

# Activity Theory as a Lens to Identify Challenges in Surgical Skills Training at Hospital Work Environment

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**Abstract:** In this paper the concepts from activity theory (AT) are applied for identifying the challenges and contradictions emerging in surgical resident's curriculum based training at hospital. AT is utilised as a lens to identify contradictions that cause disturbances, problems, ruptures, breakdowns, and clashes which emerge while surgical skills training is implemented in a new way at hospital. We especially aim at finding solutions for contradictions which emerge while the new and old working culture are confronted and the workers are required to balance themselves between the patient care demands and workplace learning requirements. We are using the conceptual theoretical approach to describe the phenomenon of surgical working.

## 1 INTRODUCTION

Surgical traditions are facing the need for radical changes. Throughout the history, the method of teaching and learning surgery has been the apprentice model in which surgical residents follow specialist surgeons at work and develop their skills with the "see-one, do-one" method while gradually progressing to become as independent physicians. The learning opportunities and method are extremely workplace dependent and situationally affected by each hospital's working culture and the supervising senior's guidance and work duties. Now, the new development of computer based simulators and skill requirements of video-assisted surgery have challenged this traditional way of mentoring residents learning (Gallagher and O'Sullivan 2012, Reznick 2006). The arguments favourable to operating skills curriculum which utilises newest technology, surgical simulators, have forced also the hospitals to consider their learning and teaching traditions in a new way (Aggarwal et al. 2006). Simulators have already proven to significantly increase the efficiency of skills learning, they are a good investment into error-preventive actions and cost reduction relating highly expensive surgical complications and should be used as mandatory part in training from patient safety reasons (Reznick 2006). However, there are various views on how

resident education at hospitals should be arranged (Hammoud et al. 2008). Even though the development of surgical computer-based simulators has been rapid, these learning tools are still not utilized systematically in surgical training in Finland, why? Previous research has found that implementation of a curriculum based training at hospital is not without problems (Silvennoinen et al. 2011 and 2012, van Dongen 2008). Hospitals are not designed for learning; instead they are built for taking care of patients. The problems in implementation process might be caused by the fact that even though the need for making workplaces effective learning environments exists, it requires a clear vision about the best possible learning structure within each workplace (Billett 2000). In order to implement new training models which will bring possible rather radical change to the old traditional training culture, we should form clear vision of both the context and the phenomenon.

Alan Bleakley (2011) suggests models of socio-cultural learning theories to be used in explaining surgical learning at work. This activity partially is seen through the model of communities of practice by Lave and Wenger (1991), as participation in a highly context-situated and dependent work-based activity. Bleakley (2011) also sees that the actor-network theory by Latour (1996) and activity theory by Engeström (1987) can be used for competence

development discussion. The advantages of AT in the role of explaining the phenomenon is the dynamic nature of learning activities, an activity system (surgical residents training at hospital), which is focused on achieving the same goal but still conflicts can be produced (Bleakley 2011). The social theories of learning are important in observing activities where the impact of the team in the learning process is highly important (Fry 2011). The strength of AT is that it allows for breaking down the structure of an activity into smaller categorical elements (Basharina, 2007), and to identify contradictions and structural tensions of the activity (Engeström, 1995; Engeström, 2001). Contradictions are not simply conflicts or problems but they are structural tensions that have been historically accumulated within and between activity systems (Engeström 2001, 137). The identification of contradictions in an activity system helps focusing the efforts on the root causes of problems. When contradictions arise, or when they are observed, they expose dynamics, inefficiencies, and importantly, opportunities for a change (Helle 2000).

In this article, surgical training as a workplace learning activity at hospital is explored. We utilise AT (Engeström 1987, 2001) as a lens to identify and explore the challenges which emerge while surgical skills training is implemented in a new way at hospital. We especially aim at finding solutions for contradictions which emerge while the new and old working culture are confronted and the workers are required to balance themselves between the patient care demands and workplace learning requirements.

This paper is organized as follows. First, we present the background on the requirements needed for surgical work. Then requirements for enhancing surgical learning at work are presented. This is followed by the brief description of activity theory and the description of the surgical training program in a hospital context as an activity in AT. Finally, identified contradictions and solutions are presented.

## **2 SURGEONS PROFESSIONAL REQUIREMENTS AT HOSPITAL IN THE CONTEXT OF LAPAROSCOPY**

Surgical work requires considerable psychomotor skills, critical thinking abilities and decision-making skills, a great deal of medical knowledge to recall and apply as well as situational awareness to be able to react rapidly to changing situations (Norman et al.

2006). Technical skills and dexterity are seen as important for safe surgery, but from a patient safety perspective, in order to maintain surgical expertise, great deal of non-technical proficiency is also needed (Yule et al. 2008, Yule and Patterson-Brown 2012). Surgeons are leaders of an operation team which requires also responsibilities and social abilities, so besides the technical skills, also the cognitive and interpersonal abilities like team working and decision making skills are needed (Yule et al. 2008, Yule and Patterson-Brown 2012).

While skills and learning demands in modern healthcare tends to increase, at the same time the surgical residency time at hospitals has been shortened as a result of new European Working Time Directive (Bleakley 2011). Many surgeons and senior residents have therefore concerns that graduating residents are not anymore fully prepared for independent work immediately after graduation (Britt et al. 2009). In Finland the residency period also contains a nine-month period of training in general medicine, which does not enhance surgical skills and surgical residents have around five years' time to develop their specialised expertise.

The awareness of the surgical skill challenges especially relating abdominal area video-assisted procedures, laparoscopies has made it topical target for research and curriculum implementation. The technique is very popular, it needs a very short sick leave, 7-10 days, and most of the patients are able to go home on the operation day (Satava 2011). There is however concerns relating increased training requirements since the complication rates of these procedures remain relatively high compared to open surgeries due to various skill demands (Subramonian et al. 2004). In video-assisted operation, surgeons have limited visual and haptic information compared to the open surgical technique where the incision is larger and the visual field is normal, not transmitted by camera and surgeons can touch the tissues with hands, not only with long thin instruments (Van Veelen et al. 2003).

## **3 IDENTIFIED REQUIREMENTS FOR ENHANCING SURGICAL WORKPLACE LEARNING**

Surgical residents learn most of the operating skills during their residency time while working in hospitals. It is notable from the point of view of education and learning that this obviously very important period includes no structured curriculum.

Therefore a great deal of attention needs to be paid on how resident's education during hospital work should be implemented in a successful way.

Making workplaces effective learning environments is an interest in many fields today including healthcare, which means creating meaningful opportunities to facilitate skills and knowledge development at work (Van De Wiel et al. 2011). Learning at work is not obvious or automatic, but workplaces should actually be designed to promote learning (Ellström et al. 2008). Workplaces vary a lot in how they enable, support or constrain learning, which effects on learning opportunities and execution (Tynjälä 2008). The 'expansive learning environments' provide the best possibilities for both organisational and individual development as well as their integration (Fuller et al. 2004). The list of the issues identified on organisations that are fostering an expansive workplace learning approach to workforce development can be shortly listed as follows according to Fuller et al. 2004, Fuller and Unvin 2010:

- Workforce development is used as a vehicle for aligning the goals of developing the individual and organisational capability
- Organisational recognition of and support for workers as learners - given time to become full members of the community through gradual transition, having a vision of workplace learning such as providing chances to learn new skills/jobs and access to range of qualifications.
- Managers given time (and resources) to support workforce development and facilitate workplace learning and individual development
- Skills and knowledge widely distributed through workplace—multi-dimensional view of expertise; valuing expertise, high trust
- Workers given discretion to make judgments and contribute to decision-making
- Participation in different communities of practice inside and outside the workplace is encouraged—job/team boundaries can be crossed, cross-boundary communication encouraged and identity extended
- Planned time off-the-job for reflection and deeper learning beyond immediate job requirements.

In a context of this study, fostering surgical expertise development at a hospital would require a vision and development of both organisation and individuals through workplace learning. As an example, this would mean a curriculum developed for the surgical residents. It would also mean hospital organisations and managers recognition of and support for surgeons as learners not just as a workforce, making commitments to chances and organising time for skills development and reflection

both on- and off-the-job during the courses, high appreciation towards expert laparoscopists, but still fostering cross-boundary communication within surgical teams.

There is still a shortage of research on how the medical experience and learning at work should be structured to enhance skills and knowledge development optimally (Norman et al. 2006, Van De Wiel et al. 2011) Employees should be provided opportunities to acknowledge and utilize the learning situations at work, and the managers should be provided with adequate competences to organise and lead workplace learning (Ellström et al. 2008). Learning task or curriculum-based learning assignment within hospital alongside the resident's normal work, is similar that Tynjälä calls on-the-job learning (Tynjälä 2008), when conducting successfully as a learning activity, at least the following elements should be taken account: First, theory and practice should be meaningfully connected, second learners need to be provided conceptual and pedagogical tools to enable the integration of theory and practice when solving problems, for example, simulated contexts, and third participating in real-life situations is not solely sufficient for the development of high-level expertise. In professional expertise, theoretical-, practical-, and self-regulative knowledge are closely integrated (Tynjälä 2008) and the education of surgical residents shall therefore also be structured and combine all three.

The current research on continuing education of health professionals tends to promote research-based pedagogical self-assessment in professional development, to help physicians become better informed about self-assessment and more skilled monitors of their own practice (Eva and Regehr 2011, Moulton and Epstein 2011). Self-monitoring is one aspect of self-assessment, a metacognitive process that is necessary to manage in order to sustain adequate situational awareness, an important feature of expert performance (Eva and Regehr 2011, Moulton and Epstein 2011). Moment-to-moment self-monitoring is an important aspect of healthcare professionalism that seems to form the basis of the early recognition of cognitive biases, technical errors and facilitating self-correction and self-questioning (Epstein et al. 2008).

Simulators are suggested to be used as training tools within formal residency curricula, which would integrate SBT into surgical residents' other daily work routines (Kneebone 2003, Van Dongen et al. 2008). Practicing opportunities should be organised systematically and periodically within longer

interval periods in order for the requirements for expertise development in complex skills like laparoscopy to be fulfilled (Ericsson 2004). It would also be important to get the senior surgeons involved in training, although simulator practise should always contain tutoring, assessment and corrective feedback for enhancing learners' evaluative reflection processes (Kneebone 2003, Epstein et al.2008).

Based on the knowledge gathered on former literature relating surgical skills training as well as the empirical findings gathered from the surgical procedures performed by the residents under senior guidance, the curriculum of laparoscopy skills learning was launched in 2008 which contained both instructive sessions with supervisor and independent training as well as lectures (Silvennoinen 2011). Simulator training took place in a skill centre at hospital, where residents could practice with the simulator when actual patient care allowed. The support during training was offered through specialist instructions, feedback and assessment tasks performed both residents themselves (self-assessments) and seniors (evaluations/exams). Also the simulator measurements were available (performance parameters) for training feedback. Training alongside real patient treatments was considered as a connective link from the simulator to real workplace learning. Also lectures and instructed self-study was organized to enhance learning (Silvennoinen 2011). However there emerged challenges such as time allocation problems which interfered both residents training and supervisor surgeon's guidance and some residents dropped out the program or didn't perform adequate amount of simulator training to achieve the required skill level, even though training was experienced both important and useful (Silvennoinen 2011).

#### 4 ACTIVITY THEORY IN THE CONTEXT OF SURGICAL LEARNING AT HOSPITAL

Activity theory (AT) offers a theoretical framework to study both individual and collective activities. The basic unit of analysis in activity theory is human activity which ties individual actions in context. An activity has in particular situation it also means that it is impossible to make general classification of what is an activity (Kuutti 1991). It provides an analytical framework within which to study human activity in general. An activity system (AS) includes

two types of constituents: core components, such as subject, object/outcome, and community; and mediatory components, such as instruments/tools, rules, and division of labor (see Figure 1).

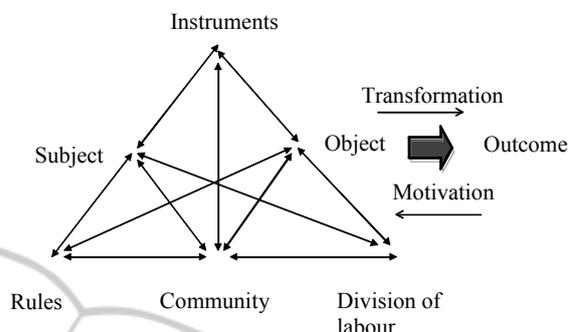


Figure 1: The structure of a human activity (adapted from Engeström, 1987, p. 78).

Engeström added the concept of contradiction onto Vygotsky's (1978) thinking. Contradictions constitute a key principle in AT and shape an activity (Engeström, 2001). Kuutti (1996, p. 34) describes contradictions as "a misfit within elements, between them, between different activities, or between different development phases of a single activity". They generate "disturbances and conflicts, but also innovative attempts to change the activity" (Engeström, 2001, p. 134).

Contradictions are significant for development and they exist in the form of resistance to achieving goals of the intended activity. They also exist as emerging dilemmas, disturbances, and discoordinations. In spite of the potential of contradictions to result in development in an activity system, the development does not always occur. Often contradictions may not be easily recognized or acknowledged, visible, or even openly discussed by those experiencing them (Engeström 2000 2001). On the other hand, contradictions that are not discussed may be embarrassing, or uncomfortable in nature. They may also be culturally difficult to confront, such as personal habits, bad behaviour, or an incompetence of the leader.

An activity is always associated with long-term purposes and strong motives. All members of the community share the object (and the motive) of the activity. Tools mediate between a subject and the object, which is transformed into the outcome. The object is seen and manipulated within the limitations set by the tools. Rules mediate the relationship between the community and the subject, while the division of labor mediates the relationship between the community and the object. Rules cover both implicit and explicit norms, conventions, and social

relations in a community as related to the transformation process of the object into an outcome. The responsibilities of the members of the community are coordinated by some division of labor (e.g., the division of tasks and roles among members of the community and the divisions of power and status), yet guided by rules. These rules regulate, as well as constrain, their actions and relationships in the activity system (Engeström 1990, Kuutti, 1996). A weakness of the AT and also strength to some extend is its generality. The definition being totally dependent on what the subject, object etc. is in particular situation it also means that it is impossible to make general classification of what is an activity (Kuutti 1991).

To summarize, subjects, who are motivated by an object, carry out activities. A subject transforms the object into an outcome. An object may be shared by a community of people, working together to achieve a desired outcome. Tools, rules, and a division of labor mediate the relationship between the subjects, community, and the object. Contradictions are a key principle in AT and they are driving force of change.

In the depiction of surgical residents training at hospital as an activity, the resident surgeons are chosen to be a subject. A subject plays a key role when analysing other elements of an activity. In this case we are interested in how the hospital working culture promotes or restricts workplace learning – how for example the tools support residents learning and achieving the learning objectives or how the

community supports the usage of the tools. From the residents’ and supervisors’ as well as hospital points of view, the main object is to produce skilled professional surgeons for the hospital work to maintain and further enhance patient safety, working efficiency and resources. The activity “surgical residents training at hospital” is presented in the terms of activity theory (AT) in Table 1.

The instruments (tools) include simulation environment for practising skills, assessment tools such as self-assessment forms and instructions for training and conducting independent learning, senior guidance sessions, lectures etc. (see Figure 2).

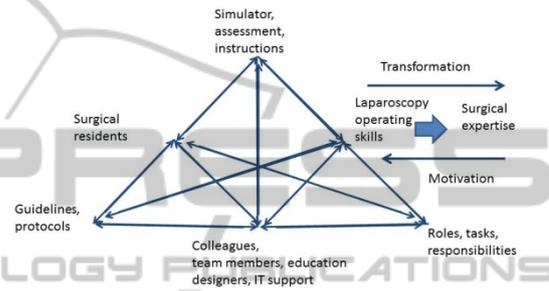


Figure 2: Surgical residents training at hospital as an activity.

The mediating tools in the surgical education context in hospitals could be seen as enhancing metacognitive and reflective skills, such as creating possibilities for supervisor-learner discussions and self-assessments. For improving workplace learning, Kyndt et al. (2009) sees as the most crucial contribution to support the condition of “feedback and knowledge acquisition”. This means creating situations for receiving feedback, such as enhancing teamwork practices, debriefings or peer feedback possibilities (Kyndt et al. 2009).

Table 1: Surgical residents training at hospital.

Component	Description
Subject	Resident surgeons
Object	To learn skills needed in operating laparoscopic procedures
Outcome	Resident surgeons with adequate professional skills to perform surgical operations
Instruments (tools)	Virtual reality simulator for practicing psychomotor skills, ergonomics, procedures etc., guidelines and instructions (written, online videos, lectures, seminars), senior surgeons guidance during simulator training, pedagogic methods
Community	Surgical residents, senior surgeons, surgical team members, education designers, IT support
Division of labour	Roles, tasks, responsibilities divided among a community such as teaching, skills practising, guidance, support
Rules	Patient treatment policies guidelines, treatment protocols

## 5 CHALLENGES IN SURGICAL TRAINING AT HOSPITAL WORK

The empirical evidences presented in this chapter are based on Silvennoinen’s study (2011). The study was conducted in a Finnish hospital in which resident training was studied with variable methods, such as observations, and data was also gathered via interviews and questionnaires and analysed with both qualitative and quantitative approaches.

However, in this paper we present several contradictions in AT system of surgical residents training applying new simulation-based learning

approach at hospital work environment. Many of the contradictions are in connection to the elements of expansive workplace learning and emerge when organisations are not fostering an expansive workplace learning approach.

The problematic issues or contradictions within AT system can be listed as the elements affecting to training program implementation and the realisation fluency of this new type of workplace learning.

- 1) Workplace culture, such as hospital's recognition and support for employees as learners can be compromised by the fact that there is not enough planned time off-the-job for simulation-based training (SBT). This creates a contradiction between the Rules and Subject.
- 2) Second contradiction relates to senior surgeons, since hospital's recognition of, and support for employees as teachers/instructors is sometimes also compromised by the same fact that they also have other tasks and not enough planned time off-the-job for instructors of (SBT) for facilitating learning and developing their own competences. This creates a contradiction between the Division of labour and Community.
- 3) Lack of metaskills – (self-assessment is experienced as difficult task). This contradiction emerges when Instruments are not supporting the Subject.
- 4) Learning requirements; the gap between the surgical work task demands and existing skills (too difficult tasks for example relating psychomotor abilities). This creates another contradiction between the Rules and Instruments.
- 5) Special characteristics /constraints of the simulation environment; usability and efficacy problems: realism, interactivity, received feedback, potential to enhance skill transfer. This inner contradiction emerges within Instrument.

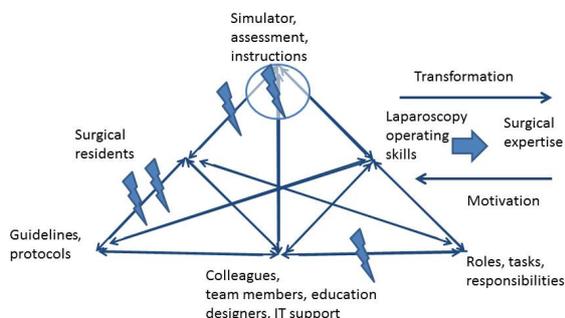


Figure 3: Identified contradictions.

Contradictions have several consequences. The contradiction between Rules and Subject creates problems with motivation when residents are not willing to come to practise skills with simulators after normal working hours. Also the problems of managing one's working hours might cause exhaustion which results in motivation decrease.

## 6 CONCLUSIONS

From the curriculum design viewpoint, we should be able to define the activities that surgical residents need to engage in. The two main tasks taking care of patients and learning to become specialised physicians seem sometimes contradictory. Identifying contradictions within and between these two different activities - effective learning at workplace and taking care of patients should enhance understanding on how the workplace learning could be enhanced more efficiently.

In this paper we used the concepts from the activity theory (Engeström 1987, 1999) to identify contradictions within the surgical residents training at hospital activity. The following contradictions were identified: contradiction between the Rules and Subject, contradiction between the Division of labour and Community, contradiction between Instruments and Subject, contradiction between the Rules and Instruments, and inner contradiction within Instruments.

There are several studies that support the findings of this paper. It has been noticed that the hospital routines and rules are not adequately supportive of changes within resident education that has remained unchanged for centuries. The study of Van de Wiel et al. (2011) is supporting this argument, which shows that learning opportunities for expertise development are not utilized optimally by the young physicians at clinics. The learning is organized according to physician's practical experience and patient care procedures, and opportunities for enhancing deliberate learning are not actively sought (Van de Wiel et al. 2011).

In the study of Kyndt et al. (2001) there emerged several prohibiting reasons for participation in formal learning activities amongst public healthcare employees. The residents were discouraged by the 'required investments' such as distance, costs, time, or writing assignments relating to the learning activity and they also more likely have children, who might prohibit extra working or training hours (Kyndt et al. 2011). On the other hand the older generation, like senior surgeons might have

attitudinal issues towards learning with new technology and might even experience that they are not good at learning new things and “refuse going back to school (Kyndt et al. 2011).

In a context of education, for example, a contradiction in teachers’ practices might occur when a new technology is introduced into their activity system and clashes with an old element (see e.g. Engeström 1995, Murphy and Manzanares 2008, and Turner and Turner 2001). The similar features emerge at the surgical simulator training while implemented in traditional working culture.

We present recommendations for dealing with the contradictions that we presented in this paper. First, the lack of hospital’s recognition and support for employees as learners and fact that there is not enough planned time off-the-job for simulation-based training. The contradiction between the Rules and Subject can be dealt with careful planning and implementation of new workplace learning activities which creates a culture in which better commitment of the whole organisation and all workers is reached. The potentiality for workplace learning depends here on the extent that hospital is designed not only to produce service of patient care, but to support workers competency development (Ellström et al. 2008). The success for supporting workplace learning would therefore require changes to traditional training culture and whole hospital organisation. Enhancing open discussions and enabling high level decisions relating trainees and trainers division of labor is needed. Better success would be acquired by investing more human resources and time allocated for instruction, training and facilitating.

Second contradiction was the lack of instructors time allocated to instructing residents since they also has several other tasks relating patient treatment. This contradiction between the Division of labour and Community could be dealt with similar proposals for action. Lack of metaskills of the medical residents as well as specialist doctors has also been found in other research (Silvennoinen 2011) which suggests that educating and practising self-monitoring and self-assessment is needed.

The contradiction between Rules and Instruments caused by too high demands in learning should be solved by offering the residents gradual progressive tasks with senior support and guidance. At work the interaction between novices and experts is very important (Billet 2000) and in surgery this means that the residents needs to interact with specialists and work under their guidance, taking part in the job tasks together – in other words,

participating in the communities of practice (Lave and Wenger 1991).

The special characteristics/constraints of the inner contradiction emerging within instruments need both the technical development and evaluation of tools used for skills practising, such as surgical simulators. Supportive actions for training implementation at hospital environment could also be co-creative planning and right placement of training and defining the right training phase within resident curriculum. Critical evaluation should be used for guaranteeing continuity and quality progress of the education design.

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