Application of Participatory Design in Designing Infrastructures for Learning in resource limiting environments

Tabo Olok Geoffrey[1][0000-1111-2222-3333] and Second Author[2][1111-2222-3333-4444]

[1] Aalborg Uninversity, Aalborg 9000, Denmaark
go_tabo@hum.aau.dk

Abstract. In this paper Participatory Design as methodological approach for designing Infrastructures for learning is explored. The paper emphasizes the need to accommodate for socio-technical and socio-cultural aspects of infrastructure to respond to requirements for new innovative ways of learning such as eLearning and Problem Based Learning (PBL). We investigate design options of infrastructure for learning in a limited resource setting environment with a case study. Participatory Design methodology with a strong tradition in empowering workers in decision making on matters that affect their work is used to foster end user participation in the design process. Since the methodology has several methods, we chose to use Focused Group Discussions/Interviews, Future Workshop and co-Design Workshops. This study outcome uniquely contributes to knowledge by offering participatory design as an alternative among other alternatives to designing in limited resource environments. Future Workshop and co-Design Workshops are new to the environment and have offered solution in user participation and shaping designs for infrastructure at Gulu University which is taken as a case.

Keywords: Participatory Design, Infrastructure, socio-technical, socio-cultural.

1 Introduction

1.1 Background

The higher education sector in Africa has seen very many changes in a drive to address the importance of quality, innovation and creativity in higher education in an African context in the 21st century [1]. The importance of these factors in attaining sustainable growth and production in all sectors cannot be over emphasized. However, many African Universities struggle to provide education, services and research needed for the continents advancement [2]. This general perception is complicated because it involves many players (i.e. political, social, economic, research issues) but there are common phenomena that can be discussed. For the purpose of this article, we shall narrow our discussion to the methodology and try to tackle the question "How" with a case study of Gulu University in Uganda.

Today there is an increasing gap between the number of candidates graduating from the universities and the available employment opportunities and those who are actually employed [3] especially for the youth holding university degrees. The high unemployment rates have led to the need for higher education in developing countries to deliver knowledge, quality and skills in line with the societal needs. These needs are often formulated as the 21st century skills: problem formulation, problem solving, innovation and collaboration [4].

With computers and Internet technology advancing at fast rate, several models of learning are made possible to deliver to those needs. In this project, we envision how to integrate both research for more tangible methods of university teaching and learning in line with the 21st century skills; and digital learning to make possible these new ways of learning in the context of a resource constraint country such as Uganda. More precisely, we are looking into adopting blended learning (problem project-based learning and eLearning) into the Master of Education Planning and Management Courses. The pedagogical mode of problem based learning (PBL) is an innovative way to learning and provides learners with multitude of skills for success in the 21st century [4] also in line with technology enhanced learning.

The use of information and communication technology for learning still is not mainstreamed in universities in Uganda [5] although it has a high priority in the governmental plans and strategies for the development of higher education [6]. However, development agencies are making this vision possible through supporting digitalisation both as a means to make university education accessible for more students and to develop new educational programs. New pedagogical principles integrating the possibilities of digitalization are researched into and integrated in the new programs [7]. Example are already seen with the world bank 2000/2002 report on education. This paper will contribute to a methodology into this unique situation, where there is a momentum to research into the implementation and use of new pedagogical approaches supported by ICT. We try to answer the question how to design infrastructures for learning to accommodate the socio-technical and socio-cultural aspects of new ways of learning? and Which methods to apply? for better adoption and change within Ugandan context

1.2   The project description

Infrastructure and the concept of infrastructure are not new to academia as well as industry. Infrastructure as a concept is defined as a set or resources [8] and as a relationship between focal resource and supporting resource [9]. The term infrastructure therefore has many perspectives as social, cultural, technical and human views [10]. Practitioners and researchers working with ICT at one point might have felt that infrastructure is insufficient and especially that its only recognized when it breaks down. This concept is referred to by Guribye as transparency or black box. These breakdowns are frequent occurrences in developing countries' higher education institutions. A more specific case can be seen in universities in Uganda where electricity, internet, physical structures and work processes are not taken at the level of seriousness they deserve. There are otherwise many challenges with infrastructure for learning in Uganda. A more

prominent challenge is experienced with the Information Technology Infrastructure such as lack of bandwidth, computing resources, skilled human capacity, policies and procedures [5], stable electricity, not widespread networked capacity, low score in networked readiness.

However, despite those afore mentioned deficiencies, we are addressing infrastructure issues for learning from both at the conceptual and at a practical level and thus the choice of a methodology that seeks to empower users and designers to share skills and knowledge. The research takes its point of departure in a case study using Gulu University in the Northern Uganda as a demonstration case.

Gulu University is a rather young university established in 2002 by act of parliament of Uganda as the fourth public university [11]. The main aim of the establishment is to promote development of the northern part of the country that had been at the center of civil war for two decades. The University mission is to provide access to higher education, research and conduct quality professional training for delivery of appropriate services aimed at community transformation and conservation of biodiversity. With the bar set so high, the university is in the process of transforming its business process to deliver services with 21st century skills.

Within Gulu University there is an interest in promoting new ways of teaching and learning in line with the 21st century skills, especially problem and project based learning as well as to promoting and developing Gulu university as an e-campus (reference made to policy papers). As such – because of the commitment to change, the University is a very interesting case for rolling out new approaches to learning integrating ICT.

The research is especially concerned with the issues of infrastructures for learning at university level and in a resource constraint setting such as Gulu University and Uganda. We understand infrastructures for new ways of learning as a crucial issue. It's crucial because a pedagogy and practice unfold itself in a dialectical response to the infrastructure. The infrastructure does not determinate the pedagogy and practice, however it affords a practice. Furthermore, infrastructure investments are expensive and should last for long. Therefore, to focus on the digital infrastructure in resource constraints settings to support the development of new pedagogical methods for learning are crucial, as well as design issues and methods for implementing are important issues to research into.

2 Methodological approach, methods and techniques

This research is inspired by the action research into transforming education though introduction of new innovative pedagogies or new ways of learning as in the proposal for Building Stronger Universities Project. Action research based on intervention in higher education in order to strengthen systems and processes for these new ways of teaching and learning that addresses the 21st Century skills.

2.1   Participatory design Methodology

Participatory design (PD) originated in the Scandinavia between the 70s and 80s motivated by a Marxist commitment to empower workers and espouse democracy at workplace [12]. PD has had impact in strengthening users' skills and product quality. User participation in the decision-making process on what affects their life at work is taken very seriously. In this study of infrastructures, the design process is moved towards user perception of the technology and how it can augment their work of teaching. It is historically, a Scandinavian traditional of involving users in the decision making in what affects workers using technology in the design process [12].

PD has been defined as set of theories, practices and studies relating to end users as participants in activities leading to computer technology products [12]. This methodology is important when users need to be empowered in developing, strengthening and sustaining collaborations between users and designers. It attempts to actively engage users and designers in the product design process to quality assure the product meets expectations of all stakeholders[13]. More emphasis is placed on the process and procedure of design as opposed on the product perfection. This is a new approach in computer system design where users play a critical role in defining their needed design or product. The method precisely blend practical intervention and theoretical reflections leading to higher acceptance of outcome[12].

PD has a rich history in incorporating disadvantaged groups in society into research which has made it widely used in development research fields relating to design of ICT systems [7]. It involves people actively participating in a research process relating to technologies in workplaces, communities, and social institutions [14].

In a way to involve people in the design of technology, participatory design thrives on collaborative processes determined by participation of stakeholders who use that technology [15].

There are methods, tools and techniques developed in support of future users, designers and reflect on future practices that new technologies might bring through participatory design whose literature is increasingly including technology use and reconfiguration of technology to support new and anticipated use.

To understand the teaching and learning process resulting from the introduction of e-learning and PBL at Gulu University, participatory design or more specifically Participatory action research as operationalised in studying experiences of educators [7] was chosen as a point departure for the research methodology with associated theoretical frameworks such as expansive learning theory and activity theory.

This approach is more about design with the aim of producing artefacts, systems, work organisation and practical knowledge as the research itself [12] and so design is described as research. The methods that are drawn from the approach are many. For example; Future Workshops, Co-Design, focused group interviews, analysis of artefacts and protocols. According to Spinuzzi (2005), I quote: "*all these methods are used to iteratively construct the emerging design, which itself simultaneously constitutes and elicits the research results as co-interpreted by designer-researcher and participants who will use the design*". The methods ensure that participants views and interpretation

are taken into the research with the goal to concurrently envisage and shape in ways described by user requirements [12].

2.2 Methods and techniques

Research methods provide necessary steps to support a research undertaking (Ramadhan and Arman, 2014). Participatory design methodology has several methods and techniques [12]. I will describe in detail the methods and techniques that are used in this study.

Future Workshop

This method was developed in the 1970's as a tool for the civil action groups striving for better enforcement of their future interest [16]. This method is based on "Social learning" and it is praised by constructivist in educational sciences where individual participants are able to find new resolutions in their reconstruction of reality [16]. In order to transform a system or a process, it is important to criticise the actual situation and then dream about a preferred future then find ways to move from current to the desired future situation [17]. This underscores Hengel's dialectics that problems are solved by critique [16] and that critiques exposes the present circumstances. This method emphasizes learning, teamwork, democracy, assessment and participant empowerment making is a good method processes leading to better society [16], [17]. Future Workshop is therefore used to facilitate participation in group processes dealing with real world problems [17], for example creating a better future work environment, tools and policies. The method seeks to support creativity and the creation of group synergies for individuals that are in the same situation.

The method has been applied in many different settings and in handling unique situations especially in Scandinavian communities (Vidal, 2005) and has gained grounds in management theories [16]. This technique where participants share knowledge and experiences in a more productive way has gained greater demand [16] for research. Vidal tried to give a practical and a theoretical insight into the method. With the increase in the popularity of the method, the need to prepare a concise guide for facilitating Futures Workshops soon arose [18]. Apel outlined the phases of the method as Preparation, Critique, Fantasy and implementation which was summarised by Vidal as Critique, Fantasy, and Implementation. The Finland Futures Research Centre presented a format that can be used when seeking answers to practical questions and devising plans for achieving desired future[18]. This as a very innovative way of involving users in innovatively solving common problems just like in designing infrastructure for teaching and learning in higher education. To prepare the teachers to design for the future of integrating technology the Future Workshop provided an excellent environment.

The workshop tasks encompasses principles of creative and or collaborative problem solving and socially a allows the group to express themselves as a way of facilitating responsible participatory democracy [17], [18].

Design Workshop: Case Study

This research method affords researcher with ability to conduct a study of a phenomenon in a real-life context, thus investigating questions like how and why of the study [19]. A prototype of the LMS developed is tested with students of Master of Education Planning and Management whose curriculum is redesigned to incorporate PBL pedagogy and eLearning. This test will run for a semester and is followed by a focused group discussion to answer on affordance of the system. Accordingly, ICT has become part of our everyday life, practice and leisure time. In designing innovative ICTs, we need to ably engage with given practices, institutional arrangements and technological infrastructures. An intervention in the Master of Education Planning and Management will be taken as a case study in this study.

Staff who teach on the programme participate and set the basis of integration of ICT to facilitate collaboration, teaching and learning. The case study is based on the courses implemented on the learning management system in the first semester of study.

Apart from an in-depth study of the main concept of Infrastructure, pedagogical principles, theories and concepts related to participatory design and qualitative research methods will be discussed. The methods [12] usually employed in iteratively constructing promising design which become the outcome as understood by researchers and participants who are users of the resulting design.

Data collection

Our data collection techniques include Future Workshop, focused group interview, document analysis and design workshops. The target group for the study are the academic staff of the department of Education Planning and Management in the faculty of Education and Humanities. This study also specifically targets the academic staff teaching in the Master of Education Planning and Management because they are responsible for the curriculum design and delivery. In addition to these staff, we have the technical staff in the IT and management. This latter category is targeted because the study of Infrastructure requires funding and maintenance of these systems for sustainability.

Data is collected through, Future Workshop with the teachers in the department and other staff who are also teachers in the programme. A focused group discussion on the state of the infrastructure with the IT staff helped in writing a sort narrative of the position on IT Infrastructure in which other infrastructure requirements were identified and presented. A design workshop was conducted from which other requirements like policies, bandwidth and technical personnel were identified as elements in infrastructure for learning.

Ethical issues

Qualitative research by its nature involves collecting data from people by involving people [19]. This underscores the importance of ethical considerations in this research at all stages of the research in taking care of issues that arise along the research continuum. For each of the sessions consent forms are used to communicate the research intention and participants consent is sought. Although the research targets a single faculty, participation where data (audio and photo) was being collected is voluntary.

Data Analysis

The audio data is transcribed and themes relating to infrastructure identified. Drawings, flipcharts, paper prototypes and PowerPoint presentations are collected from the groups and presenters. Other electronic materials are also collected on the LMS for future references by both research participants and researchers. Participants have no rights to alter the data on the system but can generally use the information for both academic are research. These are more especially data relating to curriculum redesign and Problem/Project Based Learning (PBL) discussions, notes and reports from various groups and workshop reports.

In the data analysis, we use expansive learning as a theoretical framework and as analysis lenses to understand and explain the phenomena in the data. The choice to use expansive learning was based on the fact that we note that local learning takes place in collaboration and partnerships among stakeholders.

Conclusion

Participatory design is a methodology reach in methods with so much choices to explore user knowledge and skills. PD allows for democratic developments at work place thus giving users powers to make decision on what affects them. The result of using such method is sustainable systems for change with collective responsibility.

.

References

[1]   D. Z. Atibuni, D. K. Olema, J. Ssenyonga, S. Karl, and G. M. Kibanja, "Mediation Effect of Research Skills Proficiency on the Core Self-Evaluations--Research Engagement Relationship among Master of Education Students in Uganda," *J. Educ. Pract.*, vol. 8, no. 15, pp. 103–108, 2017.

[2]   D. Teferra and P. G. Altbachl, "African higher education: Challenges for the 21st century," *High. Educ.*, vol. 47, no. 1, pp. 21–50, 2004.

[3]   A. Wilkinson *et al.*, "The employment environment for youth in rural South Africa: A mixed-methods study," *Dev. South. Afr.*, vol. 34, no. 1, pp. 17–32, 2017.

[4]   S. Bell, "Project-Based Learning for the 21st Century: Skills for the Future," *Clear. House A J. Educ. Strateg. Issues Ideas*, vol. 83, no. 2, pp. 39–43, 2010.

[5]   P. O. Ayoo and J. T. Lubega, "Exploring the Implementation of Blended Learning in a Developing Country: A Case Study of Uganda," in *Strengthening the Role of ICT in Development*, 2008, vol. IV, pp. 152–163.

[6]   National Planning Authority, "Uganda Vision 2040," 2012.

[7]   P.-O. Zander, M. Georgsen, and T. Nyvang, "Scandinavian Participatory Design - Beyond Design, Beyond Scandinavia," in *Rethinking Pedagogy for a Digital Age: Designing and Delivering E-Learning*, 2007, pp. 1–260.

[8]   S. Star and K. Ruhleder, "Steps Toward Design an Ecology and Access of Infrastructure : for Large Spaces Information," *Inf. Syst. Res.*, vol. 7, no. 1, pp. 111–134, 1996.

[9]   F. Guribye, "Infrastructures for learning. Ethnographic Inquiries Into The Social And

Technical Conditions Of Education And Training," 2005.

[10] F. Guribye, "From Artifacts to Infrastructures in Studies of Learning Practices," *Mind, Cult. Act.*, vol. 22, no. 2, pp. 184–198, 2015.

[11] P. Olango, G. Bouma, G. Andogah, and J. Nerbonne, "Effect of document enrichment on e-learning," *Procedia. Soc. Behav. Sci.*, vol. 73, pp. 1–8, 2013.

[12] C. Spinuzzi, "The Methodology of Participatory Design," *Tech. Commun.*, vol. 52, no. 2, pp. 163–174, 2005.

[13] S. Bødker and O. S. Iversen, "Staging a Professional Participatory Design Practice - Moving PD beyond the Initial Fascination of User Involvement," *Proc. Second Nord. Conf. Human-Computer Interact.*, no. January, pp. 11–18, 2002.

[14] M. J. Muller and S. Kuhn, "Participatory design," *Commun.ACM*, vol. 36, no. 6, pp. 24–28, 1993.

[15] J. Simmonen and T. Robertson, "Participatory Design," *Routledge*, 2012. [Online]. Available: https://scholar.google.dk/scholar?hl=en&as_sdt=0%2C5&q=Robinson+and+Simonsen%2C+Routledge+International+Handbook+of+Participatory+Design%2C+Routledge+2012%2C&btnG=. [Accessed: 11-Nov-2017].

[16] H. Apel, "The Future Workshop," *Heino Apel Futur. Work. Dtsch. Inst. für Erwachsenenbildung*, pp. 1–12, 2004.

[17] R. V. V. Vidal, "The Future Workshop: Democratic Problem Solving," *Informatics Math. Model. Tech. Univ. Denmark, DTU*, pp. 1–22, 2005.

[18] V. Lauttamäki, "Practical Guide for Facilitating a Futures Workshop," no. October, p. 11, 2014.

[19] T. Bj©ırner, *Qualitative methods for consumer research: the value of the qualitative approach in theory and practice.* Gyldendal Akademisk, 2016.