

Using Open Educational Resources and Technology-Enhanced Learning for Teacher Professional Development in Ugandan Schools

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Abstract

Remote areas with technological, environmental, and human barriers to education lack the innovative practices to provide sustainable, consistent, and meaningful resources and training for educators. Stakeholders, including investors, organizations, leaders, administrators, teachers, students, and communities benefit from effective research-based strategies that limit the barriers and empower new generations of educational inputs and outputs, citizens of the global community. This research examined the effectiveness of an innovative approach combining concept, software, and hardware to deliver teacher professional development. A quantitative, relational, non-parametric design reported a significant increase in personalized professional development using open educational resources and a content access point. This study established a relationship between the variables and moved the research community forward toward causal evidence for innovative educational practices.

Key words: access and equity, adult learning, open learning, professional development, Uganda, open educational resources.

Использование открытых образовательных ресурсов и усовершенствованных технологий обучения для повышения квалификации учителей в школах Уганды

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Аннотация

На отдаленных территориях с технологическими, экологическими и социальными барьерами в области образования затруднено использование различных инновационных методов для постоянного обеспечения преподавателей значимыми ресурсами, а также для их подготовки. Заинтересованные стороны, включая инвесторов, организации, директоров школ, администраторов, преподавателей, студентов и сообщества, извлекают выгоду из эффективных научно-исследовательских стратегий, которые ограничивают барьеры и внедряют образовательные ресурсы нового поколения и результатов для граждан глобального сообщества. В данном исследовании была рассмотрена эффективность инновационного подхода, сочетающего в себе методологию, программное и аппаратное обеспечение для повышения квалификации и профессионального роста учителя. Результатом количественной, реляционной, непараметрической методологии стал значительный рост персонализированного профессионального развития учителей, использующих открытые образовательные ресурсы и удаленный доступ к ним. Это исследование установило связь между переменными и представило исследовательскому сообществу причинно-следственные данные для инновационных образовательных практик.

Ключевые слова: доступ и равенство, обучение взрослых, открытое обучение, профессиональное развитие, Уганда, открытые образовательные ресурсы

Introduction

In 2010, international researchers established a relationship with a P-7 school outside of Nyenga, Uganda. The relationship began by following Maslow's theory of hierarchical needs by providing food, medicine, and clean water. A year later, following three additional short-term trips, the relationship with school personnel became personal; developing friendships, methods of constant communication, and supporting individual educator needs. In 2012, the relationship moved toward a transformational model, with personalized educational support as the delivery framework. This new relationship included providing teacher training, pedagogical modeling, resources, and administrative accountability. Over the next six years, the bi-annual resident training included small group instruction, reading strategies, math strategies, data collection, school morale, teacher evaluation, and consistent need provisions. To create a sustainable and frequent professional development, the researchers relied on technology-enhanced learning, specifically the use of a content access point (CAP) (RACHEL-Plus 3.0) to deliver open educational resources (OER) for teacher professional development.

Providing meaningful and relevant teacher professional development is essential for continued pedagogical growth (Mukeredzi, 2013). Research on educational systems reports common barriers in teacher professional development including technical, political, and cultural (Johnson, 2006), and the lack of access, vision, and time (Kopcha, 2012). Research on African-specific contexts reported similar results (Hennessy, Harrison, & Wamakote, 2010; Grantham-McGregor et al., 2007; Neuman, Mcconnell, & Kholowa, 2014; UWEZO, 2010; CSEC, 2011; Fisher et al., 2009; Kholowa, 2007; MoWCD and UNICEF, 2008). For example, a study of schools in Sub-Saharan Africa revealed internal barriers such as lack of use, technological literacy, pedagogical expertise, and teacher education (Hennessy, Harrison, & Wamakote, 2010). The implementation of the CAP provides sustainable, high quality professional development opportunities for teachers in remote Ugandan towns. However, to date, there is no published research on the effectiveness of this strategy for teachers in remote areas. This quantitative study examined the effectiveness of the CAP to deliver teacher professional development in an East African school through a nine-week, personalized, self-paced teaching module. Pre- and post-test scores were collected and analyzed to examine the effectiveness of the innovative approach.

Context

Uganda specific research on teacher professional development using technology-enhanced learning tools, such as the CAP, is minimal. Consequently, it is necessary to examine professional development in Uganda through three inclusive designations as a Sub-Saharan African (SSA) country, an Economically Developing Country (EDC), and an East African Country (EAC). Resources, research, and efforts in these areas are supported and guided by the United Nations, the World Bank, UWEZO, and United Nations Educational, Scientific, and Cultural Organization (UNESCO).

State of Education: Region

In the Sub-Saharan African (SSA) region, 61 percent of young children are affected by barriers including poverty, malnutrition, and a lack of educational access (Grantham-McGregor et al., 2007). For many reasons, navigating these barriers and improving educational opportunities is limited (UNESCO, 2012). For example, although free primary education exists for some, it is neither universal, nor equitable (Neuman, Mcconnell, & Kholowa, 2014). UWEZO reported many teacher-related problems, including shortages, poor training, a lack of motivation, classroom conditions, and a lack of materials and support (2010). Despite investments, early childhood education in SSA continues to have low outcomes, including a lack of materials and insufficient learning environments, but specifically, poorly trained and supported teachers (UWEZO, 2010).

An examination of Ugandan education from the perspective of an East African Country (EAC) and an Economically Developing Country (EDC) results in data supporting findings from the regional SSA data presented above. Specifically, a lack of classroom learning materials and a basic education for educators, some with only a primary (P1-P7) education (CSEC, 2011; Fisher et al., 2009; Kholowa, 2007; MoWCD and UNICEF, 2008). Although these findings are confirmatory, they also begin to provide meaningful conclusions for present and future efforts. In addressing the persistent issues in teacher preparation, educational researchers and the Ugandan government called for increased focus on educator resources (Neuman, Mcconnell, & Kholowa, 2014; Engle et al., 2007, 2011; Naudeau et al., 2011; The Republic of Uganda, 2015).

State of Education: Uganda

As a country, Uganda has the world's 32nd largest population with over 40 million people (www.unstats.un.org). Uganda has an unfavorable context for educational development, marked by foreign power structures resulting in "high illiteracy rates, limited access, extensive poverty, political chaos, oppression, guerrilla insurgency, influx of refugees, Internally Displaced People (IDPs), and hard-to-reach populations" (Wood, 2008 as cited by Nyenje & Nkata, 2016). Half of the total population is under the age of 14, which has tremendous implications for the education sector. Forty percent of children between the ages of 10 and 14 are working, of which, 70% are in the subsistence agriculture sector, resulting in almost 40% of the country living below the national poverty line (www.unstats.un.org). Overall, 58% of the nation is unemployed, which when combined with a young population and the lack of education, creates conditions consistent with civil violence and autocratic governments (Daumerie & Madsen, 2010).

Due to the synergy of formal position statements and policies from the 1990 World Conference on Education for All, the United Nations Millennium Development Goals, Articles 30 and 34 of the Ugandan Constitution, the implementation of Uganda's Universal Primary Education (UPE), the UNCR, the ACRWC, and the Ugandan Children Act, basic education is considered a human right (www.unstats.un.org; MoGLSD, et al., 2014; MoES, 2008; The Republic of Uganda, 2015). However, although enrolment rates increased 57%

in the first year of Uganda's UPE, universal access and high-quality education remained unavailable for many. In 2016, 42% of the population over six years of age did not have a primary education. The implementation of UPE seemed to contribute to a decline in the quality of education, support for teachers, and adequate compensation for teachers (Deiningner, 2003; Nyenje & Nkata, 2016; www.unstats.un.org). As a result, the need for teacher supervision and training is high, and increases in rural areas (Dejaeghere et al., 2009).

In the rural area of Uganda, where this study took place, there is a greater rate of risk than the regional, cohort, and country statistics provided above; including a higher population under 14, a higher total fertility rate, a higher illiteracy rate, a higher unemployment rate, and lower education attainment rate (www.ubos.org). Furthermore, a 22% increase in population and a strongly expansive population pyramid means children join the workforce at a young age, making primary education a key in this region (www.ubos.org).

Teacher Effectiveness and Professional Development

Research on teacher effectiveness in SSA, EDC, and specifically Uganda, is consistent with research on Western educational systems, which reports teacher competence as the single greatest indicator of student success (National Commission on Teaching and America's Future, 2016; Wamala & Seruwagi, 2013; MoES, 2008; MoES, 2009; UNEB, 2011a, 2011b). For example, Wamala & Seruwagi (2013) found higher teacher competence in reading and math was associated with higher student reading and math scores. Research on Ugandan teacher certification and student performance revealed a disparity between national licensing guidelines and student performance. Although 90% of Ugandan teachers have appropriate qualifications, the quality of education in UPE schools continues to decline (MoES, 2008). Furthermore, almost 65% of primary school teachers in Uganda have a Grade III certification, while research indicates teachers with a Grade V certification outperform teachers with a Grade III certification as measured by student outcomes (MoES, 2009; UNEB, 2011a). Similarly, a comparison of Ugandan certification types reveals secondary education students taught by teachers with a degree in education outperformed their peers taught by teachers with a Grade V certification (UNEB, 2011b). In addition, the National Assessment of Progress in Uganda (2011) compared primary teachers with the Uganda Advanced Certificate of Education (UACE) with those who had the lower certification, Uganda Certificate of Education (UCE). The results indicate higher teacher performance is related to higher academic training and qualification (UNEB, 2011a, 2011b). The research in Uganda on teacher preparedness, qualification and student outcomes consistently suggest systematic changes in certification structures and immediate efforts to improve teacher competence (Wamala & Seruwagi, 2013; UNEB, 2011a, 2011b; Goloba, Wokadala, & Bategeka, 2010; Chapman, Burton, & Werner, 2010).

Research on professional development specific to SSA, EDC, and Uganda is consistent with research specific to Western countries. Teacher professional development is reported as not only needed to improve student achievement, but also as significantly related to teacher performance and student achievement (Kalule & Bouchamma, 2014; Goloba et al., 2010; Mulkeen et al., 2007; Mukeredzi, 2013; Nolan & Hoover, 2011; Posnanski, 2002; Bandura, 1993, 2003). Professional development is critical in rural Uganda where teacher shortages, a lack of resources, and a lack of opportunity lead to untrained teachers (Dejaeghere, Rhiannon, & Kyeyune, 2009). Professional development takes many forms, including instruction, modeling, coaching, supervision, evaluation, resources, and training (Glanz, 2000; Wanzare, 2011; Eady & Zepeda, 2007; The Republic

of Uganda, 2003; Pfeifer, 2011). Collaborative professional development helps identify teacher strengths and weaknesses (Leithwood & Sun, 2012), provides teachers with the tools necessary to reflect, share, and improve their practice (Sergiovanni & Starratt, 2007), and increases collective- and self-efficacy, resulting in increased effort, perseverance, and motivation (Jacobs & Yendol-Hoppey, 2010; Bandura, 2003). Nevertheless, improving the quality of teaching remains a challenge (Kalule & Bouchamma, 2014).

Open Educational Resources and Professional Development

Teacher preparation is necessary for improved student achievement (UNEB, 2011b), but the ability to access more teacher training or professional development for teachers in remote places may be limited by distance and access to resources which can be costly (Muskin, 2015). However, with increased use and creation of open educational resources (OER), teachers may experience increased access and decreased barriers to opportunities for professional development and training. OER are educational resources are intentionally licensed for free distribution and use. These types of resources range from audio recordings to an entire educational course. OER provide increased access to high quality materials, and in the case of teacher education, research-based best practices for professional development. An OER limitation is that the user must gain access to repositories of resources. Accessing the resources has historically been accomplished through the print or the internet. However, these incur costs that limit access. This barrier of access to OER is being addressed through devices such as the Content Access Point (CAP).

A CAP is a device that capitalizes on the advancements in data storage. This 12 inch in diameter device allows a user to access information as if they were on the internet. The CAP can be powered by any power supply, including solar power. The user gains access from any device, such as a tablet or a phone, by either connecting through a USB port or by a local wireless network created by the CAP. At the same time, the CAP serves as a power supply to the devices that are accessing its database. Ultimately, the CAP is a delivery device for a server that stores OER. The specific server used in this study was the Remote Area Content Hotspot for Education and Learning (RACHEL). Once connected the user has offline access to preloaded open content such as Medical Information, Great Books of the World, Edison - Fun Robotics for Tomorrow's Inventors, Hesperian Health Guides, UNESCO's IICBA Electronic Library, and Microsoft Windows tools. In addition to preloaded content, the user can create and upload their own open content to share with others using the CAP.

Research Question

Persistent barriers limit teacher professional development in remote areas of Uganda. Providing long-term sustainable solutions is necessary for continued human, educational, and economic growth in the region (Engle et al., 2007, 2011; Naudeau et al., 2011). Although the United Nations Convention on the Rights of the Child (UNCRC), the African Charter on the Rights and Welfare of the Child (ACRWC), and the Ugandan Children Act all explicitly define education as a basic child right (MoGLSD, et al., 2014), issues related to teacher competency and qualification remain a problem. Many researchers and government organizations recognize the need to improve the quality of education (Kalule & Bouchamma, 2014; Lewin and Stuart, 2003; Penny, Ward, & Read, 2008; UNESCO, 2004; World Bank, 2005). A school in remote Uganda provided the opportunity to field test and research an innovative, technological practice for delivering meaningful, personalized professional development to P12 educators.

The purpose of this study was to examine the effectiveness of using a content access point (CAP) to deliver open educational resources (OER) for teacher professional development in a remote Ugandan school. This method was chosen as an innovative practice to address the barriers to teacher education and training in remote areas. The CAP may provide an opportunity for sustainable, frequent, collaborative, and personalized professional development. This study seeks to answer the question of if the use of a content access point significantly changes teacher professional development outcomes?

Method

This study used a quantitative, non-parametric, relational design. Quantitative methods examine theoretical positions through the examination of the present variables (Creswell, 2008; Gay & Airasian, 2000). The independent variable is the use of the content access point (CAP), an innovative technological approach, to deliver open educational resources. The dependent variable is teacher professional development, measured by a change from pre-test to post-test. This study theorized the use of the CAP could be successful in meeting the professional development needs of Ugandan teachers facing extreme barriers present in remote areas of East Africa.

This quantitative method is relational, attempting to measure the statistical association between the two variables (Steinberg, 2011; Vogt, 2007). There is no evidence that combined technological approaches, such as the use of the CAP, cause content learning gains. However, this design can establish a relationship, a condition for causation (Johnson, 2000; Schenker & Rumrill, 2004).

The study population, data type, and variable type violated the t-test assumptions (Wilcox & Keselman, 2003). Therefore, the non-parametric, Wilcoxon Signed Rank test was used. A non-parametric test does not assume normal distribution because the sample is too small to establish an assumption on distribution (Creswell & Creswell, 2017). The non-parametric test measures the central tendency, or median instead of the mean (Wilcox & Keselman, 2003). This limits data skewed by outliers in a small population (Wilcox & Keselman, 2003). The Wilcoxon Signed-rank test was selected based on four testing assumptions; interval scale, dependent pairs, independent paired data, and homogeneity in variances (Rey & Neuhauser, 2011; Higgins, 2003; Wilcoxon, 1945).

The study population was the teachers in a remote Ugandan school. The purposive sample included all 12 teachers, eight male, and four female, from grades P1 to P7. According to Gay (1996), purposive sampling enables the study to acquire an in-depth understanding. Data collection used a pre- and post-test method. Previous research reports personalized learning and learner choice increase agency and performance (Song, Wong, & Looi, 2012; Pintrich & Schrauben, 1992). Therefore, the participants collectively chose the professional development skill they wanted to learn. A Microsoft Excel module was selected from the OER choices on the CAP/RACHEL. The data instrument was the proprietary exam, created by Microsoft, associated with the participant-selected training module. The exam was piloted with two Ph.D. researchers and a Ugandan teacher from the study site. Instrument design followed Burton and Mazerolle's (2012) four-step design. Feedback led to the elimination of four questions and the changing of five words, which increased confidence in the instrument. The teacher participants went through a one-hour training by the researcher, took the 20-question pre-test, and completed the Week 1 Microsoft Excel module with the researcher present. The remaining eight weeks of the training module were completed without technological, pedagogical, or content assistance. At the conclusion of the nine-week training module, the participants took the 20 question post-test. Data was coded for matching and deidentification purposes.

Results

Using SPSS, the coded, non-identified data was inserted, and a Wilcoxon Signed Ranks test was used to analyze the data. The Figure 1 shows the Wilcoxon Signed-ranks test, which indicated post-test scores ($M = 8.25$) were significantly greater than pre-test scores ($M = 5.5$), $Z = 2.046$, $p = 0.041$.

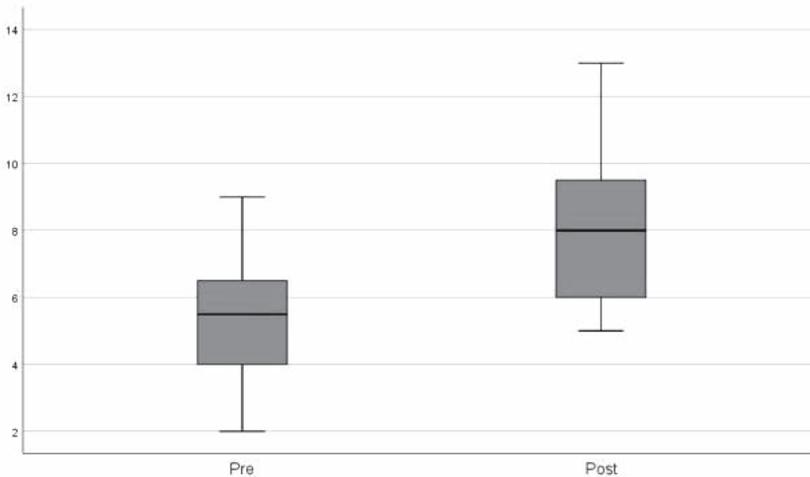


Figure 1. Means of Pre- and Post-test Scores

Note: The difference between the paired pre- and post-test scores were significantly different $Z = 2.046$, $p = 0.041$.

Discussion

The results of the research indicate teacher professional development models in remote areas of Uganda can successfully use a content access point (CAP) and OER to increase content knowledge. The post-test scores showed a significant increase in the participant's competency in Microsoft Excel. Therefore, the CAP appears to be a potential use for consistent, meaningful, and sustainable teacher professional development.

The CAP was utilized without administrative oversight by the school's director, who leads operations from the United States. The professional development in the use of Microsoft Excel was selected by onsite educators and was immediately used for student grade spreadsheets. The onsite administration, including the headmaster of the school and the bursar, began using the professional development to immediately begin tracking enrollment data, tuition payments, and school expenditures.

The fiscal and human investment into the project was minimal, under \$300. These elements are important because high cost and human capital add to the preexisting barriers. Furthermore, this cross-cultural and faculty growth project relied on significant relationships, trust, and participant investment for successful design and implementation (Cox, 2004; Basch, 1984).

Recommendations for Practice

There are three recommendations for practice. First, the CAP should be used in situations where technological, fiscal, and environmental barriers prevent other sustainable options. The use of technology in a remote area required alignment with

organizational goals, participant desire, and meaningful use. Second, the use of the CAP needs increased partnerships with OER providers. There were few culturally appropriate and current issues addressed in the OER. The OER provided a wealth of static knowledge but lacked easy access to dynamic humanitarian information, including health, security, and liberty. Third, the use of the CAP needs increased awareness. This study examined an innovative educational strategy developed in a random conversation over an Orange Fanta in a dusty, remote area, in an East African town. The increased use of this method and its innovative components have the capacity to lead to knowledge revolutions, and therefore improved discourse and diplomacy between local, state, regional, and global communities.

Recommendations for Study

Educational research is lacking for communities with extreme barriers. Most research has highlighted the struggles and issues in education for these areas. However, meaningful research needs to connect innovative, sustainable, and effective strategies to the human capital, which in this case includes the teachers, administrators, school directors, and communities. Therefore, there are three recommendations for study. First, there is a need for a replication of this study with a larger population. Due to the nature of the study design, this should include numerous remote schools, instead of larger African schools. Second, there is a need for examination of other components of using the CAP, including other OER and delivery platforms. The use of the CAP was a third iteration of the project and includes many strengths and few weaknesses. However, other opportunities include, but are not limited to, the outernet (an inexpensive use of low-earth orbiting satellites and data radios), long-range modems, and the increased use of previously military-specific communication practices.

Conclusion

The examination on innovative approaches to deliver professional development for teachers in a remote school in Uganda, specifically the Content Access Point (CAP) and open educational resources, provided promising findings. Capitalizing on relationships and support, the researchers were able to provide limited training and support on an innovative approach for Ugandan teachers to access, personalize, and use professional development trainings that were previously unavailable. The educational context in Sub-Saharan Africa, East African Countries, and Economically Developing Countries demands that not only research, but also practical application of innovative approaches for teacher development. Consistent with policies, rhetoric, and efforts of the United Nations, the World Bank, UWEZO, the United Nations Educational, Scientific, and Cultural Organization (UNESCO), national, provincial, local, community, and household leaders, this innovative approach is suggested to have success in addressing professional development and educational outcomes of educators.

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