

Utilizing Open Education Resources to Enhance Students' Learning Outcomes during the COVID-19 Schools Lockdown: A Case of Using Kolibri by Selected Government Schools in Uganda

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Abstract: A preview of the international dashboard of trends in education suggests that Open Education Resources (OER) have and will continue to impact the provision of education during institutional closure owing to the global COVID-19 pandemic. However, the toughest question that is often presented to OER promoters regards the pedagogical effectiveness of OER: If education resource users are not cognizant and do not pay for the production, distribution and utilization of the required resources, then, how can the production, distribution and utilization of such resources be effectively used? Basing on data obtained from the system (Kolibri) usage-logs and e-interviews (online conversational interviews) on Zoom which were conducted with twenty five (25) purposively selected teachers, and one hundred (100) students invited from 10 Government-Aided Secondary Schools in Uganda, this study presents a Discourse Analysis (DA) of teachers' use of OER on Kolibri and draws on such insights gained to propose a potentially transformative model for efficient and effective utilization of OER to enhance students' learning outcomes during the COVID-19 schools lockdown.

Keywords: COVID-19, Learning Outcomes, Open Education Resources (OER), and Kolibri.

Introduction

The outbreak of the Corona Virus Disease of 2019 (COVID-19) and the consequential lockdown of education institutions across the globe is continuing to impact the education landscape in many unprecedented ways. According to UNESCO (2020), at least 165 countries have closed their education institutions and now, more than 516,000 million children are out of school (UNESCO, 2020).

In an attempt to control the spread of COVID-19 in Uganda, the president directed that all schools and educational institutions in Uganda be closed March 20, 2020 until further notice. As a result of this directive, 73,000 schools and institutions, 15,000,000 learners, and 548,000 teachers are now out of school. An estimated 600,000 out of school (OOS) children are reported to be in refugee settlements (MoES, 2020). Unfortunately, most of the refugee settlements in Uganda are located in high-risk towns that border countries that report an increasing number of COVID-19 cases. In short, the COVID-19 is such a serious threat that it puts the entire school system of Uganda and the rest of the world at risk.

In its response to the school closures, the Ministry of Education and Sports (MoES), through the National Curriculum Development Center (NCDC), developed self-study materials (<http://ncdc.go.ug/content/home-schooling-materials>) and secured airtime on selected radio and



television stations to enable teachers to deliver essential lessons for pre-primary, primary, and secondary school students to continue learning while at home (<http://ncdc.go.ug/sites/default/files/covid-19/circular.pdf>).

Although the MoES offered some practical interventions for the pre-primary, primary and secondary education sector, it directed the Governing Councils of Universities and other tertiary institutions to put in place their own measures to foster deep and meaningful learning for all university and tertiary education students during the COVID-19 institutions closure. This study emerges from an educational intervention by the College of Education and External Studies (CEES) at Makerere University to build the pedagogical capacities of teacher-educators in its collaborating Pre-Primary (Early Childhood Development–ECD) teacher-training institutions to foster trainees’ learning during the COVID-19 institutions closure in Uganda.

Although there is a rising interest in the integration of Open Education Resources (OER) into teaching to augment the provision of universal education at levels of education across the globe, there is still limited empirical evidence from countries of the Global South, to indicate how this sprouting educational practice is enhancing students’ learning outcomes especially in Science Technology Engineering Mathematics (STEM) and life skills subjects. On the other hand, anecdotal evidence indicates that there is a contrast between students’ interest in engaging with the OER that are available to them, versus teachers’ abilities to effectively use such OER to enhance students’ learning outcomes. This contrast presents a call for teachers to unlearn their prior padlocked didactics to adopt emerging open pedagogical practices. Unfortunately, where robust frameworks for adoption of open pedagogical practices are missing, a number of teachers find it very challenging to effectively and efficiently integrate OER into their teaching. Based on usage-logs, focus group discussions, and interview data that we collected from 25 teachers and 100 students from 10 Government-Aided Secondary Schools in Uganda, this study assessed how teachers used Kolibri OER in teaching, and proposes a potentially transformative pedagogical model for integration of such resources to enhance students’ learning outcomes. The rest of this paper is organized as follows.

Open Education Resources (OER)

As Downes (2007) observed, the term “resources” is generally ambiguous, and yet, no attempt at qualifying this term, to say, “Open educational resources”, can significantly narrow it down. Several definitions of OER have been given. This study adopted UNESCO’s definition of OER. According to UNESCO:

Open Educational Resources are defined as “technology-enabled, open provision of educational resources for consultation, use and adaptation by a community of users for non-commercial purposes” (UNESCO, 2002).

This study assessed how teachers in selected government secondary schools in Uganda used OER on Kolibri in their teaching to enhance students’ learning outcomes during the COVID-19 schools lock down. Kolibri is an online learning platform (with an offline version) that was designed by Learning Equality (2020) for educators across the globe to have access to curated and openly licensed educational content libraries. Kolibri OER are available in several languages and the Kolibri libraries are designed in such a way to support an all-rounded curriculum, including both formal educational materials, such as lessons and assessments as well as exploratory materials, such as books, games, and

simulations for a number of subjects, especially Science, Technology, Engineering and Mathematics. In its efforts to foster students' learning during schools closure owing to the COVID19 pandemic, UNICEF-Uganda and the Government of Uganda, through the National Curriculum Development Center (NCDC), encouraged and supported teachers in selected government schools to utilize OER on Kolibri. Figure 1 below is a screenshot of the Kolibri learning platform with a range of OER in Science, Technology, Engineering, Mathematics and Life Skills subjects.

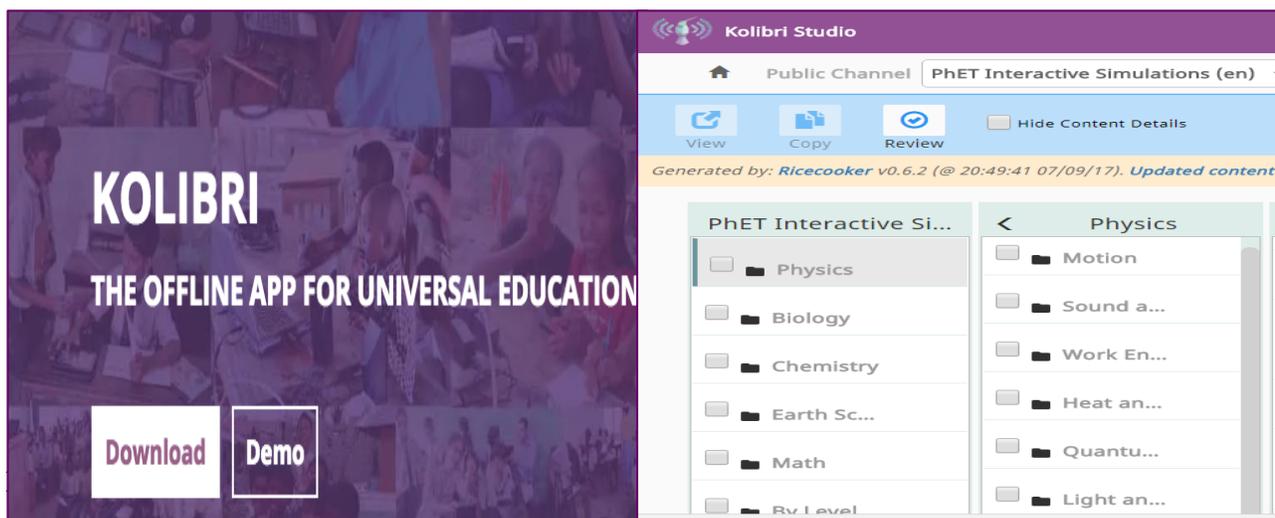


Figure 1: A remixed screenshot showing Kolibri as an offline learning platform for education

The platform was conceived by UNICEF-Uganda and the Government of Uganda, through the National Curriculum Development Center (NCDC), as a suitable space whose OER could be used by especially resource-constrained government secondary schools in Uganda to enhance students' learning outcomes, especially in mathematics and sciences. NCDC and UNICEF had also envisioned that utilization of the above platform would enhance digital and life skills of adolescents (10-19 years) in Uganda, especially girls. The need to utilize Kolibri OER was based on three key challenges in Universal Secondary Schools (USE) in Uganda: inadequate teaching spaces, limited learning materials, and teacher shortages in the discipline of STEM:

While the Government of Uganda's introduction of universal secondary education in 2007 was instrumental in increasing overall school enrollment rates, the educational standards have not improved, due in part to inadequate teaching space and materials, and teacher shortages. At the same time, the inclusion of items related to Information and Communications Technology in the National Development plan indicates the Government of Uganda is prioritizing the development of information and skills-based economy; to be competitive, young people, especially girls, must develop these skills. (UNICEF-Uganda, 2017)

In their attempt to address the above problem, NCDC and UNICEF sought to leverage computer laboratories established in government-aided secondary schools since 2013 and ICT centers equipped with digital kiosks to install the Kolibri e-Learning platform where students and teachers can access Open Educational Resources contextualized for the needs in Uganda. The platform consists of two main software components. The Kolibri Content Curation System, which is a central cloud server that aggregates content from many sources, organized into multiple content channels. The Kolibri

application is installed onto a local device, and imports channels of content. Users can interact with Kolibri offline, directly from that device or from a nearby client device that is connected to it. Once logged in onto the Kolibri application, users (depending on their role) can view at least one if not all of the following features: Learn, Coach, and Manage. A channel is a collection of content and metadata, organized into a “topic tree” structure (see Figure 1 above). The above content channels were automatically created and updated through Application Programming Interfaces (API) from external repositories such as PhET (University of Colorado, 2020). Kolibri also has the Youth Center channel which was manually curated through the Content Curation Server (see Figure 2 below).

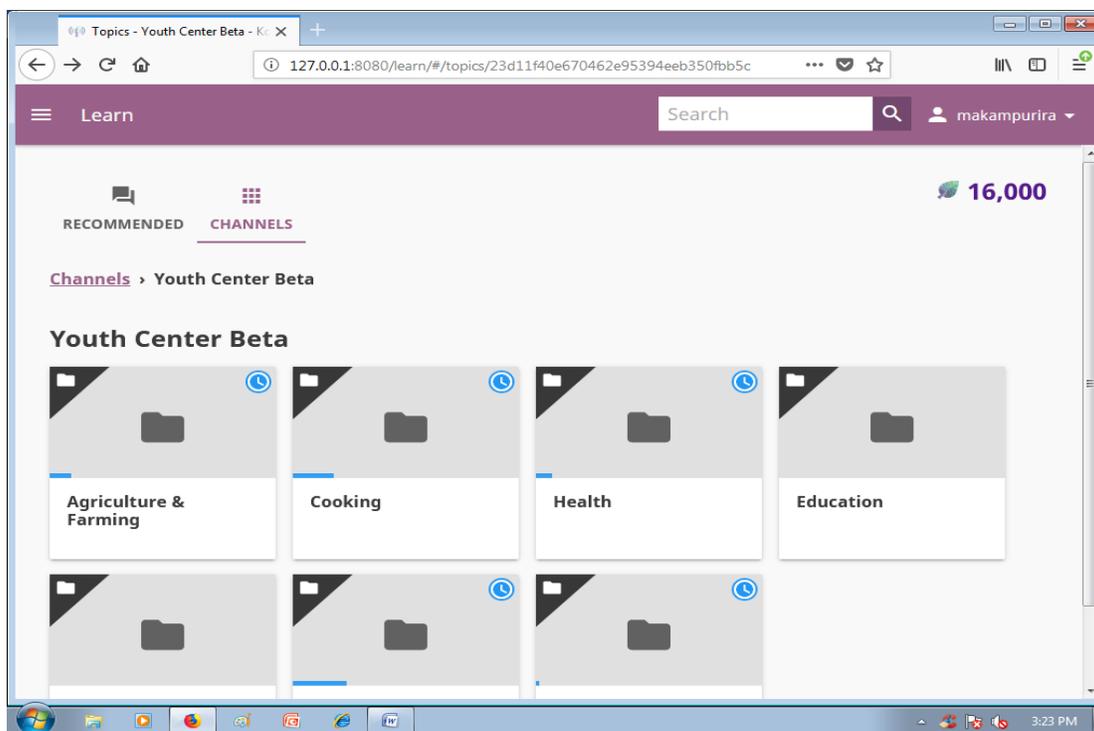


Figure 2: Youth Center OER channel on Kolibri

Both the content and youth center channels (as shown in Figures 1 and 2 above) were designed to support teachers in helping students to engage with STEM and other life skills subjects at their own pace. The content is continuously being developed through identification, sourcing, curating, uploading, and reviewing readily available digital Open Educational Resources. After a substantial amount of content was developed, NCDC, UNICEF and implementing partners deployed Kolibri in government-aided secondary schools and ICT centers equipped with digital kiosks. The deployment entailed installing the Kolibri platform on the schools’ computers and solar-powered laptops. Some teachers were trained on key features of the platform and were empowered with basic computer maintenance skills. By December 2017, over 140 teachers, 800 in-school students and 1,100 adolescents in refugee settlements could access the said contents on Kolibri (UNICEF, 2017).

Although the integration of Kolibri OER has and may continue to significantly impact the provision of education in government-aided secondary schools in Uganda, there was a need to establish the extent to which such education resources are efficiently and effectively utilized to enhance students’ learning outcomes. Thus, this study set to find answers to the following research question:

Research Question

- In what ways have teachers in selected Government Schools in Uganda (in)effectively utilized Kolibri OER to enhance students' learning outcomes during the COVID-19 lockdown of schools?

Methods

This was an exploratory case study, which followed an interpretive approach. In order to gain insights to this study's question, data was obtained from 25 teachers and 100 students.

Sampling

The 25 teachers and 100 students who participated in this study were purposively selected from 10 Government-Aided Secondary Schools in Uganda. The selection of participants was based on their prior experiences of utilizing Kolibri OER in a particular school. It should be noted that use of Kolibri OER is part of a wider government effort to enhance the teaching of STEM in Uganda and, as such, the government of Uganda, through the National Curriculum Development Center (NCDC), with support from development partners such as UNICEF rolled out a project named "Transforming Computer Labs into Learning Labs," with the view of exploiting the underutilized computer labs in government secondary schools to enhance students learning outcomes, especially in Science, Technology, Engineering and Mathematics (STEM) subjects. In order to address the challenge of inadequate STEM laboratories in government secondary schools, the government opted to use OER on Kolibri to maximize the use of extant computer labs in the schools. This case study set out to explore and interpret teachers' use of OER on Kolibri to enhance students' learning outcomes during the institutions' closure due to COVID19. In order to ensure a broad geographic sample, schools were selected from each of the four regions of Uganda namely the Central (n = 4), Eastern (n = 2), Northern (n = 2), and Western (n = 2) regions.

Online Interviews and Kolibri User-logs

This study employed online interviews (also known as e-interviews). Online interviews refer to in-depth interviews conducted with ICT-mediated communication (Salmon, 2010; Hewson, 2010). Hewson states that e-interviews are used for primary Internet-mediated research (IMR) and are aimed at gathering original data via the Internet with the intention of subjecting such data to analysis in order to provide new evidence in relation to a specific research question. While any ICT can be used for online interviews, the e-interviews of this study were done via Zoom (Zoom.us). Zoom is a web-based conferencing tool with a variety of real-time dialogue tools including scheduling and invitations to join an online meeting, wirelessly sharing your screen, waiting in a Zoom room, instant messaging to individuals and groups through the chat room, demonstration tools via annotation, among other tools (Zoom.us, 2020). In this study, an email invitation was sent to Head Teachers of 10 Government Secondary Schools in the Central, Eastern, Western and Northern regions of Uganda who then purposively selected 25 teachers and 100 students to participate in the e-interviews. The teachers and students were identified based on their experiences in utilizing Kolibri in these schools. The purpose of e-interviews on Zoom was shared with the participants before joining the meeting. The link and passcode to the Zoom meeting were forwarded to the participants via their Whatsapp and email contacts. During the meeting, participants were asked to share their experiences of teaching and learning using the Kolibri OER. Below is the screenshot of the Zoom meeting with the participants.

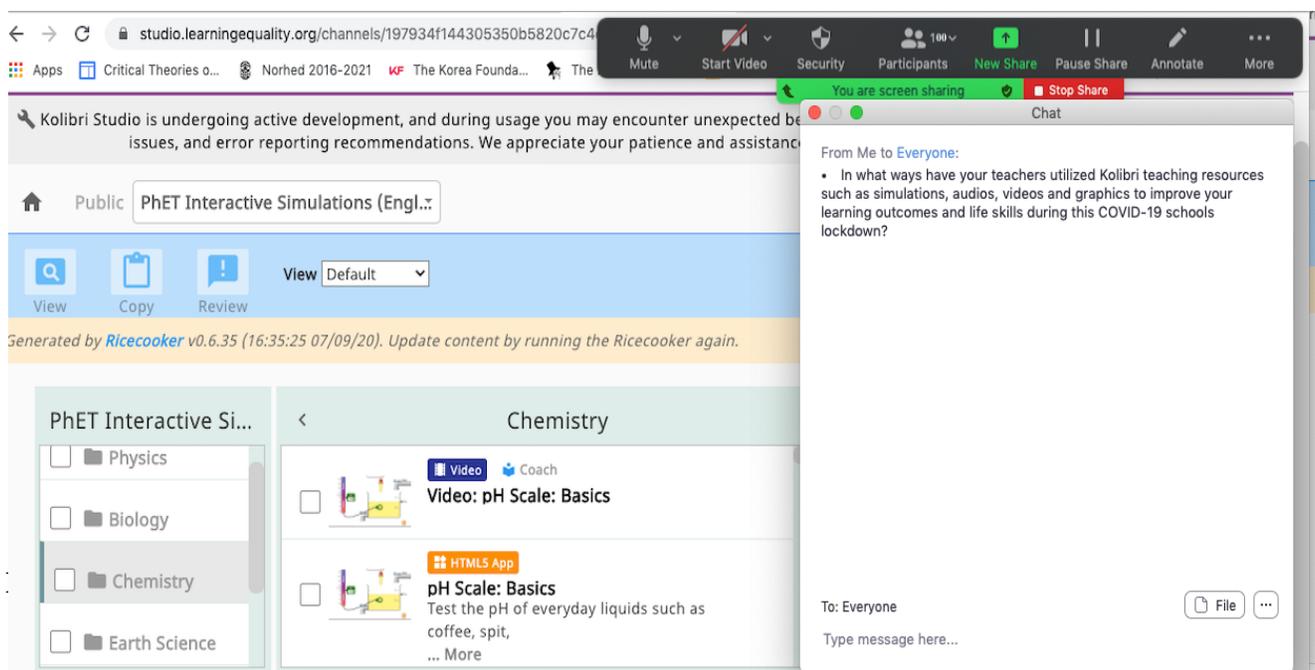


Figure 4: A screenshot of a Zoom-mediated interview conducted with students

Ethical Procedure

Several ethical issues were considered in this study. First, participation in this study was entirely voluntary. Before joining the e-interviews on Zoom, participants were required to sign a consent form indicating whether they consented or not to participate in the study. Secondly, the researcher ensured respectful inquiry, and accurate collection of data relevant to the research purpose and question. Furthermore, as a researcher, the interviewer placed the interview exchange within a scholarly context. Participants were also encouraged to respond honestly to questions during the meeting. During the online meeting, the researcher provided ideas that offered insight into his or her perceptions, understandings, or experiences of the personal dimensions of integrating online and offline education resources into teaching and learning. The participants responded in both the audio-video and text-based (chat room) interactions.

Interpretive Framework

The Kolibri OER usage-logs and interview data, which were collected from the 25 teachers, were analyzed using discourse analysis. Discourse Theory (DT) states that discourse, i.e., spoken and written texts, as well as artifacts are shaped by, and recursively shape, people's socio-structures and practices (Fairclough & Wodak, 1997; Marianne & Louise, 2002; Ng'ambi, 2008). The OER usage-logs and interviews, which we collected were the teachers' artifacts and recorded spoken texts, respectively. The strengths of DT lie in helping analysts to make connections between discourse properties on one hand, and people's socio-structures and practices on the other hand (Fairclough & Wodak, 1997). Given its potential to link texts to socio-structures and practices, DT has widely been utilized as a tool for analysing social practice. The social practice of interest in this study was the teachers' utilization of Kolibri OER to enhance students' learning outcomes in STEM and life skills subjects.

Although several models have been suggested to guide researchers in utilizing DT as an analytic lens, this study adopted the model offered by Fairclough (1992). According to Fairclough (1992), every discourse instance has three distinct properties or dimensions and these are: a) the material text or artefact itself, b) interaction, i.e., production and consumption of the material text or artefact, and, c) context, i.e., socio- environment in which the text or artefact is produced and consumed. Secondly, Fairclough (1992) suggested that each of the three properties or dimensions of discourse is analysable at three different levels namely: a) Description, b) Interpretation and, c) Explanation. Fairclough (1992)'s guidelines for utilizing Discourse Theory as an analytic tool can be represented in form of a three-dimensional framework as below:

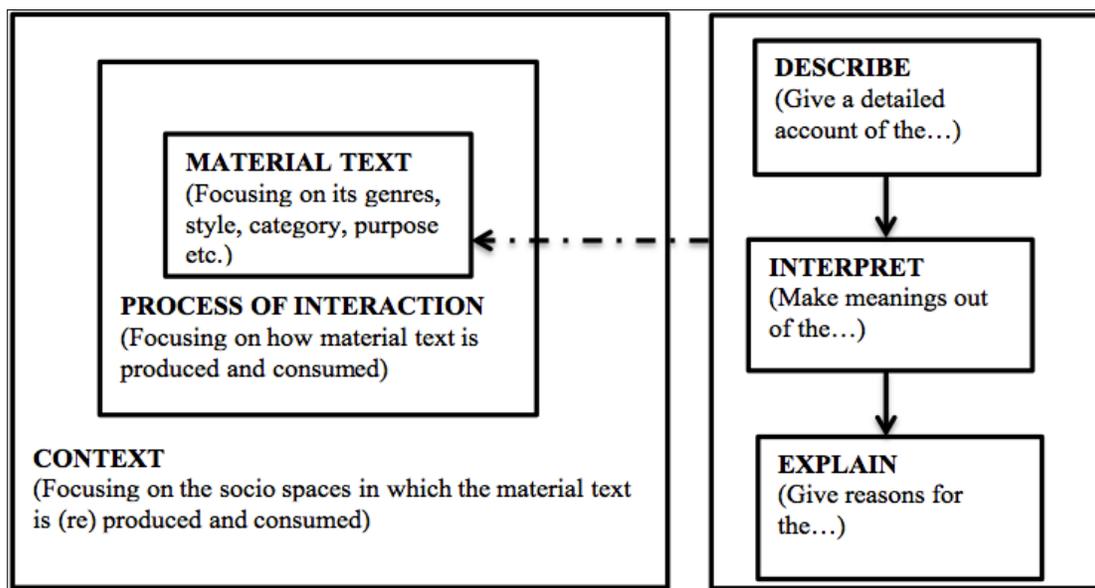


Figure 5: A three-dimensional framework for analysing discourses

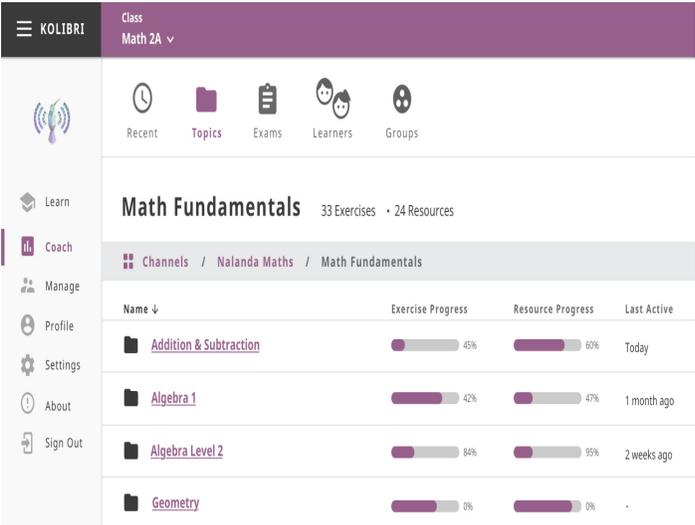
In Figure 4 above, each one of the stacked boxes on the left contains a distinct discourse property. The inner box on the left represents discourse as the material text or artefact itself. On the other hand, the middle and outer boxes of the left, respectively, represent discourse as a process of interaction, i.e., production and consumption of the material text and, the context, i.e., socio space, in which the material text or artefact is produced and consumed. On the right-hand side are the three levels at which each discourse dimension can be analysed, namely, description, interpretation, and explanation. It should be noted, however, that there is usually a subjective judgment in analysing discourse dimensions at each of the said levels (Roode, Speight, Pollock, & Webber, 2004). In order to compensate for such subjectivity in this evaluation, two discourse analysts were employed. The analyses of the two were then compared and a common (shared) language was established. In the subsections that follow, the key findings of this evaluation are presented.

Findings of the Study

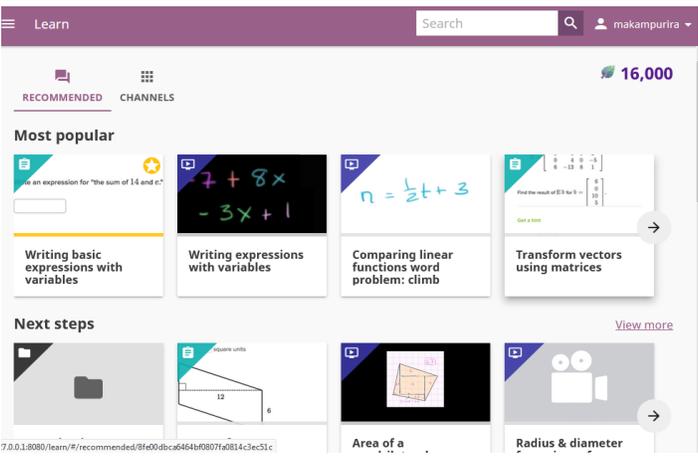
Four distinctive pedagogically effective ways of utilizing Kolibri (OER) were established based on teachers' Kolibri data usage logs and data from e-interviews and these were; behaviorist, cognitivist,

constructivist, and social constructivist ways. A detailed discussion of each approach to integrating Kolibri into teaching is presented in a tabular format below given a compelling opinion and or artefact from the STEM teachers engaged. For each approach considered, the underlying teaching method, teaching strategy, cognitive strategy, and learner’s motivation scheme is considered.

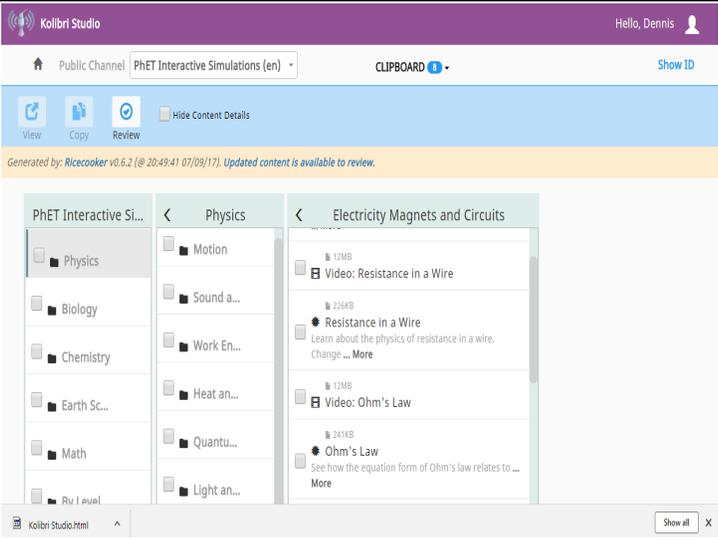
A Discourse Analysis of Artefact/Text #1

Artefact/ Text from Teacher #1																						
 <p>The screenshot shows the Kolibri interface for a 'Math 2A' class. It features a sidebar with navigation options like 'Learn', 'Coach', 'Manage', 'Profile', 'Settings', 'About', and 'Sign Out'. The main content area displays 'Math Fundamentals' with 33 Exercises and 24 Resources. Below this, there's a table of progress for different topics:</p> <table border="1"> <thead> <tr> <th>Name</th> <th>Exercise Progress</th> <th>Resource Progress</th> <th>Last Active</th> </tr> </thead> <tbody> <tr> <td>Addition & Subtraction</td> <td>45%</td> <td>90%</td> <td>Today</td> </tr> <tr> <td>Algebra 1</td> <td>42%</td> <td>47%</td> <td>1 month ago</td> </tr> <tr> <td>Algebra Level 2</td> <td>84%</td> <td>95%</td> <td>2 weeks ago</td> </tr> <tr> <td>Geometry</td> <td>0%</td> <td>0%</td> <td>-</td> </tr> </tbody> </table>		Name	Exercise Progress	Resource Progress	Last Active	Addition & Subtraction	45%	90%	Today	Algebra 1	42%	47%	1 month ago	Algebra Level 2	84%	95%	2 weeks ago	Geometry	0%	0%	-	<p>“I encourage my students to go to Kolibri in order to practice the things that I taught them in class. During this time, I give them questions whose answers they have to remember as they reread on Kolibri. When they go to Kolibri, they get the answers and tend to respond well. You see, Kolibri is also a nice platform for them to practice the answering of different questions in Physics. For example the multiple choice questions on the topic of heat. When students attempt the questions, they get instant feedback and this motivates them to practice. I know they will perform well when schools reopen.”</p>
Name	Exercise Progress	Resource Progress	Last Active																			
Addition & Subtraction	45%	90%	Today																			
Algebra 1	42%	47%	1 month ago																			
Algebra Level 2	84%	95%	2 weeks ago																			
Geometry	0%	0%	-																			
Description	Interpretation	Explanation																				
<p>Teacher utilises Kolibri OER as a stimulus in order to elicit response from students about what they covered in the class.</p>	<p>The underlying cognitive strategy that is being used by students is remembering, i.e., when students see Kolibri OER, they remember what they covered in class. This strategy of utilising Kolibri resources promotes memorisation and rote learning of concepts. Here, students’ view their access to Kolibri resources as reinforcement / incentives to participating in class.</p>	<p>This way of utilising Kolibri OER is underpinned by Behaviorism. See behaviorist learning principles in (Skinner, 1974) and (Reese, 1991)</p>																				

A Discourse Analysis of Artefact/Text #2

Artefact/ Text from Teacher #2		
		<p>"I refer my students to Kolibri especially to watch those videos concerning difficult concepts in Mathematics such the concept of transforming vectors using matrices and the wiring of expressions using variables. By using these videos, students see for themselves and are able to derive mathematical rules and principles by themselves."</p>
Description	Interpretation	Explanation
<p>Teacher uses on Kolibri OER (videos) to scaffold and mediate learners' understanding of difficult mathematical concepts.</p>	<p>The underlying cognitive strategy here is derivation and application of principles/rules.</p>	<p>This way of utilising Kolibri's OER is based / underpinned by Cognitivist Learning Principles. See Cognitivist Theory in (Tyler, 1978).</p>

A Discourse Analysis of Artefact/Text #3

Artefact/ Text from Teacher #3		
 <p>The screenshot shows the Kolibri Studio interface. At the top, it says 'Hello, Dennis'. Below that, there's a navigation bar with 'Public Channel' and 'PhET Interactive Simulations (en)'. A 'CLIPBOARD' icon is visible. The main content area shows a list of topics under 'Physics', including 'Motion', 'Sound a...', 'Work En...', 'Heat an...', 'Quantu...', and 'Light an...'. The 'Electricity Magnets and Circuits' section is expanded, showing videos like 'Resistance in a Wire' and 'Ohm's Law'.</p>		
<p>“During this time of school lockdown due to Covid19, I use Kolibri videos to give an opportunity to students to discover the relationships between different topics such as these one (motion, sound, work, energy, heat, and light), which I hand not yet taught. When students see and follow these videos, they are able to do so many things for example creating or setting up their own light system. When students create their own experiments, this motivates them so much.”</p>		
Description	Interpretation	Explanation
<p>Teacher uses Physics OER on Kolibri to engage students in personal discovery and experimentations.</p>	<p>The underlying pedagogical principle here is problem solving in realistic and investigative situations. This type of learning makes students active and self-regulated learners.</p>	<p>This type of teaching and learning is greatly informed by the Constructivist Theory. See Constructivist Learning Principles in (Bruner, 1990) (Piaget, 1981).</p>

A Discourse Analysis of Artefact/Text #4

Artifact/ Text from Teacher #4		
<p>“In Biology, my technique is to give different learning tasks to different groups of students. At the end of each lesson, I ask students to form different groups of say 4-5 on Zoom in order to do a particular exercise on Kolibri. For example, I can ask them to watch a particular video on Kolibri say about how digestion takes place or about blood circulation in the body. Then, I ask them to note or write down in details via the chat room or the annotation board their own observations and then they screen share with the rest of the groups online.”</p>		
Description	Interpretation	Explanation
<p>Teacher uses Biology OER on Kolibri to engage students in group/collaborative learning tasks.</p>	<p>The main principle informing this teachers' pedagogical use of Kolibri is problem solving through collaborative. This approach to teaching promotes discovery learning, multiple perspectives and shared meanings.</p>	<p>This teacher's way of utilising OER on Kolibri is greatly informed by Social Constructivist Theory. See Social Constructivist Learning Principles in (Bickhard, 1992), (Vygotsky, 1978).</p>

Conclusion and Recommendations

A preview of the international dashboard of trends in education suggests that OER provide, and will continue to impact the provision of, universal education across the globe in the next decade. However, the toughest question that is often presented to OER promoters regards the pedagogical effectiveness of OER: if education resource users are not cognizant and do not pay for the production, distribution and utilization of the required resources, then, how can the production, distribution and utilisation of such resources be effectively used? Based on data obtained from the system (Kolibri) usage-logs and e-interviews (online conversational interviews) on Zoom, which were conducted with twenty five (25) purposively selected teachers and one hundred (100) students invited from 10 Government-Aided Secondary Schools in Uganda, this paper presents a Discourse Analysis (DA) of teachers' use of OER on Kolibri and draws on such insights gained to propose a potentially transformative model for pedagogically effective utilisation of OER to enhance students' learning outcomes during institutions lockdown due to pandemics like COVID-19. This study established that pedagogically effective integration of Kolibri OER into teaching has enormous potential to augment the provision of quality universal education in resource-constrained schools in Uganda. Effective integration of Kolibri OER into teaching requires that teachers: a) unlearn their prior closed didactics so as to learn emerging Open Pedagogical Practices (OPPs), b) Capture and analyze students' OER usage-logs as well as opinions on the role of OER in enhancing their learning outcomes, c) may use OER in a behaviorist, cognitivist, constructivist, and, even more so, in a social constructivist way, and d) be incentivized and motivated to continuously integrate OER into their teaching so as to enhance students' learning outcomes.

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