the theme of the symposium will be to discuss "interactive research" or "developmental activity research": a way to bring practitioners – groups of skilled people whom the university tends to marginalize – as a resource into joint knowledge production.

Let me start with a short notice of the missions of the university. What I say is related to Sweden, but I imagine that some patterns have more general bearings. From the establishment of the first university in Uppsala in 1477 and the second one in Lund in 1610, the mission of the university was education, in a framework set by the Lutheran church. The decision to include research as a mission came much later. It is less than a century ago (1908 and 1916), that the regulations of the university were expanded to include research (Svensson 1981), although in practice the inclusion of research came earlier, as part of the modernistic breakthrough some fifty years before.

Lately, a third mission has been added to the two missions of higher education and research. This means that research and higher education in cooperation with other partners have been encouraged for some decades, in Sweden as well as in other countries. In Sweden this collaboration is established in the "Högskolelag" as a special mission, besides higher education and research. Even though there is an ongoing debate whether this so called third mission should be accomplished by means of the two traditional missions of the modern university, or if it can be achieved as a more independent activity, and even though there are many arguments in favour of the university having a certain independence, there seems to be an agreement in favour of an increased collaboration between partners from the university and partners from "the surrounding society." The question is what such a "working together" might look like. Currently, ideas and practices of university-community collaboration are multifarious, and collaboration is being addressed on different levels and in diverse scales, from the so called Triple Helix visions of large scale collaboration between industry, the state and the university, covering vast regional or national districts, to more limited local or regional networks.

To me it is obvious that the vital debate currently taking place about the role of the university, the importance and ways of innovations and knowledge building, as well as the rhetoric about the importance of research to bring wealth, health and success to humanity, is not primarily driven by external causes, such as giving an account of the uses of the taxpayers money, but by internal ones. If research is still the point – and almost every voice says this is the case - it is often strongly suggested that research has to find a new orientation and organisation. The questions are why and how.

This is not the place to review the many suggestions for renewal that have been promoted, (and I am not the man for that). Before I proceed to my own ideas, which have their bearing from cultural-historical activity theory (CHAT) and empirical low-scale experimentation, I will restrict myself to one such suggestion that I find informative. It was made by Shigeru Nakayama, in 1981. I will introduce his standpoint by means of a figure of his own.

	Academic science	Industrialized Science	Service science
Assessors	Peer review	Sponsor	General public
Motive	Individual competition	Business competition International competition	Response to community needs
Referees and examiners	Fellow researchers	Higher level administrators Sponsors	Local residents General Public
Rewards	Personal distinction	Promotion of the organisation	Solidarity
Values	Pure scholarly interest	Fidelity to organization (business principles)	Contribution to society
Evaluative criteria	Objectivity, universality	Practical use (business profits) (national prestige)	(Restoring science to society)
Form of presentation	Academic meetings Scholarly journals	Research reports Patents	Handbills General magazines
Promoting body	Elite university Professional associations	Industry research institutes National research institutes	Citizen movements Regional university Local research institute
Source of funds	Pocket money University budgets	Industry Government	Voluntary contribution Local government
Organizational configuration	Professorial chair	Centralization Integration	Decentralization Dispersion
Research location	Laboratory	Research institute	Field
Spokesmen	Humboldt, Helmholtz	Technocrats, Bernal	Ravetz, Shibatani
Users	Fellow researchers	Business and industry State	Local residents Society
Ranking disciplines	Basic science	Engineering research and development. Military science	Social sciences Public sciences
Work style	Interest-intensive	Capital-intensive	Labour-intensive
Political regime	Laissez-faire capitalism	Monopoly capitalism State monopolies	???

Figure 1. A classification of science (after Nakayama 1981, p. 86).

As can be seen, Nakayama distinguishes three types of science – academic science, industrialised science, and service science. They differ in several respects, but the distinctive feature is whom they primarily address, or in other words, who their referees and examiners are – fellow researchers for academic science, sponsors for industrialised science, and local residents and the general public for service science. Nakayama’s historical explanation of the birth, growth and incipient problems of the different types of science, is briefly as follows. The success of academic science was based on free debate among colleagues in the academic societies and later at the universities. The motive was personal interest and curiosity. In the 20th century academic science to a large extent was replaced by a science connected to industry and the state, a big science in which competition became restricted by monopoly. The result was “industrialised science,” which cannot afford what was the strength of academic science – to experiment freely, to be wrong, and to learn from a trial-and-error way of working. In big science, stakes and consequences are so huge that “being wrong” is no longer permitted as an ingredient of the scientific profession. Service science, just emerging, is a “manpower intensive research” or “research for education.”

From my own small-scale experimentation on “productive learning” (Sutter 1991) and “developmental activity research” (Sutter and Lindberg 1994), I have come to the conclusion that there are two keys to a new kind of societal knowledge creation. The first key is to re-think learning; the second is to re-think the role of higher education in knowledge generation. In my presentation I will argue for this claim. As a first step in my argumentation I will revisit learning. From a cultural-historical activity theory (CHAT) perspective, I intend to show how learning goes hand in hand with development, and what the implications of this are. The second step is to re-think higher education as a resource for research and development. In the third step I will present a case of a “joint venture” that our research group and our students have been running for several years, together with nurses from the municipality. The aim of the account of the case is to illustrate and develop my theoretical discussion. Finally, I will sum up the lessons learned, including speculations about possibilities and problems when scaling up the model system that our research group is testing on a small scale.

Re-thinking learning

In the CHAT tradition, some important distinctions are made to get a grasp on the phenomenon of learning and its role in human activity. For example, Regi Enerstvedt (1986, 1988) has elaborated upon the distinction between learning as a universal act (learning for all living organisms) and learning as a special activity. He defines learning as a universal act as “the self-transformation derived from a system’s own information activity” (1988, p. 11). Enerstvedt claims that a second kind of learning, *learning as a specific activity*, is characterized by having “a goal different from all other activities, namely the goal: *transforming of the self*” (ibid.) or shorter, “*learning activity is motivated learning*” (1986, p. 192; my translation). The problem with defining learning activity seems to stem from the fact that there are at least two answers to the question of what the goal of this motivated activity is: the mastering of knowledge or the method for the mastering of knowledge. (1988, p.12)

Vasily Davydov has introduced a second kind of distinction which is of importance to learning. He claims that learning as activity presupposes a developmental dimension: “What is special about learning activity is that the pupil appropriates *theoretical knowledge* in the process of its realization. The content of this knowledge is the *emergence*, the *becoming*, and the *development* of some object” (1988, p. 30).

Bernd Fichtner (1988, 1996) too underlines that a developmental aspect is essential to learning activity. According to Fichtner, the emergence of learning activity in Europe during the nineteenth century implied that learning was associated with development in an earlier unknown way. During the Middle Ages, the content of learning was stable and inflexible, laid down from the beginning. In the centre were sacred texts that rendered the core of the canon. These texts were so to say without history – in the beginning was the Word. They established the fundament of the tradition, and were fixed and as complete as Athena when born out of the head of Zeus. Given such a tradition, learning meant reproduction of texts. Learning hymns by heart can stand as an emblem for this kind of activity. Learning under these circumstances could not transform the content of learning, nor could it change the learner himself. Fossilized knowledge “is degraded to ‘stuff’ and the pupil becomes a container to be stuffed” (1988, p. 44). This kind of learning did not have much to do with development. According to Fichtner, this was changed with the introduction or emergence of the Humboldtian educational tradition. “Learning first had to be directed to a scientific knowledge as ‘subject matter, which all our own doing always has to follow’ but an orientation on learning how to learn was – at the same time – of the very same importance” (1984, p. 58).

After stating what human learning is as a general phenomenon, Fichtner (1996, p. 11) continues: “Learning activity means a historical form of this appropriation, namely a form of learning that is characterized by reflection on the process itself, on itself as a subject, and on the result.”¹ Built on a historical analysis of the emergence of learning as a specific activity, Fichtner comes to the conclusion that “substantiation of knowledge” and “development of knowledge” are the units of analysis, which are constitutive of learning activity. Essential to his argumentation is that: “The development of knowledge always implies that activity itself also develops” (1988, p. 46). To sum up, the activity of learning is concerned with the fact that knowledge is produced and has a history. In order to gain access to knowledge one has to know its “circumstances of production” and its mediated character. Knowledge develops and so does the learning subject – the individual subjects and the collective subject – and, accordingly, the knowledge-generated activity itself.

In his seminal book, “Learning by expanding”, Yrjö Engeström (1987, p. 125) *defines learning activity as “an activity-producing activity.”* In another phrase he states (Engeström 1987, p. 155-156): “In learning activity, development itself becomes the object of learning.” Thus, the outcome of learning activity is an activity. In my opinion,

¹ “Lerntätigkeit meint eine historische Form dieser Aneignung, nämlich ein Lernen, das durch eine Reflexivität gegenüber dem Prozess selbst, gegenüber sich als Subjekt und gegenüber dem Resultat gekennzeichnet ist.”

this definition of, and the stance it expresses towards, learning and development is very fruitful and highly consequential. I will later return to this.

All of the CHAT-oriented researchers referred to here see development as an essential aspect of learning activity. When learning activity is going on, something is transformed – the content of learning, the individual subject, and the activity system that ‘contains’ the learning activity. Engeström explicitly takes the aspect of expansion the furthest: learning activity is an activity-producing or activity-transforming activity. The outcome-activity can be the learning activity itself that is changed into a new learning activity. This is what Davydov aimed at with his experimental teaching in school, and it seems to be what Humboldt strived for. The outcome-activity can also be another activity, for example work activity, which the activity of learning transforms or produces. I am tempted to regard this insight as a *“quantum leap” in the conception of the relation between learning and development*. Through this, the focus is changed, from the individual (who is at the heart of “learning” in our culture) to the transformation of an activity system. In the first case of “individual learning,” the learning activity system also changes, and in the latter case of “development of the activity,” individual members of the activity system also change, i.e. learn. With this conception of learning, it is acknowledged that the development of knowledge always implies that the activity itself also develops. One can describe this conceptual shift like this:

learning/development → development/learning

As a consequence of the conceptual shift of learning, some action research methodologies have been designed. Developmental work research (DWR)², developed by Yrjö Engeström and his colleagues at their centre in Helsinki, is perhaps the most influential one. DWR is a kind of “action research” or “interactive research” (Svensson et al., 2002). Our research group in Ronneby also adheres to a variant of the DWR methodology.

Learning, development, and research are basic elements in the kind of action research that DWR stands for. In a way, it all goes back to the distinction between the learning of the culturally given, on one hand, and the learning of the new, on the other hand, and the distinction between development as a secondary phenomenon (usually conceived as individual learning only) and development of an activity (where the participants as a collective are “learning the new” while “doing the new”). Figure 2 sums this up.

² Developmental Work Research (DWR) was elaborated as an approach based on Activity Theory and research projects in collaboration with practitioners from diverse fields of work. The methodology is applicable also to other activity systems than work, for example to activity systems of play, learning and leisure. To pinpoint this broad range, the approach is sometimes called Developmental Activity Research.

	LEARNING AS APPROPRIATING THE GIVEN NEW	LEARNING AS COLLABORATIVE MASTERING OF THE SOCIETAL NEW
Learning as a specific activity	E.g., organized as traditional school-instruction	E.g., organized as in-house instruction at work; Learning by expanding
Learning as a general phenomenon	Learning as a by-product of participating in activities, e.g. apprenticeship learning	Spontaneous innovative work actions

Figure 2. Learning related to the “given new” and the “societal new”.

What is said in the figure is that traditional school-instruction is a way to organize learning of what is societal important, but which is not appropriated spontaneously. The same holds true for in-house instruction at work. Both cases are about learning as a specific activity. Learning by means of participation in any activity is about the learning of actions and strings of actions. It is the most common way to learn. One learns what is given in the culture by participating in the culture. On occasion, spontaneous innovations occur as actions in response to challenges in work practice (see, for example, Sutter and Lindberg, 1994). The conception of learning and development that is shown in Figure 2 is a fundamental feature of the DWR approach.³

Another feature making up DWR is the mutual collaborative efforts between researchers and the practitioners from the activity to be developed. Nissen (2000) calls it “joint venture.” The term refers to the fact that “joint venture” concerns two projects; on the one hand the developmental project, and on the other hand the research project. “The point of the model” he underlines “is that the important angle of approach is neither the researchers’ use of practice as empiric data, nor the practitioners’ use of research as evaluation, but the collaborative work that is growing as a result of the project” (2000, p. 35).

Engeström (1991, p. 80) has described the core idea of the form of “action research” that DWR represents as “expansive re-mediation in developmental work research”. In DWR, practitioners and researchers work together in a certain way. Supported by “the activity system framework” which the researchers provide, the practitioners “design and implement novel solutions to contradictions they encounter.” The outcome of the collaboration is “new ‘intermediate’ conceptual tools” (ibid. p. 79), which are usable for the researchers in their theoretical work and for the practitioners in the development of

³ In my interpretation, the consequences for traditional school learning would be: Open up the school! Connect it to the diverse societal movements! In a historical perspective the compartmentalization of the school has been motivated by the need to get away from the urgent practical demands of daily life and productive work activity, to concentrate on the learning of skills necessary for a more complex society. But nowadays, the compartmentalization is more hampering than supportive. There is a need for a slightly retrograde movement, connecting instruction and learning to the complexities of modern life, including cultivating systematic reflection as a key issue.

the work practice. “The task of the researchers is twofold: to facilitate and to document each step in the expansive learning process. This dual task demands that the researchers pay special attention to the documentation and ‘distanced’ analysis of their own roles in the process.” (Ibid, p. 80)

Thus, what we expect from the joint-venture projects we participate in are two main outcomes, that spring from the interplay between the university and the community partners of the local joint-venture R&D project - one outcome beneficial to the work activity, namely a changed work practice, and another outcome beneficial to academia, something concerning description, theory, method, software development, or physical artefact design.

Re-thinking higher education

In popular media, science and research are often presented as a theoretical enterprise conducted single-handed by a scientist. Of course, research is theory-related, but it has many more aspects than theoretical ones. Research activity is of a practical nature. Likewise, the sole scientist is a myth. Research activity is always a collaborative activity, even if scientists sometimes are seemingly working by themselves. In short, theories are produced by practical work in communities of practice.

The Swedish philosopher of history, Sven-Eric Liedman, and the philosopher of science, Håkan Törnebohm, have classified scientific studies in ways that have a bearing on our questions. Liedman (e.g. 1980) imagines a dimension ranging between an empirical pole and a theoretical pole of the research activity. Törnebohm made a distinction between explorative studies and synthetic studies in empirically based disciplines. Explorative studies are those which establish close connections between empirical data; that is, they are of a low-level conceptualisation. Synthetic studies are of secondary (or higher-order) character. They build upon explorative studies and try to synthesise them into higher-order theories. (Törnebohm, 1972)

It is reasonable to imagine that students within higher education, and sometimes, even laymen – imagine bird-watchers or local historians - might produce knowledge new to the society, but surely that will be empirical knowledge gained by explorative studies. Theoretical knowledge acquired through synthetic studies requires familiarity with the body of an academic (or similar) field, including procedures and instrumental know-how, which take a long while to attain. As a rule, it is beyond the scope of undergraduate studies.

Another circumstance that makes bird-watchers, local historians, and undergraduate students unlikely to generate theoretical knowledge, and even empirical knowledge particularly valuable to society, is that they act in a context, which is peripheral to prioritised societal knowledge. (In a prioritised context professionals will take part.)

In their book about situated learning, Lave and Wenger (1991) underline that learning always takes place in a community of practice. This was probably a kind of breakthrough

for a broader acceptance of the idea that learning presupposes participation as well as a community in which to participate.

The communities that Lave and Wenger mention are well-established communities, be they guild-like communities of tailors and midwives, non-drinking alcoholics, or quartermasters on a naval ship. In contrast to that, the educational projects that I will present are far from characterised by taking place in a well-established institution. On the contrary, they break out from confined school and university institutions, and open up for extramural learning relations and artefact uses. Their organisational form is a university-community coalition where (graduate) students play a significant role. What is happening is that the university-community coalition establishes an inter-institutional collaboration, which is built up in order to overcome the inabilities of the traditional school and university and to take advantage of the resource that the students represent.

For the sake of the further discussion, let us delimit the field of research by means of two dimensions, one representing research from the empirical pole to the theoretical pole, and the other dimension representing developmental work from the pole of product development to the pole of activity development. See Figure 3.

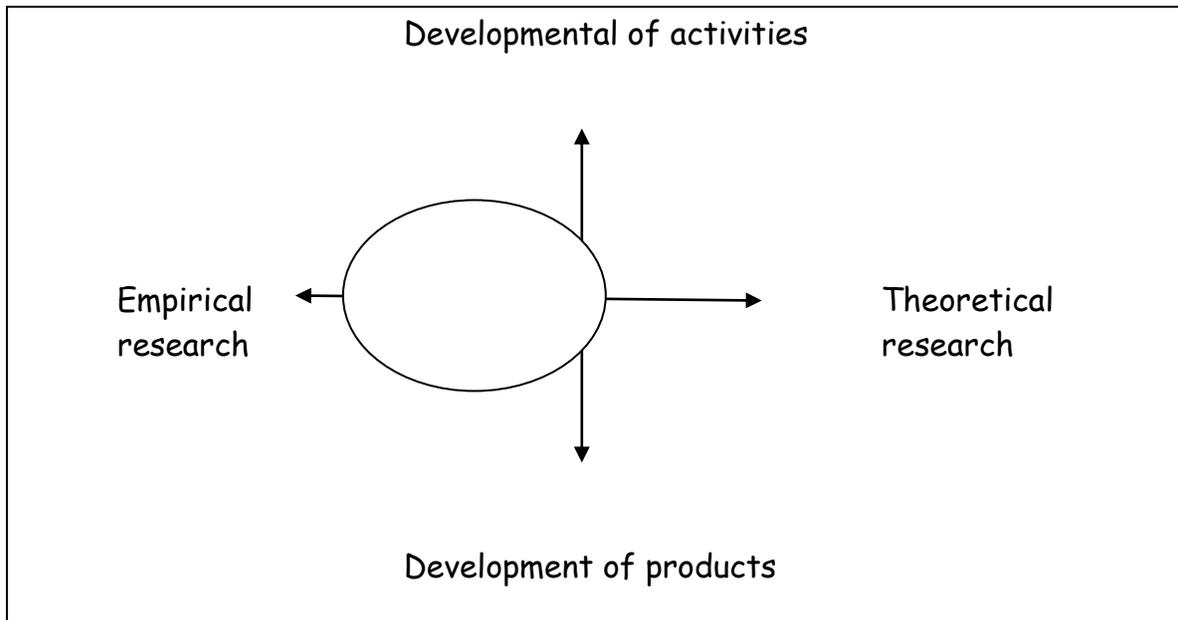


Figure 3. Two dimensions of research and development, and an attempt to illustrate possible contributions of undergraduate students.

Figure 3 is an attempt to say that one cannot expect undergraduates to have much to offer to theoretical research. The reason for that is that theoretical research means syntheses made on the basis of results from empirical studies. It takes time, and requires extensive reading and participation in international research discussions. As a rule, this is not within the scope of graduate education.

In the figure, there is another dimension represented in developmental work research, namely “development”, the development of activities and products.

It is a well-known fact that students in higher education, even at undergraduate level, can make a substantial contribution to the deployment of products, e.g. software, architectural drawings, machine construction, etcetera. As well, it is acknowledged that undergraduates can give competent assistance in empirical research. For example, in the case of Blekinge Institute of Technology – my academic home - it is evident that the educational programs of urban planning, software development, machine technology, signal processing, and People-Computers-Work – in different ways and guided by different kinds of pedagogical ideas – have systematically succeeded in involving undergraduate students in research activities. (Ohlsson and Johansson 1995; Johansson, Dittrich and Juustila 1999; Eriksén 1998).

I am convinced that undergraduates can make substantial contributions to R&D, provided the research activity is properly organised. And it is exactly the aim of my presentation here to suggest a model for organising developmental activity research as a systematic kind of research-and-education.⁴

A case of municipal wound care⁵

One of our joint ventures, which we call the wound care project, has been running in a small municipality in the south of Sweden for almost four years. The treatment of wounds is only one out of many things the nurses take care of, but it is an important part of their work. Planned and emerging treatment is provided in close contact with the patients, typically elderly persons. Each care situation comprises assessment, communication, decision-making and sometimes hands-on work

A cluster of artefacts is used in each working shift. It consists of a set of medical instruments, a diary, a note pad and or a deck of small slips of paper, and four or five ordinary paper binders, all of it packed into a bag on wheels, one for each nurse. This *bag-on-wheels* is currently the working mobile information system used by the nurses.

In everyday work, the nurses improvise and adapt to the circumstances of place and time. They may place their slip of paper, diary or checklist on any table or object of furniture, in order to document by things means of a pen. If needed, binders are consulted, before or at the actual moment of giving treatment. Short notes on slips of papers are temporarily put in the nurses’ pocket or the notes will be found in the note pad. When appropriate, the

⁴ The contributions from the “reflective practitioners” are of a somewhat different kind. According to Donald Schön (1983) and his “epistemology of practice”, they master and make sense of the practice situation, characterized by “complexity, uncertainty, instability, uniqueness, and value conflict (p. 18) by means of, for example, on the spot experimentation, improvisation, and reframing. In that way it seems reasonable to imagine that the practitioners are substantially involved in the development of the activity. What they don’t do in the story told by Schön, is add to the discourse of knowledge by, for example, writing an R&D paper.

⁵ The case has been reported in Kyhlbäck and Persson (2003), Sutter and Kyhlbäck (2003), Kyhlbäck and Sutter (2004,a and b).

nurses withdraw to a secluded place and do the final documentary work: transferring first-hand notes from the slip of paper into the regular paper forms stored in the binders. The work in elderly care is typically an unforeseen mix of planned events and a diversity of emerging cases. The nurses have to embody a vast set of operations in performing an appropriate action. Most actions are dependent on artefacts that are familiar to the nurse and which constitute parts of the socio-technical system. Since the practice involves a diversity of people to interact with and also demands an ability to change location for meeting the care recipient in her or his own home, a nurse must bring along necessary artefacts in the bag on wheels. Closer to the target location, artefacts are put on a tray and in the pockets. Other artefacts, specific to each care recipient, are found in a cupboard at the individual's home. To make the needed tools, medicine and other materials ready at hand, the nurse has to choose tools and items. Indeed, she makes a redesign every time at the location where she provides health care.

The socio-technical system of wound care work is in our case characterized by three things: First, the nurses are on the go and on the move, second, they are interacting face to face and in different places with a lot of people, and third, they use a variety of artefacts, the combination of which they quite often design themselves. The bag-on-wheels contains the most essential set of artefacts and provides an access point to those at the individual care recipient's home, as well as allowing for rapid shifts between various places. In the municipal elderly care, the bag-on-wheels obviously is still a working mobile information system.

Our research group has run the long-term wound care project in collaboration with the nurses for several years. This joint venture of interaction research aims at knowledge production and work practice development. The main events of the joint venture are summarized in Figure 4.

2001	<ul style="list-style-type: none"> - A 3-page wound care paper form adopted in 1999 is used daily as part of a "Bag on wheels" artefact. - The "joint venture" between the university and the municipal nurses starts. - A digital camera is introduced for documentation of the wounds. - Development of stand-alone software, which integrated various notes on treatment and digital photos of wounds. (Designed by 5 students as a software development project.)
2002	<ul style="list-style-type: none"> - Test of the stand-alone software prototype (by students and nurses)
2003	<ul style="list-style-type: none"> - A new digital prototype for wound care documentation was developed by 17 software engineering students during five months. - Nurses were heavily involved in the design process by means of several participatory design sessions.
2004	<ul style="list-style-type: none"> - Evaluation of the digital prototype. Discussions on whether it could be integrated into the Magna Cura information system that is in use for administrative purposes.

Figure 4. Main events of the wound care project.



Figure 5. The “raw material” for the participatory design session: three case books in paper format.

Lessons learned from the case

The *raison d'être* of interaction research is twofold. First, there is knowledge production (generation/creation), that is, development of research practice, and second there is “inter-action”, that is, development of the practical activity as a joint endeavour.

The story of the case presented here clearly shows that the university partners (researchers and students) have substantially contributed to the development of the wound care documentation work, primarily by designing and introducing technical artefacts. But what about the other way suggested by the word *inter-action* research – how did the practitioners contribute to knowledge production? Of course, it is not to be expected that the practitioners will write academic papers, but they may provide something else to the discourse of knowledge, e.g. give a talk for geriatric care professionals, or be so integrated in some phase of the research process that the R&D outcome (be it in the form of a technical artefact or some theoretical insights) would not have been achieved without their participation. Indeed, they made contributions to research in several ways:

- They taught us that in order to take practitioners seriously, we have to involve their central artefacts in the design process. (Input in the participatory design sessions; see Figure 5.)
- Doing that, triggered the idea of making a distinction between general design and specific design, an idea that “was in the air” for those of us that are inspired by cultural-historical activity theory (in analogy with the distinction between learning as a general activity and learning as a specific activity, or, for that matter, work as a general activity and work as a specific activity). We learned that in this case, the practitioners contributed to the specific design (“the entrance gate” – the first view of the ICT prototype display) in addition to what they added to the general design of the wound care work environment and the care practices.

- They also taught us that, although they have been heavily involved in the design of the wound care documentation system, they nevertheless preferred to use their “old-fashioned” mobile information system, the “bag on wheels”, in their work activity. We learned that it better fitted a fundamental feature of their work practice – almost always being on the go and on the move – better than the “office-usage” which the designed prototype was taking for granted.
- In the give and take between field practice knowledge and academic knowledge, that has become a feature of our joint venture wound care development, the project was presented at a national conference attended by nurses. The topic was how the digital prototype was developed in parallel with the development of the wound care work activity. The project was presented jointly by one of the nurses and a member of our research team,

By re-thinking learning from a cultural-historical activity-theory perspective, the developmental aspect of learning came into focus. To speak in Engeström’s terms, learning activity is an activity-producing or activity-transforming activity. Development-learning was shown to be the pivot around which the joint project revolved. Researchers, undergraduates, and nurses were all involved. They learned the new while creating the new.

Organization of a new kind of knowledge creation – the key role of higher education

What I have done so far in my presentation is to outline some theoretical and practical implications for “joint ventures” by re-thinking learning as an activity-transforming activity. In addition, I have presented a “joint-venture” project in some detail. Finally, I will briefly explain what it means, as stated in the title of my presentation, that there might be a new kind of knowledge production that goes beyond individual projects and makes up a *societal* creation of knowledge.

It is here higher education is a key. I suggest that, when suitably organised, university students might form a mighty R&D resource, which is tremendously underestimated today. For example, the students could be organised as parts of research teams, which in turn could participate in joint ventures of interaction research - or in some other way that enables them to make contributions to research, to artefact development and to the development of work activities. “Manpower intensive research” - to use the words of Nakayama.

Is what I imagine possible? Well, in the end, a lot is up to us. What kind of research and higher education do we want? Are we satisfied with the state of the art of today? With what Nakayama calls “industrialized science”? Perhaps my visions are utopian dreams? But they are based on theoretical considerations and empirical experiments. Where else should we start?

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