

Towards the incorporation of Activity-Based Learning and Reflection into Botswana Information Systems Development Practice

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Structured Abstract:

Purpose: This paper reports on a co-design process that was initiated between government and the private sector in Botswana to redesign current ISD practice with particular focus on finding a solution for learning failure. Learning failure was analysed retrospectively using concepts of 'task conscious' and 'learning conscious' learning.

Design / methodology / approach: On the basis of a typical Botswana ISD project in which the lead researcher participated, inefficiencies and shortcomings in the standardised Botswana ISD process in terms of full utilisation of learning processes to support systems success were examined. Through the Developmental Work Research (DWR) methodology, which is based on Cultural-Historical Activity Theory (CHAT) principles, IS practitioners from government and the private sector, together with users collaborated to redesign the current Botswana ISD work practice in order to address this shortcoming.

Findings: The result has been the incorporation of activity-based learning and reflection into a proposed improved ISD practice framework for Botswana.

Practical Implications: Through collaborative redesign between government and industry, a new Botswana ISD practice model that incorporates activity-based learning and reflection has been designed, and findings from examination of the model suggest that it has potential to address current learning deficiencies and thus contribute to efforts of avoiding IS failures. There have also been contributions to DWR resulting from the manner in which the methodology was applied.

Originality / value: This is the first known study that uses concepts of 'task-conscious' and 'learning-conscious' learning to analyse learning retrospectively and at the same time adopting the DWR methodology in a developing country social context such as Botswana.

Keywords: Botswana ISD practice, cultural-historical activity theory, developmental work research, information systems development, learning.

Introduction

Information Systems Development (ISD) has seen significant evolution over the years, not only because of rapid changes in technology, but also due to significant advances in methodologies used. The methodology evolution has for example resulted in the general move from waterfall (structured) methodologies towards more agile methodologies with a view to achieving rapid application development. However, despite these changes there are still implementation challenges that manifest themselves in slow system uptake and minimal work improvement.

Although learning failure has been acknowledged as a contributing factor to systems failure this aspect has not been extensively covered in literature. Lyytinen and Robey (1999) carried out a study on learning failures, but the focus was on learning at organisational level within an ISD organisation. Bondarouk (2006) also studied learning in ISD, the major interest being the influence of group learning in information technology implementations. This is done using Kolb's (1984) experiential learning theory which views learning as action derived from experience. However the paper limits its focus to group learning processes during the use of information technology.

An area which is therefore underrepresented in literature is a focus on individual learning within the context of the complete ISD process. This paper contributes to this gap and takes an activity-theoretical perspective of learning, which views learning as situated practice and unit of analysis being the ISD network of activities (Engestrom and Sannino, 2010; Virkkunen and Kuutti, 2000).

The paper describes how information system (IS) practitioners from government and the private sector, together with users collaborated to redesign current Botswana ISD work practice in order to incorporate learning as an explicit part of ISD. The result has been the incorporation of activity-based learning and reflection into current standard ISD practice adopted for Botswana governmental IS

projects. The process was facilitated using Engeström's (1987) Developmental Work Research (DWR) methodology, which is based on Cultural Historical Activity Theory (CHAT).

The paper is presented in eight sections. This introductory section is followed by a discussion on the study background and context. The methodology for the co-design process is then presented followed by the co-design process that was carried out in the specific study reported here. This is followed by a discussion and lastly the conclusion, where the contributions and limitations of the study are discussed.

Study Background and Context

Current Botswana ISD Practice Model

The study reported here was carried out in the context of a developing country, Botswana, which like most countries recognises the strategic value of Information and Communication Technologies (ICT) and their potential to spearhead socio-economic development. The responsibility to develop policy and standards for deployment of ICTs in the government of Botswana resides with the Ministry of Transport and Communications and more specifically the Department of Information Technology). A typical ISD project in the Botswana government will normally follow the Software Development Life Cycle (SDLC) with four key phases: analysis, design, build and implementation. All phases are supported by project and process management (Figure 1).

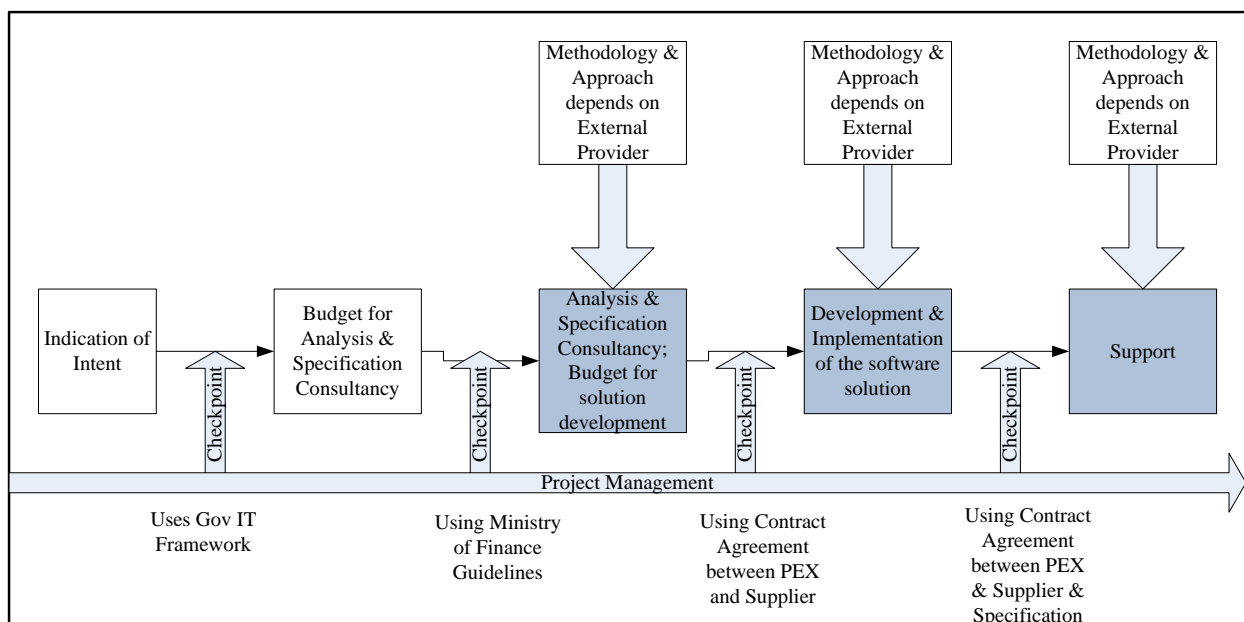


Figure 1: Current ISD Practice Model

The Case Project

The selected case project was, to a large extent, carried out in accordance with the standard Botswana government ISD practice. The case project was for a public entity X, now referred to as the PEX, whose core business is the multiplication of seed for the arable farming community. The limitations with the current system, together with advances in information and communications technology were cited as some of the reasons for embarking on this project, whose objective was to develop and implement a comprehensive system that would improve the PEX practice.

Prior to this project, the PEX or indeed the department within which the PEX was located had not engaged in a large scale ISD project of this nature, especially with external service providers involved. This was therefore a new experience for the staff and the organisation.

The PEX system requirements elicitation and documentation was done by an external supplier. The choice of methodology for requirements analysis was left to the supplier who used a combination of the critical success factor method and structured analysis techniques. The design and development of the PEX system was also outsourced to an external developer. The developer's choice of methodology was rapid application developing using prototyping. **Figure 2** depicts the development process as followed by the developers. Five (5) developers and fourteen (14) users were involved actively in the development of the PEX system.

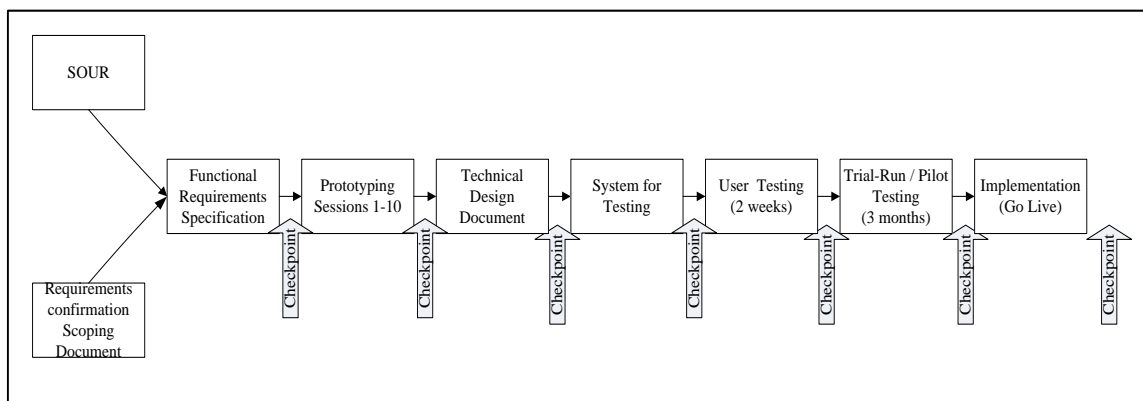


Figure 2: Design and Development for the PEX Project

Methodology for the co-design process

Developmental Work Research (DWR)

DWR is a specific interventionist methodology developed by Engeström (1987) and is based on five key CHAT principles (Engeström, 2001; Hill et. al., 2007):

- 1) The prime unit of analysis is a collective, artefact mediated and object-oriented activity system, seen in its network relations to other activity systems
- 2) Activity systems have multiple voices which may result from the different actors engaged in the activity i.e. multivoicedness of activity systems
- 3) Activity systems are historical formations
- 4) Activity systems may be characterised by contradictions which act as sources of change and development
- 5) There is a potential for expansive transformations in activity systems.

DWR follows the epistemic actions depicted at Figure 3 and allows carrying out learning activity in collaboration between a researcher / interventionist and practitioners.

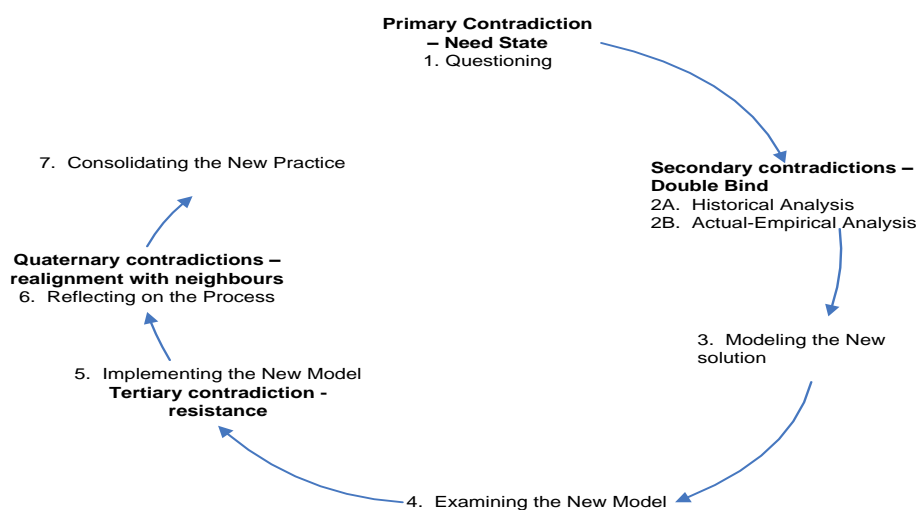


Figure 3: Expansive Learning Cycle (Engeström 2001, p. 152)

In DWR the role of the researcher as the interventionist is to facilitate a process of undertaking these epistemic actions and creating an environment where practitioners begin to analyse the current activity based on its historical development and to think about an expansive transformation of the activity system. Most DWR (and Expansive learning) studies that have been carried out tend to use ethnographic research for the initial field work and data collection (Hasu 2000; Toiviainen, 2003; Pihlaja, 2005; Kerosuo, 2006). Ethnographic research, which draws its roots from the discipline of social and cultural anthropology is characterised by the long period of time a researcher needs to spend in the field. The ethnographic researcher is totally immersed in the research environment as they attempt to gain a deep understanding of what people are doing as well as the environment around them. Though in this particular study an in-depth ethnography was not done in terms of trying to ‘... follow the people, follow the thing, follow the metaphor, follow the plot, story or allegory, follow the life or biography, and follow the conflict (Kerosuo 2006, p. 93)’ on a day to day basis as such, the

researcher was associated with the project long enough ((i.e. from 2004 to 2011) to observe intimately what was going on.

The first stimulus in the DWR process as depicted in Figure 4 is provided by the researcher to the practitioners in the form of data about problematic aspects and disturbances of their daily activities in order to trigger an identification of the need for change. This could be in the form of videotaped data or any other similar data. The general model of an activity system is used as an intellectual tool for modelling both the systemic cause of the identified problems and a new form of activity during the DWR process. This acts as a second stimulus. The third type of tools / artefacts that are used as instruments of expansive learning actions are analytical concepts and various representational means for analysing the data in the mirror and for constructing alternative solutions for specific parts of the activity.

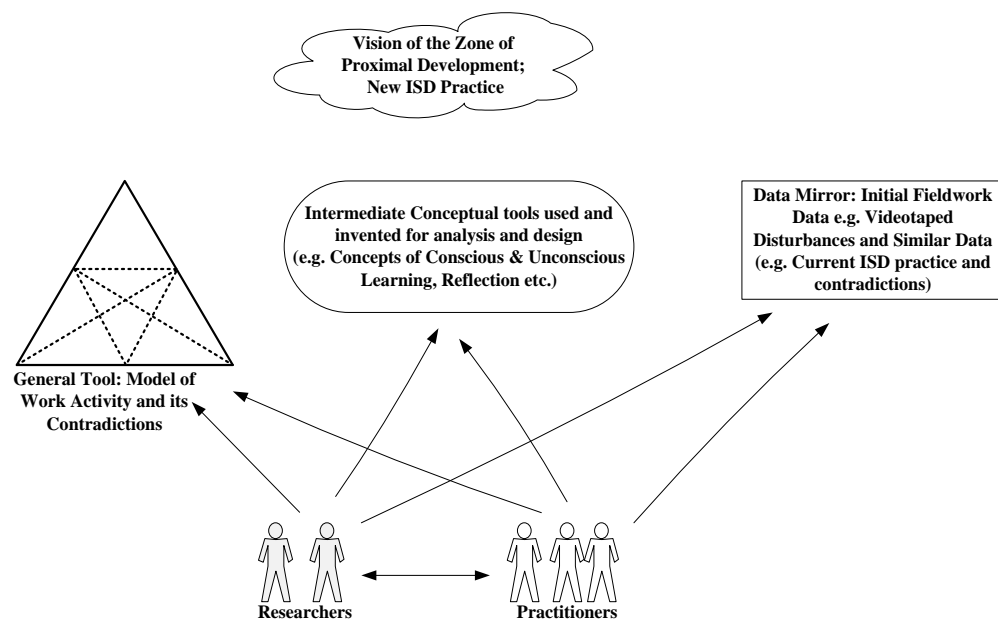


Figure 4: Developmental Work Research Schematic / Design (adapted from Engestrom, 1999, p. 7)

The Change Laboratory Method

The change laboratory method, which is commonly used with DWR interventions, is a method that was developed in the mid-1990s by researchers from Helsinki University. The method provides an environment for the various participants to think through and experiment with new ways of working. It is particularly useful in supporting practitioners in the theoretical-genetic reflection on joint activity as well as on conceptualising new practice through interactions and discussions. The change lab provides an opportunity for participants to engage in a collaborative learning activity by carrying out systematically expansive learning actions of questioning current ways of thinking and working, analysing and modelling the activity system, and conducting thought experiments concerning possible

changes to their work activity. In the change lab the interventionist facilitates a process whereby participants move between the past, the present and the future activity (Engeström, 2001; Pihlaja, 2005; Hill et al., (2007)).

The change laboratory process typically comprises of five (5) to ten (10) sessions of two (2) to three (3) hours (i.e. 10 to 30 hour sessions) and a varying number of follow-up sessions. Participants comprise of practitioners and managers and where possible, users, customers or patients are invited to the sessions in order to create the necessary tensions as their cases, problems are being looked at. Because the change lab sessions themselves are videotaped for analysis it allows for the collection of rich longitudinal data on the discussions, actions and interactions involved in the collaborative learning activity (Engestrom, 2001; Pihlaja, 2005; Hill et al., (2007)).

The change lab method was used for this research study, but instead of short 2 to 3 hour sessions, only two sessions of seven hours and five hours respectively were held. The study restricted itself to two long sessions because it had already been anticipated that it would be difficult to get sustained representation from government and the private sector if more sessions were held.

Towards an improved ISD Practice Model

Initial analysis of Learning Failure

The initial analysis of learning failure on the case project was done retrospectively, by the researcher, by applying concepts of two types of learning as provided by Rogers (2003) and Malcolm et al., (2003). This distinction by Rogers (2003), between two types of learning is mainly based on the work by Krashen (1982), Vygotsky (1962) and others in their study of the development of language skills where two ways of learning a language are identified i.e. ‘acquisition’ (i.e. natural learning as demonstrated in the children’s learning of first language) and ‘learning’ (i.e. formalised learning as exhibited in the learning of a subsequent language in a formal setting such as in school).

Adopting this distinction, Rogers (2003), distinguishes between two types of learning, ‘acquisition learning or informal learning’ and ‘formalised learning’ which he calls ‘task-conscious learning’ and ‘learning-conscious learning’ respectively. Malcolm et al., (2003) in their study where they sought to clarify the meanings and uses of such terms as formal, non-formal, and informal learning found the same distinction being made in the 250 texts that they surveyed.

The main distinguishing feature between these two types of learning is that acquisition learning is concrete, immediate and confined to a specific activity and therefore highly contextualised. Acquisition learning is also described as unconscious or implicit learning where the learners are not always aware that they are learning anything beyond the task at hand. Instead they are more focused on completion of the task and hence the name ‘task-conscious’ learning. In formalised learning,

learners are conscious of the learning, that is, that they are engaged in a learning task / activity or the task at hand is learning such as in schools (Davydov, 1999; Rogers, 2003; Malcolm et al., 2003). Formalised learning is facilitated and structured learning where the facilitator's role is to help make conscious the subconscious or task-conscious learning of the acquisition process and thereby enhance the learning.

Both Rogers (op. cit.) and Malcolm et al., (op. cit.) argue that both kinds of learning should be usefully brought together in different mixes in order to facilitate the most effective kind of learning (i.e. in both formal and informal settings) because each has advantages and disadvantages. Rogers makes the point that bringing in formalised learning into acquisition learning should be an objective of learning facilitators. He states:

'To engage in task-conscious learning through specific activities (tasks) alone without making conscious the conclusions which such exercises demonstrate is to render these activities (despite all the acquisition learning accomplished) less than fully effective.' (Rogers 2003, p. 36)

Malcolm et al. (op. cit.), further argue that it is important to be able to recognise and identify the attributes of formality / informality in any learning situation and therefore understand their implications. It is through identification and knowledge that an appropriate balance can be found to enhance effective learning.

The analysis of learning on the case project, using a heuristic devise derived based on concepts from Davydov (1999), Rogers (2003), and Malcolm (2003) classified most of the learning actions as facilitating mainly task conscious learning. This led to the conclusion that in the PEX project learning opportunities were not being fully exploited to achieve both task conscious and learning conscious learning, which Rogers (2003) states facilitates effective learning in any learning environment. Furthermore, on the PEX project, learning was only evaluated at the end of the project and only as part of the post implementation review. There was no evaluation of learning at the end of each stage / learning action. Therefore one was left to wonder whether there would have been benefits if the evaluation had been done at the end of each action, especially since, according to Rogers (2003), evaluation of learning focuses reflection and makes that which was unconscious conscious.

This initial analysis led to the initiation of the co-design process by the researcher.

*Co-design following the DWR methodology**Learning Action 1 – Questioning*

The initial questioning was triggered through guideline questions that were provided to the different participants as preparation for the initial change laboratory session. The guidelines provided a ‘mirror’ for participants to use for introspection, reflection and dialogue on current ISD practice. The following themes for reflection were provided:

1. Specific Botswana ISD project experience
2. ISD Methodology, Techniques used including justification for choice of methodology
3. Suitability of ISD methodology to specific projects
4. Meanings that users in particular assign to the ISD methodologies used
5. What learning took place on the projects by the different social actors i.e. users, and developers
6. Suitability of chosen methodology to system uptake and learning
7. ISD practice challenges

At the first change lab session, where there were twenty-two (22) participants, the researcher / interventionist kicked off with a presentation of the initial analysis of the current Botswana ISD activity system which was based on data obtained from the PEX project. This was later developed into the network of activities depicted at Figure 5, showing subject producing activities as the PEX organisation, government IT department, analyst firm and developer firm, and the rule producing activities as the government IT department, Finance and Procurement activities.

This was then followed by a discussion on the historical development of current practice that was triggered by a presentation by a senior representative from the government IT department. The questioning of current practice continued with presentations from two user representatives (i.e. one from the PEX project) and three developer representatives (i.e. one was the developer of the PEX system). Discussions and interventions continued throughout the presentations.

The presentations and discussions on the historical development of current practice were quite insightful as they offered a perspective on how government arrived at the current state of ISD. It also provided a useful context within which to understand and analyse the ‘current’ through a look at the ‘past’. It was also interesting to see through the questioning, the different motives of the three subject groups i.e. functional users, government IS practitioners, and the developers. It was quite evident from

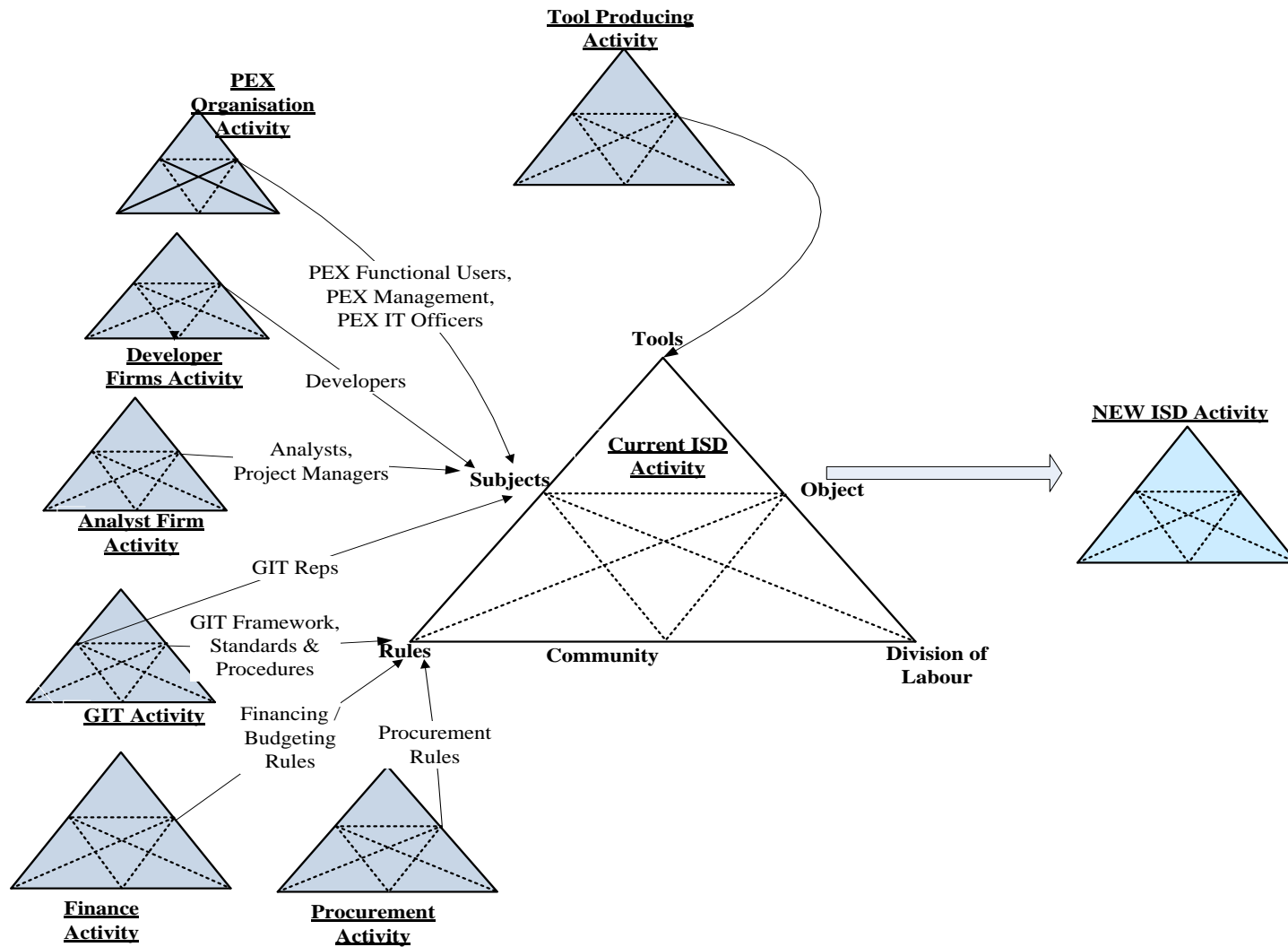


Figure 5: Current Botswana ISD Network of Activities

the different classifications of challenges identified that they had different interests as far as the ISD activity system was concerned. But despite there being some divergence in thinking in some areas, there was overall agreement on the current ISD process as well as agreement on IS learning failure as the problem.

A major observation from this initial session was that there was enthusiasm from participants to engage in this exercise of questioning and reflecting on what they did. Therefore, what started off as individual questioning by the researcher ended up being a collective action by all participants.

Learning Action 2A - Analysis of Historicity

As stated earlier, tracing the historical development of current practice was triggered through a presentation by the government IT representative. The historical analysis started as far back as 1969 when the government IT department was originally established. According to the historical analysis, the period 1968-1995 (i.e. 27 years) was characterised by centralised, in-house development of systems based on structured techniques. User demand for more IS / IT and demand for efficient delivery of IS / IT services created tensions and contradictions that brought about transformation to the current era (i.e. 1995-now). This current era is characterised by decentralisation of IS / IT services, outsourcing of the development and greater involvement of users in ISD activities. The historical development of these two main era's (i.e. 1969-1995 and 1996-now) is shown in the activity system model at

Figure 6.

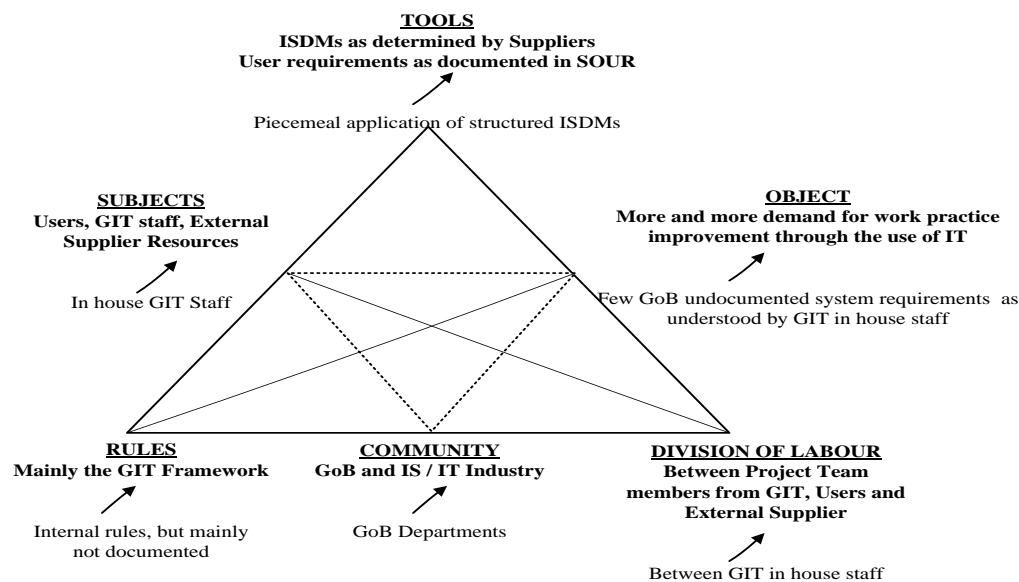


Figure 6: Historical Development of Botswana ISD Practice from 1969-1995 to 1995-now

The changes (as shown from the normal to bold text) from one period to the next for most if not all of the activity system elements were mainly of a qualitative nature e.g. the change in rules from undocumented to documented standards and procedures through the government IT framework and the change in subjects from in house government IT resources to now include users and external suppliers etc. However, it is significant to note that these qualitative changes were mainly brought about by the quantitative change in the object in terms of higher user demand for IT systems.

Learning Action 2B- Analysis of Contradictions (Actual-Empirical Analysis)

During the first change laboratory session there was an extensive analysis of the current contradictions as presented by the different participants representing the multiple voices in this network of activities which make up the current Botswana ISD practice. Each of the voices as represented by the user and developer subject groups had their views on what the current challenges were. The government IT representative identified challenges in the areas of system integration, enforcement of standards and overall learning. The user group articulated some of the challenges as management visibility on projects, level of preparedness and slow system uptake and the developers identified some of the challenges as the life cycle split between Analysis and Design, lack of well-balanced project teams, insufficient project funding, inadequate change management and slow system uptake.

The government IT representatives perspective on challenges was consistent with their role as a government IT advisors and enforcer of standards (and therefore at a higher level) whereas the perspective of the departmental users and developers was system and project specific. This is evidence of different motives by the different subject groups, but also hierarchical (and vertical) levels of challenges depending on the level of the subject group. This suggests that within a network of activities there are (vertical) hierarchies of contradictions that lead to different levels of learning similar to those identified by Toiviainen (2007) in her study of inter-organisational learning across levels. This of course needs to be subjected to further empirical research.

Figure 7 is a representation of the identified contradictions in activity theoretical terms. There are primary contradictions in the use value and exchange value in the subject, and rules elements of the current activity system. For example, there were reported instances where the user's clients (e.g. farmers in the case of the PEX project) are consulted during the ISD process and instances where they are not. The other inner contradiction is where a representative of the Analyst firm as Project Manager assumes the role of user during the design and development of some projects and not others. The same applies to the inconsistent application of the Rules where in some instances a post implementation review is carried out at the end of the project and instances where it is not deemed to be part of the process.

There are also a number of secondary contradictions as shown between elements of the current activity system i.e. between subject & tools, subject and object, tools and object, subject and rules, rules and object and division of labour and object. But overall there was agreement that these identified contradictions contributed to the current learning problems and slow system uptake as they shifted the focus from the object of the activity.

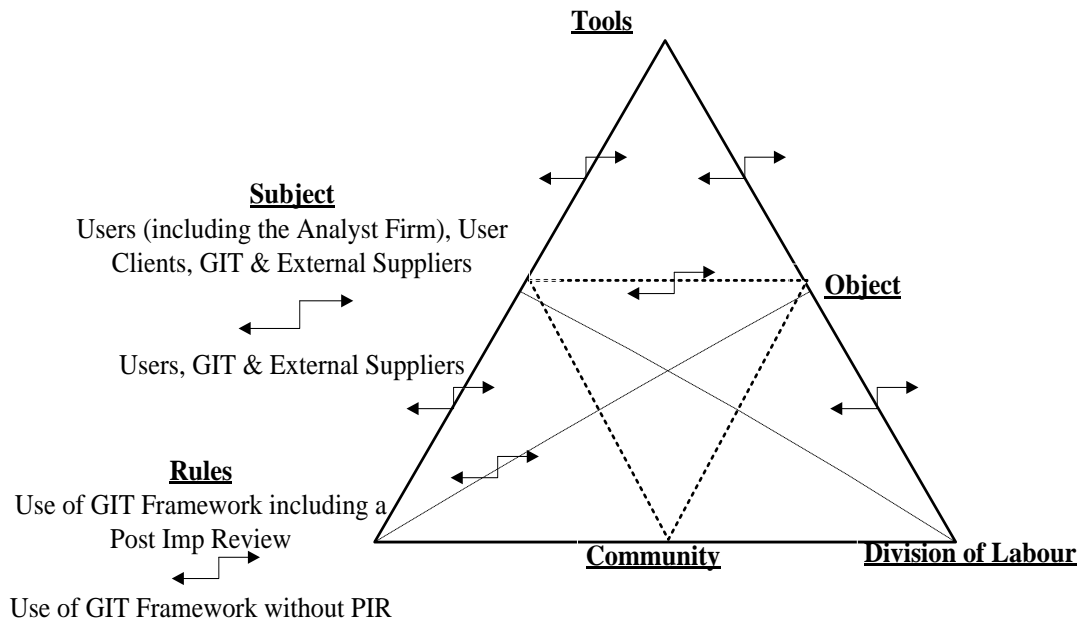


Figure 7: Representation of Primary and Secondary Contradictions

Learning Action 3 – Modelling the New Solution

The main objective of the study was to find a solution to the current learning problem that manifested itself in slow system uptake and lack of meaningful work practice improvement. The suggestions made, which also represent the multiple voices, are tabulated in Table 1 below.

Table 1: Summary of suggested Improvements

User Suggestions	Developer Suggestions
Readiness Assessment	Change Management
Change Management	Due diligence on needs analysis to ensure Department is ready
Enforcement of system usage	Enforcement of system usage from top Management
	Client resources must be involved from the beginning
	Carrying out two User Acceptance Tests to address pre- and post-pilot implementation

Another improvement that was suggested by the researcher was the inclusion of learning ‘check points’, in a similar manner to having sign-offs at each phase / stage of the process. The learning checkpoints would allow for reflection on action at each stage of the process in terms of not only what had been achieved in terms of deliverables but also the learning that had taken place. The idea of introducing some form of reflection was adopted from the concept of reflective practice introduced by Schön in 1983 which can also be traced back to the work by Dewey on exploration of experience, interaction and reflection (Bould et al., 1985). Reflective practice enables one to reflect on their actions and thereby achieve learning. This is also consistent with Rogers (2003) view that evaluation of learning focuses reflection and makes that which was unconscious conscious. The new model that was a result of the collaborative redesign effort is depicted at Figure 8 and Figure 9.

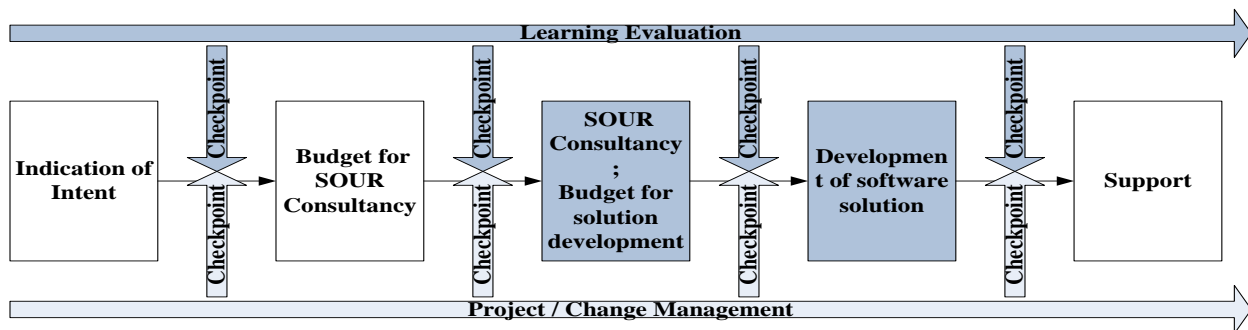


Figure 8: Learning Evaluation Checkpoints in the New ISD Process

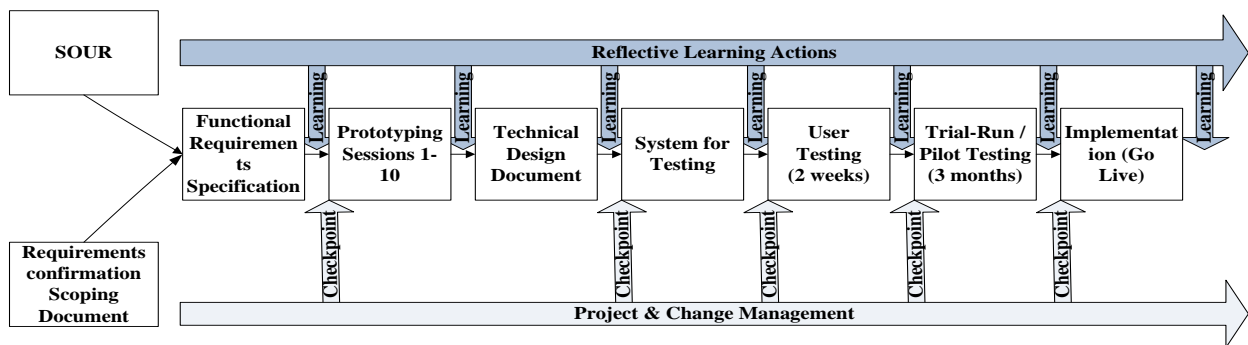


Figure 9: Learning Evaluation Checkpoints in the Design Process

The proposed model suggests that in activity theoretical terms, learning should be included together with work practice improvement as the object of the ISD activity. The suggested transition from the current to

the new activity system is depicted at Figure 10 (i.e. normal text to bold) with the following qualitative changes to the current activity system:

- Tools – in addition to the existing information system development methodologies that various developers use, they would have to also use the new ISD practice model that incorporates learning checkpoints;
- Subjects – Both users and developers would need to be active participants not just in the development process but also in the learning process;
- Rules – The current government IT framework would need to include the new rules to facilitate implementation and adherence by all social actors.
- Community – All members of the community (i.e. the various government departments) and the IS / IT industry would need to have a clear understanding of the new model and also be active participants in its realisation;
- Division of Labour – there may be need to add more resources and teams on both sides to facilitate the learning evaluation process.

From a systemic point of view, these qualitative changes affect mainly the subject and rule producing activity systems. The subjects produced in order to realise this model will need to be what Schön (1983, 1987) terms reflective practitioners. A study of whether current ISD practitioners are reflective along the lines described by Schön would be an interesting one to carry out. In terms of the rule producing activity, a process will need to be initiated to incorporate this new model into the government IT framework as well as to put the necessary measures in place to ensure adherence in line with government requirements.

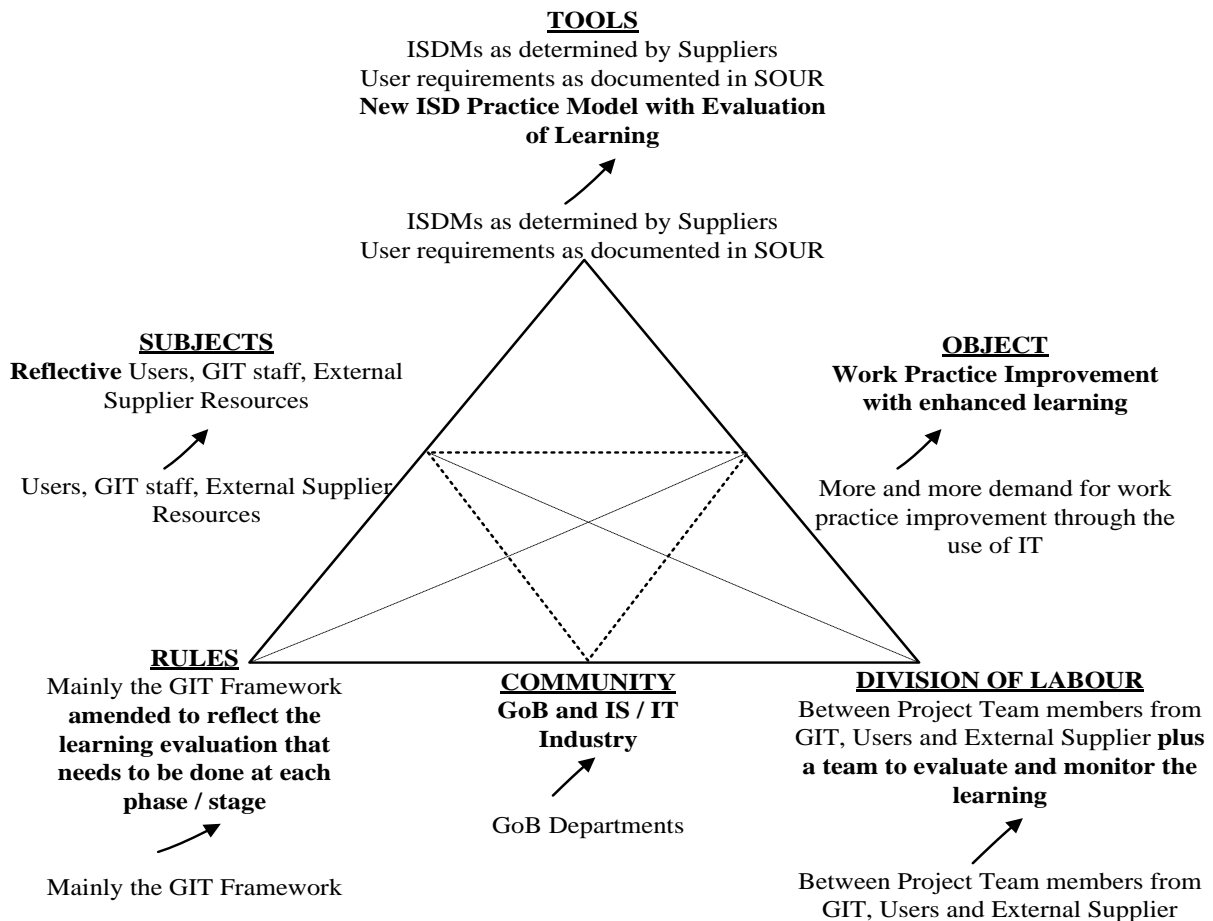


Figure 10: New ISD Activity System

Learning Action 4 – Examining the New Model

Examining the new model was done during the second change lab session mainly using three guideline questions provided by the researcher. Fifteen participants attended this second session. The guideline questions were meant to assist in the analysis of expansion of the object in four dimensions i.e. social-spatial, systemic-developmental, anticipatory-temporal and moral-ideological (Engeström, 2000; Hasu, 2000; Engeström and Sannino (2010)). The questions, presented here, were open ended in structure to allow flexibility in examining all aspects of the model.

- i) **So would this (i.e. the new model) suffice and will it address the current learning challenges?**

This represented a systemic-developmental dimension of expansion where the questioning and learning is on “how does this shape the future of the activity?”. Through this question participants

dialogued first of all on whether the model would achieve the desired results in terms of learning and secondly how the future activity should be constituted based on the new model.

- ii) How can we make it work in practice? Do we need to have a ‘Learning Contract’ in addition to the Memorandum of Agreement between clients (i.e. users) and suppliers (developers)?**

This represented the anticipatory-temporal dimension where the questioning relates to “what previous and forthcoming steps should be considered”. This question triggered discussions on what forthcoming steps should be considered for the new activity. This question also touched on the systemic-developmental dimension as mentioned above.

- iii) How and when can we test and implement this model? What needs to be done in order for us to implement and test this new model (e.g. does the current government IT framework need to be amended?).**

This third question was also along the lines of anticipatory-temporal dimension of expansion and triggered further discussion on the next steps.

The anticipatory-temporal dimension revealed possible expansion of the object through incorporation of the model into the government IT framework and adding the necessary contract provision in the Memorandum of Agreement to ensure adherence by all parties. On the moral-ideological dimension, management was seen as the ideal candidates to drive and lead the learning process. Analysis on the systemic-developmental dimension further confirmed the need for considering the network of activities and the wider community (e.g. the Government Finance Department as mentioned here) in the eventual testing and implementation of the new model.

Discussion

This study has provided a further example of how DWR can be applied in the co-design of work practice, especially where government and industry are involved (Hill et. al., (2007). In applying DWR to the collaborative review and redesign of ISD practice the key CHAT principles of historicity, contradictions, multivoicedness and expansion of the object were applied. The analysis showed primary and secondary contradictions in current ISD practice which contribute towards ineffective learning by social actors. The analysis also showed the multi-voicedness of activity systems as participants during the co-design sessions expressed differed perspectives on first of all current challenges and then what they viewed as solutions to those challenges.

Learning actions 5 (Implementing the new model), 6 (Reflecting on new practice) and 7 (Consolidating Practice) have not been possible as part of the current study. However, discussions have been initiated with Government on how this model can be tested and adopted within the government system. Although it was not possible to go through all the epistemic actions, learning was achieved as described by Daniels et al (2007), Engestrom and Sannino (2010). It was possible to observe how the participants were able to expand the object of the activity and enrich it. Participants traversed the zone of proximal development together as they moved from the two key suggestions of Change Management and Readiness Assessment, to a model that incorporates learning checkpoints and requires reflection-on action at each phase / stage of the ISD process. This in itself constitutes the creation of new knowledge. At the beginning of the process participants did not know what the final outcome would look like. The resulting model evolved as a result of the learning activity that they engaged in.

It was interesting to observe how participants reacted to the introduction of intermediate concepts such as conscious and unconscious learning, and reflection. This interpretation and reconstruction of the task at hand (i.e. in line with Vygotskian theory) using concepts that were new to some, opened up potential and emerging new psychological formations of the participants.

The new ISD model has the potential to have a meaningful impact on improving current ISD work practice in Botswana because the solution addresses mainly secondary as opposed to the primary contradictions identified in the current activity system. It will mainly address secondary contradiction between Tools and Object, and between Rules and Object. This, according to Engeström (1995) and Pihlaja (2005), is the best scenario since, although solutions to primary contradictions may be necessary, they are much more hypothetical and therefore may achieve minimum benefit.

Conclusion

This study has contributed to ISD practice through the incorporation of activity-based learning and reflection to current Botswana ISD practice. In addition, there have also been contributions to methodology through the manner in which DWR was applied. This is discussed next.

Use of a Case Project as opposed to Ethnography

Most DWR studies start with ethnography for the initial fieldwork. In this study ethnography was not done instead a case analysis plus some interviews were used. The case data provided adequate

information from which the study frame or space could be defined and used to trigger the learning challenge of questioning current practice and redesigning it. This implies that one is not limited to ethnography for the initial fieldwork. What is important is to have in-depth data to define the research problem space and for the subsequent DWR epistemic learning actions.

Examination of the model outside practice

Also in this study, it was possible to use the four dimensions of learning as suggested by Hasu (2000) and Engeström (2000) during examination of the model and not at implementation as was the case during their respective studies. Analysing learning at this stage revealed that a guideline question could have other dimensions embedded in it – or that the dimensions are not fixed dimensions. There is a constant movement throughout the zone of proximal development and therefore the dimensions of object expansion are in a flux. This further shows the variability and flexibility of application of expansive learning concepts.

Change Laboratory Sessions

The other methodological deviation was that two long change lab sessions were held, instead of six or seven two hour sessions because of concerns over the availability of participants. It would not have been possible to achieve the same level of interest and participation in the research activity had more sessions been opted for. This indicates that there can be flexibility in the change lab design and approach which depends on the social context of the study and the practicalities on the ground.

Researcher / Interventionist and also IS Practitioner

Most of the DWR / expansive learning studies found in literature were conducted by researchers who were not themselves engaged in the specific work activity they were researching on. In this particular study, the researcher / interventionist was also one of the practitioners engaged in the ISD activity daily and more specifically the PEX project. The question that arises then is how have these two distinct roles been handled and how has this influenced the research process and the findings. In our view, this dual role has enhanced the process rather than influenced the results.

Challenges and Limitations

Although there have been some notable contributions to practice and theory, there have also been some research challenges and limitations.

Stakeholder Participation and Interest

Sustaining interest from all concerned stakeholders was a challenge. Initially government IT department was fully supportive, but momentum and interest was lost due to transfers, management changes and restructuring within that department. It was equally difficult to sustain the interest of the private sector since changing current practice was not a priority for them. Therefore, any future research that seeks to bring government and industry together in collaborative review and redesign of practice will need to find means and ways of ensuring sustained participation and interest from the two subject groups.

Testing and Implementation of the Model

Another limitation of the study is the fact that it was not possible to report on the implementation of the model. This, however, presents an opportunity for future research in terms of carrying out and analysing learning during the remaining three epistemic learning actions of implementation, reflection and consolidation.

Analysis of other activity systems

The research design did not provide for analysis of all the activity systems making up the network of activities (i.e. Finance activity, procurement activity, subject-producing activity, tool producing activity etc.), as the focus was on the two interacting activities of users and developers. It will be interesting to study, for example, the subject producing activity system to see whether Botswana institutions are producing reflective practitioners and the impact of that on the ISD process.

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