Contextualizing Learning for Rural Community using Library-in-a-Box: Experience from Penan Community

Amit Pariyar, Narayanan Kulathuramaiyer, Johari bin Abdullah, Chuah Kee Man

Abstract*: Online Learning Platforms (OLP) have incredible potential to achieve the vision stated in the Malaysia Education Blueprint (2015-2025) - to become a nation of lifelong learners and to embrace globalized online learning. But there exists technological and social challenges in replicating the connectivity model of OLP to achieve the much extended and inclusive vision of connecting the rural population to the knowledge ecosystem. In response, the Institute of Social Informatics and Technological Innovations (ISITI) has developed a low-cost offline learning tool 'Library-in-a-Box'. This research investigates the suitability of offline learning platform/tool to meet the knowledge demands of remote and indigenous Penan communities from the Borneo Malaysia. Based on community based participatory action research, we conducted learning session and interview with the community. The findings revealed enablers and inhibitors – both anticipated when contextualizing offline learning to rural community. The enablers of offline learning are delivery of value-added content, affordability and connectivity, fostering communal values, proper utilization of local resources, early childhood development and empowerment of local capacities especially teachers. While the inhibitors are dispute over control and ownership of content/tool, quality issues of content, detrimental effects on health and social well-being, threat to culture and undervaluing teacher's role. This research reaffirmed technology as a partial solution and suggested offline learning modus operandi to reflect the socio-cultural context.

***Index Terms*: Digital Divide, Library-in-a-Box, Offline Learning, Penan Inhabitants, Rural communities.**

I. INTRODUCTION

Current pedagogical reform marks the evolution of a knowledge-based society made possible by the rapid technological progresses. In present day, this educational reform resonates with the famous quote "where the knowledge is free, where the world has not been broken up into fragments by narrow domestic walls" by Rabindranath Tagore. Online Learning Platform such as MOOC (Massive Open Online Course) has a huge share in this radical pedagogical reform with three driving principles: Massiveness, Openness and Connectivity [1]. First introduced in 2006, MOOC in its short span showcased tremendous potential by reaching millions of learners world-wide. Daphne Koller, a co-founder of Coursera shares that the first ever MOOC course on Machine Learning by Stanford had 100,000 students registered for the course which otherwise would have only 400 enrolments per semester [2]. To put that into perspective, a lecturer would require 250 years to teach the same course in a conventional setup. The transition from 'under one classroom' setting to 'classroom with no physical walls (boundaries)' has also crumbled the knowledge monopoly by providing open access to learning materials from top ranking universities provided that connectivity via the Internet is secured [3].

To embrace such pedagogical reforms in learning, the Ministry of Higher Education (MoHE) in Malaysia has strongly advocated the use of technology to improve quality and widen access to education, as one of its critical agenda projects, which came to fruition with the launching of Malaysia MOOC in 2014 [4-5]. Further Malaysia Education Blueprint 2015-2025, projects a roadmap for educational reform with aspirations to become a nation of lifelong learners (Shift 3) and embrace globalised online learning (Shift 9) [6]. To achieve these shifts, MOOC platform is seen as an agent of change [7], but there are significant challenges. The connectivity requirement for MOOC is a major disadvantage in Malaysia, especially to address the knowledge demands of the rural communities. Though the telecentre project in Malaysia is seen as a beacon of hope in bridging the digital divide and to provide connectivity to rural areas, the impact is not fully and equally achieved in all regions – primarily due to lack of value added benefit to the community [8-9]. Besides lack of basic ICT infrastructures, poor/non-existent broadband connections and digital incompetency – geographic remoteness, cultural differences and isolation further compound existing challenges in Malaysia. For instance, Long Lamai, a Penan village in Sarawak of Malaysian Borneo is geographically remote and inaccessible by road. Travelling to the settlement comprises of long eight hours drive on rough logging from the nearest town Miri and an hour of hiking through dense rainforest.

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Alternately there is an hour flight via a 19-seater Twin Otter from Miri to Long Banga, and then a one-and-half hour boat ride to reach the settlement [10]. On a cultural front, Penan
inhabitants are unique as they have transitioned from a nomadic life style and fear losing their signage language Oroo [11] from the amalgamation of foreign cultures. Due to which Penan inhabitants are isolated and have a reputation of maintaining minimal contact with the outside world. Penan inhabitants are also defensive when it comes to preserving bio-diversity and forests, which has led to minimal intervention of government projects [12] and hence isolated from development priorities. Even interaction protocols are suggested to address communication gap between communities in Long Lamai and researchers [13]. In this sense, the disparities and inequalities are beyond the realms of digital divide, and constitute both social and technical challenges as bottlenecks in replicating the connectivity model of online learning platforms. This research introduces an offline learning tool with the objective to explore the social and technical aspects of its implementation in a rural setting.

II. LIBRARY-IN-A-BOX: OFFLINE LEARNING TOOL

To overcome the socio-technical challenges inhibiting knowledge sharing in a rural context, the team at the Institute of Social Informatics and Technological Innovations (ISITI) – a globally known research institute for its flagship bridging-the-digital-divide eBario project [14], has designed and developed an offline learning tool 'Library-in-a-Box' [15-16]. The aim of this tool is to foster inclusive learning whereby rural communities have equal opportunities for intellectual growth as their urban counterparts. Functionally this tool disseminates information and knowledge in a digital format which can be accessed offline by the remote and rural communities. The tool is literally an offline library with collection of resources such as eBooks, videos bundled into a small device, a size of credit card as seen in Fig. 1.

Fig. 1: Hardware Component of 'Library-in-a-Box'

The tool is backed with the principles of Internet of Things (IoT) built using Raspberry Pi as the hardware platform, and powered with content from variety of open sources such as Wikipedia, Khan Academy, Project Gutenberg and many more. The 'Library-in-a-Box' is operated by a power bank or adapters and accessed by connecting devices such as mobile phones, tablets, PC/Laptops to the tool over Wi-Fi or network cables. A total of 10-15 devices can be connected to the tool at a time. The tool is equipped with a web-server which is remotely accessed by the connected devices by providing IP address of the server in the client browser. Fig. 2 depicts the tool connected to a power bank and the contents displayed via tablet.

Fig. 2: Tablet displaying contents of 'Library-in-a-Box'

The layered architecture in Fig. 3 depicts the simplicity of configuring the tool to different connection choices and device access options to a variety of end users, and the ease of scaling up the content repositories with both open source and self-created content. The main features of this tool are: portability, offline contents, low-cost and scalability which makes it ideal for a rural context to counter the technological challenges. The tool has already received accolades at global podiums such as Seoul International Innovation Fair 2017 (SIIF2017) for its noble invention [17].

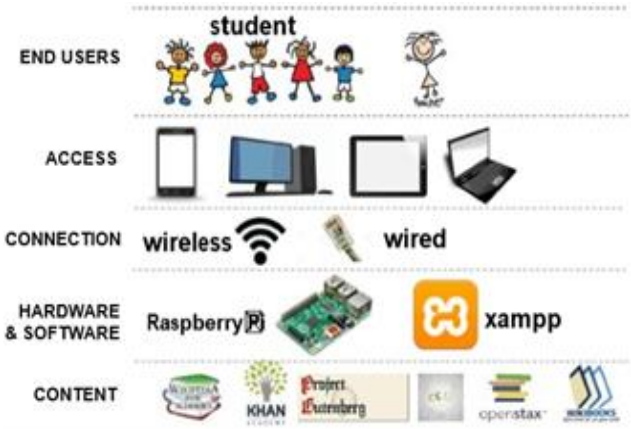

Fig. 3: Layered Architecture of 'Library-in-a-Box'

One of pioneering work for rural education was the 'hole in the wall' project which started as an experiment project by embedding a PC in a wall of slum areas in New Delhi to see what children would do with it [18].

The research stated that children learned to use PC on their own without any external support. Contemplating to the situations where there is no internet access, projects such as LibraryBox [1], RACHEL [2] have surfaced which aims to provide a delivery platform for distributing offline digital content for education, libraries, healthcare and emergency response. Even flash drives pre-packaged with contents are also used to deliver resource materials to rural health practitioners [19], which is costly when scaling up the number of learners. The unique value proposition of 'Library-in-a-Box' is low cost and its use case - delivering offline learning material to rural indigenous communities, particularly in Sarawak of Malaysian Borneo. However, the feasibility of the tool to foster learning and education in a rural context is still being explored. As confirmed in several ICT projects, technology is only a fraction behind the success of development interventions [20] - the offline learning tool 'Library-in-a-Box' can only partly account for bridging the knowledge gaps but it's the people that can promise the overall feasibility of the tool. Penan inhabitants in Long Lamai represent an isolated, remote community where few development interventions are a success – and offer a testing ground for this research.

To examine the suitability of offline learning in general and offline learning tool 'Library-in-a-Box' in particular we state the following research questions.

RQ1: *Does offline learning meet the knowledge demands of rural communities?*

RQ2: *Does 'Library-in-a-Box' cater to the learning requirements of Penan inhabitants in Long Lamai?*

This research presents a qualitative investigation on the suitability of offline learning modus operandi and the related offline learning tool 'Library-in-a-Box' to bridge the knowledge gap of the remote and isolated Penan communities in Long Lamai, and explores prospects for future implementation.

III. RESEARCH METHOD

This qualitative study is carried out as 'in-the-field' research with an emphasis on 'people-centric' and 'bottom-up' participatory approach engaging Penan communities from Long Lamai throughout the process. The field visit to Long Lamai was conducted in January 2018 and necessary equipment required for the 'Library-in-a-Box' such as power banks, chargers and laptops were used. There were two students from UNIMAS who assisted in resolving language incompetency of the author by facilitating dialogue with the community. The stages are outlined in subsection.

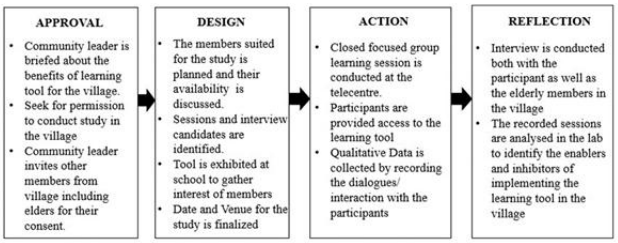

Fig. 4: Stages in Community-Based Participatory Action Research

A. Context

At the time of visit, community in Long Lamai had no broadband or wifi internet access and mostly relied on cellular data provided by the telecom company MAXIS to access internet. It was also noted that the telecom network signal kept fluctuating hence it was asserted that the internet access was unstable. The telecentre in Long Lamai which was established in 2009 was also found inoperable and in abandoned condition due to power generation related issues and poor management. This sets a perfect ground for this study as community lacked access to content such as news, articles, entertainment and know-hows of problem solving. It was also found the communities in Long Lamai had past experience of confrontation and resistance to certain developmental agendas that were not in their favour of Penan core values of unity, cohesion, collective decision making, benefit to all and fairness. One notable incident was the opposition to the road construction project which the community believed would attract logger companies with business profit motives, as a result lead to import of items such as alcohol and lure youths into crimes. The odds that Penan community will be supportive to technologies such as 'Library-in-a-Box' seemed minimal.

B. Stages

Fig. 4 highlights the key four stages in the research: approval, design, action and reflection – with community involvement throughout the process.

Approval

This study commenced with an approval stage by initiating a meeting with the community leader in a small gathering. The importance of 'Library-in-Box' to promote education and for collective socio-economic benefits was shared with the leader in their local language. The objective of this phase was to educate a few members from the community about the tool and seek permission to conduct the study. The leader then took charge of spreading this message to the rest of elders in the community for their collective consent. Trust and partnership are crucial to initiate dialogues with the community and it bears emphasizing that the good rapport which ISITI has built over the years of its community-based

research with community in Long Lamai and other remote villages in Sarawak, played a major role in gaining the approval to proceed with this study.

Design

After initial approval the design stage was initiated. The potential participants for the study and their availability were confirmed in a meeting. Due to harvesting season scheduling a day for the study was cumbersome as participants would be busy in their farm fields. For ease the study was scheduled for the evening. The session on closed group learning session with youths and interview with selected community members was agreed. The telecentre which was in destitute state was also decided as a venue for the session with a spirit of reviving the space as a learning centre in the future.

Action

The action stage constituted the workshop session. A total of six youths aged between 18-20 participated in the closed group learning session. Fig. 5 shows the participants of the session. The participants were equipped with mobile phones and used internet only on need basis, mostly using expensive and unstable MAXIS network. The participants were first briefed about the principle behind 'Library-in-a-Box' and how it makes variety of content available even without the Internet. The content in 'Library-in-a-Box' was then projected via a browser in laptop and the participants were explained about various features and kinds of content which at the time primarily comprised of Wikipedia articles, Khan Academy lectures notes, Story books and Animation videos. The participants were also asked to access the content by connecting their mobile phones to the 'Library-in-a-Box' over Wi-Fi. The laptop was also in place for the participants to explore the content in a big screen. The session lasted for an hour which was wrapped with a discussion. Qualitative data was collected by recording the entire session which can be made available upon request.

Reflection

The reflection stage included collecting feedback from the participants in an impromptu question answer session which were recorded for analysis in the lab. The interview with community representatives was also conducted to gather experiential insights into the suitability of 'Library-in-a-Box' for their community in Long Lamai. The recordings of interview can also be made available upon request. The recorded sessions were analysed in the lab to determine the suitability of offline learning in general and offline learning tool "Library-in-a-Box" in particular to meet the knowledge demands of rural Penan communities. The findings are compiled in the subsequent sections.

IV. RESULT

The discussion from an hour-long closed group learning session and the interview revealed some interesting findings that can shed light on what Penan communities in Long Lamai prefer from offline learning and how offline learning tool 'Library-in-a-Box' can cater to those needs.

Value-Added Content

It was found that content that enriches the current state-of-knowledge, the one that broadens the scope and better prospects for future job and quality of life, and the one that enhances skills, local talents and helps solve a problem was mostly preferred by the youths. This was implied from a broad range of interests expressed by the youths which included learning personality and technical skills for becoming a YouTuber, skills for creating/ editing videos, how-to on making animation videos, how-to on using social media such as Facebook, Twitter, learning a new language e.g. Filipino to know about global culture, counselling and coaching on career advices and personal growth. To create lasting impact, content that adds value to the way of life of Penan community is needed and should be delivered via offline learning tool.

Free Content

One of the interviewees Mr. Lerroy Lemen who is also a youth representative and a participant of the closed learning session phrased *"... the box is a good piece of technology to access relevant knowledge which could be used to improve our lives."* One good aspect he pointed was that the content was free and they did not need to pay for using mobile data to access content. To sustain the tool in a long term, the business model of free content has to be supported not only in beginning but also in later stages. The interviewee further added that given the content was free they would need to use the tool for some more time so that they would be able to give additional feedback on the continued use of the tool after the

Fig. 5: Participants of Closed Group Learning Session

session and whether the tool is capable of retaining the interests of the youths. Hence more time for exploration with free content is required.

Rich Multimedia Content

Youth also expressed their preference for rich multimedia content mostly video lectures and animations rather that text-based content. The reason being that video content is easy to grasp and helps form a conceptual model. But the content has to be engaging, fun and of short duration. In addition, depending upon the subject matter and engaging content, youths also expressed their interest in doing weekly assignments and following curriculum-based courses, for instance a four-week course. To be appealing, it is required that content is not only contextual but also rich in multimedia features such as embedded videos, animations.

Communal Learning

Youths also preferred to study in a group most probably in the telecentre and in the evening. The reason being that it fosters communal learning and follows the Penan core values of unity and benefit for all. Such values are engraved and passed down from generations. The success of ISITI's community-based research with Penan communities also rest on the realization of such values of shared/mutual benefit. Right from the beginning of this research, the community leader made it clear that the collective benefits for all Penan community was met with the offline learning tool. The sharing culture is also reflected by youths who preferred peer-to-peer based learning with additional support from mentor. One of the interviewees also suggested telecentre to be the appropriate place for hosting 'Library-in-a-Box' because it was originally built as a gathering place for community to stimulate learning and knowledge sharing. Hence Penan core values of collective benefit should be embodied in the design.

Big Screen for Display/ Form Factor

Though the youths were equipped with mobile phones they found it tedious and time consuming to read content in a small screen. They preferred using desktop PCs, or Laptop/ Tablets for accessing and browsing content provided in the 'Library-in-Box'. Bigger form factor is required to enrich the learning experience.

Suitable for Primary Level Education

Mr. Garen an elderly member and a local champion of the Long Lamai community who we interviewed shared his memories of learning English listening to recordings aired by BBC radio programmes during British occupancy. Recalling the difficult learning process in the past he remarked *"… Library-in-a-Box is a sophisticated technology which can be introduced to children at an early age of their schooling to teach them English."* He also opined that it is meaningful to use the tool for teaching students aged 3-4 years at the local kindergarten before they can start their Form 1 education in the school.

Empowerment of Teachers

The interviewee in response to the reaction of kindergarten teacher using the 'Library-in-a-Box' also stressed the important role the tool can offer in building local capacity of teachers by exposing them to vast relevant and up-to-date knowledge and empowering them to excel in career pursuits as well as to create a feedback loop to the school ecosystem. The periodic update of offline content was felt necessary to bring fresh knowledge to the community, which could be achieved by coordinating regular visits to the sites or training community to update content on their own by visiting the cyber cafes in the nearest city.

Though the potential of 'Library-in-a-Box' as an offline learning tool was instantly perceived by all age groups from youths, teachers and elders in Long Lamai there were also some serious concerns raised by the community.

Health and Social well-being

The interviewee feared that the long-term exposure to unlimited and unrestricted access to content in 'Library-in-a-Box' could also turn students into screen gazers with detrimental effects in their mental and physical health. This would restrict their mobility, confine them in their inner world and limit their interaction with family and elders, disrupting social bonding. This is a serious concern since past studies [21] have confirmed the growing cases of internet addiction among youths and its effect on personality traits and health and adaptation problems. It has to be ensured that proper time management, parental control, and monitoring tools has to be added in the design of offline learning to avoid health issues and assure well-being of the community.

External Influence

The interviewee also stressed that without any control over the kind and the quality of content that goes into the 'Library-in-a-Box' the offline learning tool posed a risk of delivering unfiltered content of external influences threating the integrity of Penan culture. For instance, the content that comprises the unity of Penan community by pushing external beliefs and values might create conflict and disturbance in social structure. The community in the past have objected to road construction project fearing that it would allow liquor businesses to flourish thereby attracting the youths into crimes. With digital platforms it is much easier for youth to be influenced by contents on crimes/drugs and develop individualistic values. Hence when implementing the tool, it is important to monitor and keep track of what content is accessed and what progress has been made. The interviewee also suggested that the guidelines on how the tool will be used, who will use, what types of content will go into the tool, has to be designed by collaboratively discussing with the community members, parents and teachers. To avoid unfiltered content, it was also further suggested to host the tool inside the classroom or telecentre with content controlled and delivered by teacher to meet specific curriculum and to enrich the learning experience of the students.

Role of Teacher

It was stressed that the tool should not replace the current teacher-guided learning rather reinforce guided learning and create a sustainable ecosystem for education to flourish. The role of teacher in the learning process is valued by the community and it was stressed that this role should not be substituted by any technology.

V. DISCUSSION

Past experiences have shown that jumping to hasty conclusions especially when proposing ICT based solutions to address community needs has always resulted in unpredictable outcomes. This qualitative study was intended to gather insights into the suitability of offline learning modus operandi and the related offline learning tool 'Library-in-a-Box' to Penan communities in Long Lamai, known for its geographic remoteness, cultural uniqueness and isolation, in additional to the technological challenges. Based on the results compiled from the closed group learning session and the interview, we anticipate mixed consequences (enabler and inhibitors as shown in Table 1) when introducing offline learning platform/ tool to communities in Long Lamai.

Table 1: Consequences of Introducing Offline Learning

Enablers	Inhibitors
Delivery of Value-added Content	Control and Ownership disputes
Affordability	Impact on Health and Social Well-being
Platform to foster Communal values	Threats to Culture
Utilization of Local Resources	Dependence on Tool
Early Childhood Development	
Capacity Building	

A. Enablers

Delivery of Value-added Content

The growing interest of youths in content that add values to their quality of life, nurtures and showcase their local talents, places a strong demand on content with a local context. Offline learning tool 'Library-in-a-Box' can turn out to be effective in delivering 'content-in-context' to empower the youths and community as a whole.

Affordability

The provision of accessing free content via 'Library-in-a-Box' and that too without the need for internet connection heavily reduces the financial burden on the youths who would otherwise have to pay for expensive cellular data to fulfil their learning needs. Offline learning certainly reduces the cost of learning for the community.

Platform to Foster Communal Values

It was evident that learning as cohorts inside a classroom or in a shared spaced such as telecentre was most preferred to keep intact the unity among youths. With 'Library-in-a-Box' it is easy to setup and display contents in larger screens, TV monitors or projectors to aid group learning and foster community values and unity. Offline learning can further reinforce unity among communities.

Utilization of Local Resources

Since the telecentre was inoperable and all equipment including desktop computers were underutilized, 'Library-in-a-Box' can reignite the passion for learning and knowledge sharing and put existing underutilized resources to good use. Offline learning can put local resource and local talents to maximum use for the collective benefit.

Early Childhood Development

'Library-in-a-Box' can have positive impacts in the early development of habits and skills of children who will be engaged to animated content. The kindergarten teacher was excited about using the tool in the classroom.

Capacity Building

'Library-in-a-Box' can help teachers to access relevant and up-to-date knowledge necessary for their students. Though the content repositories are offline the possibility for timely updates can be drawn by coordinating regular visits to the sites or inviting community members to the lab. In the long term the communities are required to be trained to update contents on their own by visiting the cyber cafes in the nearest city. With this tool the empowered teachers can also excel in their career pursuits as well as create a feedback loop to the school ecosystem.

B. Inhibitors

Control and Ownership Disputes

The dispute over control and ownership of the content that goes into the tool can be anticipated. Should the community be solely responsible for creating and curating content or whether the content is to be pre-packaged by the educational bodies is a big question? If the control is given exclusively to the community, the quality of content being produced will be an issue. Some hybrid control mechanism seems reasonable to allow both communities and educational bodies to collaboratively create and curate content. Series of focused group workshop sessions has to be planned in designing the curriculum.

Impact on Health and Social well-being

Without guidelines it can be anticipated that access to unfiltered and unlimited content will occur which will affect physical and mental well-being of the youth. Children may spend more time with the tool which may limit their interaction with the family and participation in social events organized by the community.

Threats to Culture

Communities in Long Lamai are also protective when it comes to preserving their Penan culture and knowledge and hence external influences can be anticipated as a threat. This further entails the importance of control and filtering mechanism to continually track what content goes inside the box. For this a local champion has to be trained in using the control and authentication features of the tool to block undesired content. Furthermore, community has to be involved in designing content of context which further reduces the chances of delivering undesired content. It also has to be asserted from the beginning that the 'Library-in-a-Box' should not only be seen as an educational breakthrough for the community but also serve as a way to preserve their local knowledge and culture.

Dependence on Tool

If the control and ownership of content is not secured and designed beforehand, it can be anticipated the students may start to value the tool more than the teacher which would disturb the current school ecosystem. Children may develop dependence on tool for all their information needs and may undervalue their teachers. Hence 'Library-in-a-box' should reinforce the teacher student relationship by allowing teachers to conduct assessments and quizzes face-to face while delivering learning material via the tool.

The identified enablers suggest that offline learning has a tremendous potential in delivering contextual knowledge to rural communities, since it is affordable, fosters communal bonding and operationalizes local resources. But regular monitoring and content updates are an important issue in offline learning which has to be resolved by coordinating regular visits to the sites or in the long-term training community members to update contents on their own by visiting the cyber cafes in the nearest city. Though the research targeted to Penan communities, in response to RQ1, it can be suggested that offline learning in general is likely to meet the knowledge demands of rural communities provided that there are periodic updates with community-led actions.

For offline learning tool 'Library-in-a-Box' the identified enablers and inhibitors confirms RQ2, that the tool can have a positive impact on learning of Penan communities in Long Lamai but there are concerns like health and social well-being, control and ownership disputes which has to be addressed. This research contributes by illustrating both positive and negative outcomes of offline learning modus operandi and the related offline learning tool 'Library-in-a-Box' which can serve as a guidance for the implementation of offline learning to rural community.

VI. CONCLUSION

The disparity in knowledge is a gruesome reality of rural community in Malaysia, resulting not only from technological barriers but also due to geographic remoteness, cultural differences and isolation. This qualitative study examined the suitability of offline learning with 'Library-in-a-Box' to meet the knowledge demands of remote and indigenous Penan communities in Long Lamai, inhabitants of Malaysian Borneo. From a closed group learning session and interview conducted, this study revealed that by contextualizing offline learning platform/tool for a rural setting one can anticipate mixed consequences. The positive consequences are delivery of value-added content, affordability to content and connectivity, fostering of communal values, proper utilization of local resources, early childhood development and empowerment of local capacities especially teachers. Such benefits are enablers for offline learning in general to appeal to the community. Some of the undesirable consequences one can anticipate are dispute over control and ownership of content/tool, quality issues of content, detrimental effects on health and social well-being, threat to culture and undervaluing teacher's role.

To avoid such inhibitors, community participation is important and processes such as co-design and co-creation has to be embodied in offline learning modus operandi. In particular, with 'Library-in-a-Box' guidelines on how to use the tool, when and how long will it be operational, who gets to use the tool and where it will be hosted has to be drawn out from discussion with the community. This research reaffirms that technology is only a partial solution and suggests that offline learning modus operandi has to reflect the social and cultural context. It is also worth reflecting upon the definition of development made by one of the local champions Garen who envisions development as a gradual process bringing benefit to all. This places a huge responsibility when embarking on technological interventions such as offline learning with 'Library-in-a-Box' to integrate Penan core values and create conducive environment for collective growth of the community.

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