The knowledge externalisation cycle (KnEx): development of a systematic cyclic research method to guide researchers

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Knowledge workers (such as group facilitators) reflect and externalise prior knowledge as a means to plan for future activities. Reflection and knowledge externalisation can be increased by engaging in reflection with other people through dialogue. Reflecting and planning in a group can assist with articulation and transference of tacit knowledge. The Knowledge Externalisation Cycle (KnEx) is developed as a method within social constructivism, to capture and communicate the complexities of knowledge within this context. The KnEx takes as its point of departure, Engestrom's expansive learning cycle (ELC), which was developed as a method for studying and transforming work activities. The original objective of the expansive learning cycle was as a means for practitioners to consider their own ways of working, with data, conceptual tools, and guidance provided by the researchers. This paper describes the contradictions identified between the original objective of the ELC (to directly assist the practitioners) and the objective of the KnEx (to create a systematic cyclic research method to be used by the researcher). This paper aims to explain the transformation of the ELC to the KnEx, and provide a detailed description of each phase within the cycle.

Keywords: expansive learning cycle, knowledge externalisation, knowledge workers, planning, methodology.

Introduction

When planning, knowledge workers draw on their prior knowledge and reflect-before-action [38] on how the future activity could play out. Facilitators, as knowledge workers, plan future meetings, drawing on their past experiences. The knowledge externalised from these past experiences can be increased by facilitators reflecting as a group, as well as modelling the dialogue. It is within this context of externalising knowledge that the Knowledge Externalization Cycle (KnEx) was developed to guide the researchers through the research process from data generation to the presentation of results. The KnEx was modified from the Expansive Learning Cycle developed by Engestrom [9].

In this paper, I briefly discuss Engestrom's ELC and how a change of motive of the ELC led to the development of the KnEx. I will then describe the KnEx using data drawn from research looking at facilitators' knowledge to illustrate each phase of the KnEx. Providing a clear exposition of the research process is a way of overcoming debates about objectivity since:

It opens up the possibility of getting beyond the meaningless abstractions of objectivity and subjectivity and moving ahead to carefully selecting descriptive methodological language that best described your own inquiry processes and procedures [32, p. 576].

The Point of Departure — Engestrom's Expansive Learning Cycle

The original purpose of the expansive learning cycle (Figure 1a) was as a means for practitioners to consider their own ways of working, with data, conceptual tools, and guidance provided by the researchers [11]. The ELC was initially applied to large-scale transformations spanning several years [12]. Later Engestrom [10] identified miniature cycles of innovative learning which could occur in shorter timeframes (e. g. Hours duration rather than years), which were regarded as potentially expansive. These miniature cycles focused on teams rather than a whole organisation. Malopinsky [26] noted that «Engestrom provides a rather limited explanation of how the process of movement through the phases is reflected in the discourse» [26, p. 91]. In describing the modifications made to the ELC (Figure 1b), it is the aim of this paper to answer Malopinsky's concern and provide a detailed explanation of each phase within the KnEx.

The Expansive Learning Cycle (ELC) [9] was developed as a method for studying and transforming work activities. The core of the ELC is to «go beyond the given, to achieve something that is not yet there, and to master the future» [24, p. 5]. The KnEx also holds to this core, as the process of externalising more of the

knowledge contained within dialogue aids the use of this knowledge in mastering the future. The ELC is a «sequence of epistemic actions that starts with questioning the accepted practices and applying historical analysis of the situation with the goal of exploring underlying principles and rationales» [26, p. 54]. The KnEx, after describing the cycle context, also has a strong focus on questioning like the ELC. In the ELC, the analysing phase is often a challenge. In the KnEx, the stages of analysing and modelling have been combined. The analysis of the conversation during the focus group is undertaken by the researcher, to highlight discussion of the origin (historical [11]) of the facilitation situations, and the current understanding (actual-empirical [11]) of the facilitation situations, along with aspects of the discussion that look to future possibilities. Identification of the separate activities from the dialogue is undertaken prior to modelling the activity using the activity theory framework. The second part of analysis occurs between the identified activities and the modelled activities leading to the identification of the types of knowledge externalised within a given activity.

Before moving to a discussion of the phases of the KnEx, a brief discussion on activity theory is provided.

Activity theory

Activity theory reflects how language «expresses the rules of an activity, shapes the community, formulates the object, positions the subject, and affords or constrains the actions of the subjects working on the object» [2, p. 160]. The activity theory framework, contributes to understanding knowledge externalisation, as the activity theory framework is used as a representational device [33] to articulate the knowledge identified within the data. By drawing on activity theory notation (subject, object, tools, rules, community and division of labour) [13] the knowledge cases can be visually represented.

The other concept within activity theory that is important in question development to assist knowledge externalisation is that of contradictions (primary, secondary tertiary and quaternary) [19]. Contradictions aid in knowledge externalisation as they « help to identify problematic areas whose investigation is necessary for the purpose of understanding» [28] the knowledge used in an activity system. Tensions and breakdowns, being inextricable aspects of activity systems [4], are consequently used as points of reference for studying knowledge externalisation. The identification of problems or conflicts signifies the presence of contradictions [21], and can highlight where to ask questions to externalize more knowledge. This research relies on activity theory constructs to form the basis of what to code and how to categorize facilitators' descriptions (Phases 5 and 6 provide more details).

The KnEx

An expansive learning activity produces new ways of thinking and doing, which are «literally learned as they are being created» [9, p. 138]. In addressing the issues of questioning accepted practice and learning during creation, the KnEx sets the contextual scene prior to addressing accepted practices within the questioning phase. The path which the discussion and questions take within the focus group is identified as the dialogue is being created, not before. During the conversation activities that have occurred or will occur are discussed. Questioning is directed at understanding what the facilitator knows of the historical development of the group and the issue that will be facilitated. Where the discussion refers to a previous facilitated meeting, questioning is directed at how things developed prior to the meeting, as well as changes that came out of the meeting. For the facilitator, a reflection on past facilitated meetings provides a chance to consider how their own practice was changed following a given meeting. Finally, the questioning and discussion considers what impact the facilitators reflection of their past facilitated meeting may have on future activities and actions.

The KnEx has been developed to aid the systematic and explicit progression through the research process in order to show how knowledge has been identified within conversations. The KnEx reflects the phases through

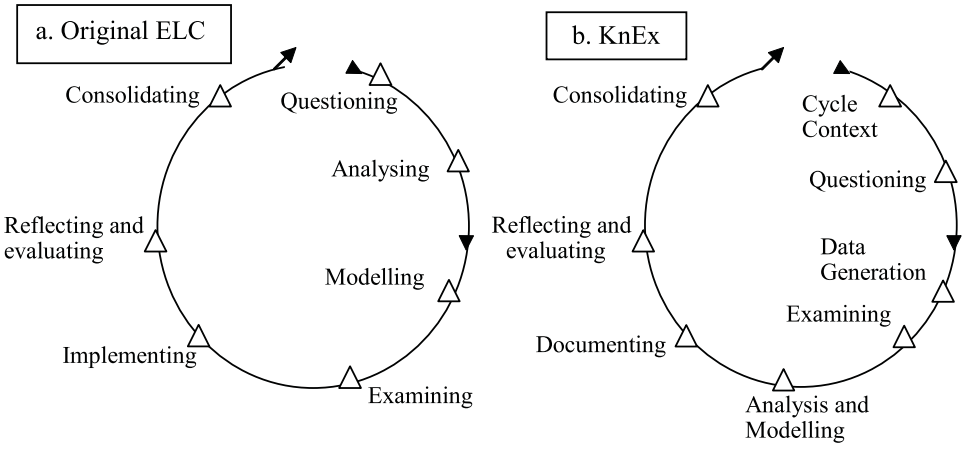

Fig. 1. The original Expansive Learning Cycle (ELC) and the Knowledge Externalisation Cycle (KnEx) [16, p. 15]

which the research (and researcher) moved through the research process. During the research discussed here, three sites were visited. For each site, the researcher moved through the KnEx once; therefore giving three KnEx cycles. Moving through multiple cycles allowed the documenting of the researcher's progressive understanding of the phenomena of planning knowledge under focus.

The KnEx is a procedural model to assist a group of researchers (or an individual researcher) to move constructively and openly through the research process. The KnEx also aids the researcher in navigating through the complexity and volume of data that is generated within qualitative research [39]. The purpose of the ELC is to assist practitioners to look at their own work activity, while the KnEx is to guide the researcher. Drawing on the fact that in activity theory, a different object equals a different activity [18], the KnEx has a different purpose to the original ELC. The path through the phases of the KnEx is towards knowledge building [24]. The KnEx is utilized in this project as a research tool to identify and evolve knowledge artifacts [30] which can be further manipulated and transformed. The rest of the paper will describe the aim of each of the phases of the KnEx, illustrated with data from a focus group discussion run with facilitators within a large multinational company.

KnEx Phase 1: Cycle context

The first phase of the KnEx involves presenting a description of the context within which the conversation has taken place. This contextual information is especially important where multiple cycles with different participants and locations are involved. Participants are described within their particular work context, including the «ease of access to the [participants, and] whether data can be adequately recorded» [36, p. 8].

Participants for this research were facilitators with varying levels of face-to-face electronic and distributed facilitation experience who all worked within a multinational company. Facilitation was one part of their job, and none of the participants were full-time facilitators. The site was selected fortuitously [36] through personal contact by the researcher made at a conference. Entry to the data site was negotiated through the contact person.

KnEx Phase 2: Questioning existing practice

During the questioning phase the questions asked by the researcher and participants during the focus groups and individual interviews were identified. Prior to the discussion with the participants, the researcher identified questions based on the notation structure of subject-tool-object and social rules — subject as suggested by Mwanza [27] and Boer et al. [4] (Table 1).

Table 1

Examples of notation used for question development

AT Notation defined within the literature	Examples of questions using Mwanza and Boer's notations applied to this research
Subject — Tool — Object [27]	How does the facilitator (subject) utilize computer technology (tool) to assist group process (Object)?
Social Rules — Subject [4]	To what extent is the facilitator (subject) restricted in his or her behaviour by the rules of facilitation (rules)?

The notational structure presented in Table 1 incorporates the idea that «human understanding is mediated not only by physical and symbolic artefacts, but also by the social division of labour and cultural practices' [34, p. 7]. The same notation was also used to analyse the questions identified within the data transcript that had been asked during the focus group.

During the focus groups the researcher and the facilitators asked questions of each other by highlighting contradictions, which enhanced the externalization of knowledge. «Contradictions are not the same as problems or conflicts» [9, p. 137] but should be seen in the case of knowledge research as opportunities to externalise more knowledge. It is through the energy generated by these contradictions that activities can be transformed and further explained beyond the current level. A contradiction often encountered by facilitators relates to circumstances under which it is ok for a facilitator to provide input into the content of a meeting. Most facilitators hold to the rule that they should only provide process guidance, not content direction. Through dialogue, facilitators can engage in reflection of experiences where for example, they have provided input into the meeting content, and through this reflection transform their future activities. Drawing out the knowledge of facilitators can be accomplished by asking questions that assist the facilitator to reflect on their existing standards of practice [8]. Questioning and the surrounding discussion were digitally recorded as part of the next phase of the KnEx: data generation.

KnEx Phase 3: Data generation

The third phase of the KnEx, data generation, involves audio recording the interactive conversation between the facilitators and between the facilitators and the researcher. The term data generation is used in this research instead of data collection, as reality is understood to be co-generated. The data is not sitting there waiting for the researcher to come along and pick it up; the data has to be generated through joint interaction of all parties involved (this includes the researcher). «The knowledge to understand, frame, and solve these problems does not exist, but is collaboratively constructed and evolved during the process of solving them» [15]. The aim of the data generation phase was to engage in «meaning-making in the context of joint activity» [34, p. 3].

KnEx Phase 4: Examining

The aim of phase four, examining, is to transform the digital audio files into transcribed written documents. The audio recordings were listened to and then transcribed using Transcriber© software. «Transcription is not simply a way for a researcher to capture, represent, or re-present talk, but a constructive and interpretive act in which the researcher positions him/herself» [23, p. 209]. The interpretation given to the data during transcription and therefore the positioning of the researcher in relation to the data is dependent on the researcher's cultural and social context. Each phase in the KnEx is described here as a way of making explicit some of the researcher's decision making.

Each knowledge case is now identified and articulated (modelled) in phase 5, and then described in phase 6.

KnEx Phase 5: Analysing and Modeling

Knowledge cases, precepts and theory were identified from the data. For this paper, the discussion will be restricted to a single knowledge case as the focus here is to provide a detailed description of the KnEx. The analysis and modelling phase involved searching the transcribed data for activities in order to identify the elements of the activity theory framework that make up those activities (subject, tools, rules, community, division of labour and object) [7]. The activity theory framework was «useful in identifying what to look for» [3, p. 157] within the transcripts, as well as providing a powerful explanatory framework when analysing a large body of qualitative data [17].

Prior to articulating (modelling) and describing the knowledge cases, we first need to define the rules by which knowledge cases can be identified within the data transcripts (Table 2).

Table 2

Rules for identifying knowledge cases

A case:

1. Consists of a description of a particular instance of facilitating (a story)
2. Provides details for at least three elements within the activity theory framework (subject, tools, rules, division of labour, and community).
3. May or may not provide details of links to other activities within the system (historical, possible culturally advanced activities, and/or concurrent activities).
4. Describes/provides identification of contradictions that aid knowledge externalization/identification.
   - i. Contradictions: The presence of words with meaning similar to: *disturbances, obstacles, difficulties, failure, disagreement, conflict, trouble, innovation, potential, etc.* [9, 20] and potential contradictions [35, p. 628]

Table 3 presents an example of a knowledge case that was identified from the focus group transcripts. Within Table 3, each row shows what the participant said and immediately below the activity theory elements that the dialogue relates to. The object of the activity for the facilitator (Table 3) was to develop a plan by mentally rehearsing different scenarios.

Table 3

A knowledge case identified from the data transcripts with links to activity theory elements

Data	Speaker #7: In my	head, when I'm running a	session, before I start I
AT elements		**Subject** (Speaker #7)	**Future activity**
Data	...go through what I think possible reactions could be to it, and try and sort of devil's advocate.	I try and think of scenarios that may come up that I can	
AT elements	**Division of Labour** (**Subject** speaker#7)		
Data	...address in advance.	So, I always try and think about ...what I'm going to do in those complete silences	
AT elements	**Future activity**		
Data	...if I've really got, someone who is antagonistic	then I know I that I will say, «oh, but I'm not an expert in this, so it's not my role». I'm waiting for the question, in that sort of way. but sometimes, it really is... it's just that	
AT elements	**Community** (personality of a participant)		
Data	tactic	when you've got a very difficult person in a group, when they've really	
AT elements	**Tools**	**Community** (personality of a participant)	
Data	don't want to be there, or they're so set in their path or their role,		
AT elements	**Contradiction** between personalities (**community**) and meeting **object Contradiction** between **subject** and personalities (working at odds with each other) **Contradiction** between personalities (**community**) and participants role (**division of labour**)		
Data	then, I do I do find that difficult. I go through what I think possible reactions could be to it, and try and sort of [unclear audio] devil's advocate. (C1II2L196-202)		

Note: The object (motive) of the planning activity is the development of a plan.

Once the cases have been identified within the data (Table 3) each case needs to be articulated using the activity systems framework [33]. Articulation refers to how some of the knowledge within the extracts will be transformed (modeled) for further knowledge externalization and analysis (Table 4).

Table 4

Rules for articulating knowledge cases

The case:
1. Mapping [3] AT elements to the activity systems analysis framework.
2. Tools can be described within a hierarchy of characteristics. There are four classes of tools: what, how, why and where to tools).
3. Contradictions between elements within an activity or between activities will be identified by a thick line between the relevant elements/activities.
4. Describe the case in one sentence (this sentence will then be used as the title of the Knowledge case — e. g., «Run through scenarios on the facilitator's internal mental plane»).

Each knowledge case (such as the example presented in Table 3) is articulating using the rules presented in Table 4. The output of this articulation process is presented in Figure 2.

KnEx Phase 6: Documenting

The documenting phase makes connections to previous knowledge literature. Previous literature that is considered includes general knowledge theories [5—6; 14; 22; 29] and facilitation knowledge research [1; 25; 37] as described in Table 5. Making connections to previous literature provides support to and combine previous knowledge theories as a means of supporting the contextually rich process described by the KnEx.

A description of the knowledge theories and facilitation knowledge theories in relation to Figure 2 is now presented:

Knowledge theories present in Figure 2: The knowledge that Speaker #7 is drawing on, within Figure 2, include analysis of the context centered on who the participants will be, a plan for implementation, as well as a forecast of the possible outcomes [22] (Table 6). By drawing on predictive, problem solving knowledge [29], Speaker #7 is able to match participants and motive with a selection of processes from her facilitators' toolkit. An antagonistic personality is one aspect that Speaker #7 is considered during this planning activity. The aim of planning for possible antagonistic personalities is for Speaker #7 to consider a number of alternatives and justify those scenarios which have a better chance of being able to reduce the negative impact of the antagonism on the meeting [6]. Mentally rehearsing a variety of scenarios also means that

Table 5

Rules for describing knowledge cases drawing on published theories and activity theory

1. Describe the knowledge contained within the case using, as much as possible, the actual words of the facilitators.
a. Knowledge theories
i. Case Problems [22]
ii. Replicative, applicatory, interpretive and associative knowledge [5, 14]
iii. Conceptual and instrumental knowledge [29]
iv. Functions of knowledge [Loewenberg 1984, as cited in 29]
v. Knowing (empirical, ethical, personal and aesthetic) [6]
b. Facilitation theories
i. Development facilitation, Content facilitation, Process facilitation, and Technical facilitation [1]
ii. Intellectual, Managerial, Social, and Technical facilitation [37]
iii. Divergent/convergent methods x innovative/adaptive methods [25]

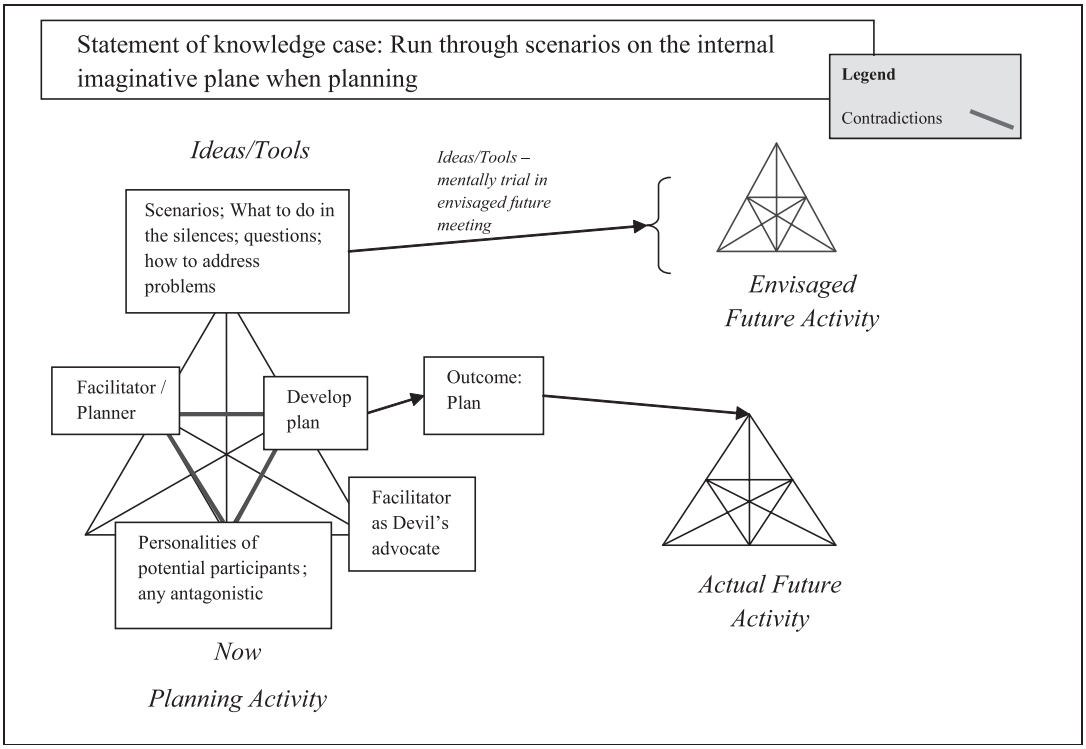

Fig. 2. Articulating the knowledge case from Table 3

Speaker #7 can envisage what each possible scenario would mean for the meeting members [6].

Facilitation knowledge theories present in Figure 2: When considering the facilitator knowledge literature, we see a combination of content and technical facilitation [1], and the drawing on of innovative divergent methods as Speaker #7 considers a variety of techniques and tools. A summary of the knowledge theories and facilitation knowledge theories drawn on in describing Figure 2 are presented in Table 6.

Table 6

Knowledge theories compared to case

Knowledge Theories		Case: Scenario planning before the meeting
[22]	**Case Problems**	who the participants will be, a plan for implementation, as well as a forecast of the possible outcomes
[5, 14]	**Professional Knowledge**	Interpretive - judgement
[29]	**Conceptual Knowledge [29]**	Predictive knowledge
	Instrumental Knowledge [29]	Problem solving knowledge
	Functions of Knowledge (Lowenberg)	Explanation, practice
[6]	**Empiric knowing**	NA
	Ethical knowing	Justification to herself of scenarios that have a better chance of a positive outcome than other scenarios
	Personal knowing	NA
	Aesthetic knowing	Rehearsing – what do these envisioned scenarios mean for this group?
Facilitation Knowledge Theories		
[1]	**Facilitation classification**	Content and technical facilitation
[37]	**Within meeting roles**	NA
[25]	**Innovative/ adaptive method characteristics**	innovative convergent methods

The richness of the knowledge externalized in this case has been shown in Figure 2 and in Table 6 have communicated the complexity of knowledge within a given context. Presenting Figure 2 and Table 6 back to Speaker #7 will provide another opportunity to reflect on the knowledge externalized through dialogue.

The final theory to consider in describing each knowledge case are the what, how, why and where to tools identified within activity theory. **Activity theory description of tools within Figure 2:** The scenarios that Speaker #7 is considering are ideas/tools that cross from the current planning activity to the model of the future activity. Within Activity Theory, tools are understood within a hierarchy (*what, how, why and where to tools*). The *What* tools, a different group exercise, will be used by Speaker #7 if the conversation (to reach motive) within the group slows down or stops, as a way of getting the conversation moving again. The How tools provide knowledge of how these scenarios will get the participants interacting positively and moving towards the object.

KnEx Phase 7: Reflecting and Evaluating

Before consolidating what has been learnt about knowledge and the research process in Phase 8, we now turn to Phase 7: reflecting and evaluating, to consider the researcher's role in the process.

As I identified each phase of the KnEx, including similarities with the ELC [9] and the order in which each phase occurred, I was challenged to find ways of explaining my decision making to others in a concise written manner. My aim was for other's to read about the phases and be able to use this as a blueprint for their investigation into externalizing knowledge (I leave this to the reader to decide if I have achieved this aim).

KnEx Phase 8: Consolidating

Consolidation as the final phase of the KnEx draws together the knowledge cases and knowledge externalized from the discussions undertaken with a particular group of participants. The consolidating phase is also the transition phase between one research site and/or research participants, so it is an opportunity to identifying what this iteration of the KnEx means for the next cycle (in a different location with different participants). In describing each phase of the KnEx, and using the KnEx in practice, this paper has consolidated «the new practice in its new form» [31, p. 557].

As only one knowledge case has been described in this paper, it is not possible here to draw overarching conclusions to what knowledge was externalized across all the knowledge cases identified from the data transcript. However, in concluding the KnEx and this paper, we are able to consider what the output of the KnEx means for the facilitators, and for knowledge theory researchers.

For the facilitators, the output, in the form of identified, articulated and described knowledge cases can be presented back to the participants as knowledge artifacts that can be used to continue the reflective dialogue of facilitation practice.

For knowledge researchers, the KnEx provides a systematic process through which they can work with qualitative data while maintaining rich descriptions of the concepts under investigation. For activity theory researchers, the KnEx provides a research process that is congruent with activity theory principles. Identification of tools at different levels of the hierarchy of activity theory tools has supported the depth of knowledge externalized using the KnEx. By modifying Phase 6, with the identification of theory in an area other than knowledge, researchers can use the KnEx as a generic qualitative analytical tool. Further research is needed to show if the KnEx is a useful process for qualitative research.

Future research will investigate the extent to which the KnEx increases quality of knowledge externalized by presenting the KnEx analysis of individual cases back to the original participants for further reflection. Future research will also investigate what additional richness can be identified when a sequence of multiple KnExs are conducted with different groups, and what this means for knowledge externalization and planning.

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Цикл экстернализации знаний (ЭкЗн): развитие последовательного циклического исследовательского метода для ориентира исследователей

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Работники умственного труда (например, группа фасилитаторов) рефлексируют и экстернализируют имеющиеся знания в качестве средства для планирования будущей деятельности. Рефлексия и экстернализация знаний могут быть увеличены путем включения в рефлексию с другими людьми посредством диалога. Рефлексия и планирование в группе может помочь при формулировке и передаче неявных знаний. Цикл экстернализации знаний (ЭкЗн) разработан как метод в рамках социального конструктивизма для запечатления и передачи сложности знания в этом контексте. ЭкЗн в качестве отправной точки принимает цикл экспансивного обучения Энгестрёма (ЦЭО), который был разработан как метод исследования и преобразования трудовой деятельности. Первоначальная цель цикла экспансивного обучения заключалась в предоставлении средства практикующему специалисту для рассмотрения своих методов работы, при использовании данных, концептуальных инструментов и руководящих указаний исследователей. Данная статья описывает противоречия, установленные между первоначальной целью ЦЭО (непосредственно помогать практикам) и целью ЭкЗн (создать последовательный циклический исследовательский метод для использования исследователем). Данная работа призвана разъяснить преобразование ЦЭО в ЭкЗн и предоставить подробное описание каждого этапа в течение цикла.

Ключевые слова: цикл экспансивного обучения, экстернализация знания, работники умственного труда, планирование, методология.