2018 WEI

INTERNATIONAL

ACADEMIC

CONFERENCE PROCEEDINGS

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SOLVING THE 'LEARNING CRISIS' IN DEVELOPING COUNTRIES THROUGH JUGAAD INNOVATION EDUCATION TECHNOLOGY: A QUALITATIVE STUDY

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ABSTRACT

This study set out to investigate how combining jugaad innovation with Education Technology (EdTech) can help solve the 'learning crisis' in developing countries. The problem centres on education quality; large volumes of underprivileged students in developing countries are attending school, but many fail to learn basic skills (The World Bank, 2018:3). Globally, over 617m students are failing to achieve minimum proficiency standards in maths and reading (UNESCO, 2017). Consequently, the global problem in education is not simply about the provision of learning but also ensuring high quality (Pearson PLC, 2018). This research explores how jugaad innovation, including key themes such as the jugaad innovation process and jugaad operating models, could inspire the development and use of EdTech in order to improve education quality for the masses in developing nations. In order to investigate how jugaad innovation theory and EdTech can help solve the 'learning crisis, this study used a case study approach and four semi-structured interviews. The investigation relied on understanding the interviewees' experiences, how they describe them, and the meaning behind those experiences. As jugaad theory is not well understood in practice (Agnihotri, 2015; Ajith & Goyal, 2016; Jain & Prabhu, 2015), a case study with semi-structured interviews achieved a better insight, through uncovering rich, empirical evidence to answer 'how' and 'why' questions (Ridder, 2017). Jain & Prabhu's (2015) work highlighted three core principles of jugaad innovation: frugality, flexibility and inclusivity. Jugaad is a verb to describe the innovation process itself, and a noun to characterise

the process outcomes. Conceptual views suggest jugaad innovators put diffused education technologies through a jugaad innovation process, whilst utilising a human rights-based approach to education quality. Therefore helping to deliver quality learning for consumers at the bottom of the pyramid. However, the findings of this study advocate that although a human-rights based approach is essential; high quality learning content, educational scaffolding, an understanding of factors impacting technology adoption and the use of traditional teaching methods are also important in solving the 'learning crisis'. A partnership operating model is required to combine jugaad innovation with EdTech; and to scale and commercialise such innovations. Findings also identified a fourth, holistic principle of the jugaad innovation process, namely, iterative design. The study's findings put forward ways to implement a frugal, flexible, inclusive and iterative EdTech innovation process. Results confirm that education quality is multidisciplinary (EdQual, 2010). Jugaad innovators must partner with state departments of education and/or NGO's to access their network of learners, resources and capabilities. This will serve learners at the bottom of the pyramid in volume and mitigate against the problem of ultra-thin per consumer margins (Kansal, 2016).

Keywords: 'Learning Crisis', Developing Countries, Jugaad Innovation, Education Quality, Education Technology, EdTech.

Introduction

UNICEF (2018) states that education helps eradicate absolute poverty, whilst supporting peace and democracy. Education improves human capital, through empowering individuals and creating opportunities (Paraschiv, 2017), which in turn drives economic growth (The Economist, 2014). Indeed, as Kuan Chung stated in the 7th Century BC (The World Bank, 2018:3): 'If your plan is for one year, plant rice. If your plan is for ten years, plant trees. If your plan is for one hundred years, educate children.'

Harnessing the true power of learning has never been so important. According to the Education Commission (2016), half of the world's jobs - around two billion - are expected to vanish because of automation by 2030; workers in developing countries face the largest risk of technology-related unemployment, because these economies support many low-skilled jobs most vulnerable to automation. As a result, educational providers occupy a crucial position within the global economy, because they develop and align the skills of workers to the evolving needs of businesses. However, the provision of education alone is inadequate to really improve people's lives. The United Nations (2017) highlight the importance of a quality education to truly drive sustainable development.

The Problem

The World Bank (2018:3) warn of a 'learning crisis' in global education; underprivileged students in developing countries are attending school, but many fail to learn basic life skills. Consequently, as Pearson PLC (2018) explain, the global problem in education is not simply about provision, but also ensuring quality learning. UNESCO (2017A) states that globally, over 617m students are failing to achieve minimum proficiency standards in maths and reading. If education remains unchanged, it will take approximately 100 years for students in low income countries to reach the learning levels students in developed countries have today (Stanford Social Innovation Review, 2017).

However, the budget needed to solve this problem is practically unobtainable. The Global Partnership for Education (2018) highlight an annual financial deficit of US$39 billion to deliver quality pre-primary, primary and secondary education for everyone in low income countries by 2030. The Federal Ministry for Economic Cooperation and Development (2018), explain that classrooms in developing countries rely on outdated teaching methods; autonomous learning, critical thinking and problem solving, the implementation of educational technologies and the teaching of life skills tend to be disregarded because of constrained financial, infrastructural and human resources.

This paper uses India as a primary research case study to investigate the aforementioned problem. According to The Economist (2017B), India has utterly failed to convert going to school into learning; roughly half of fifth-grade students can't read a book intended for second-graders. Moreover, The Economist (2017C) also emphasises the poor quality of Indian teachers; since 2011, an estimated 99% of would-be teachers have failed their pre-joining test. A primary research case study of India has been selected for two reasons. Firstly, Prabhu *et al*. (2012) explain that most Indians use the concept of jugaad innovation in their daily lives, meaning India naturally fits the aim of this investigation. Secondly, India is earth's largest education system (The Economist, 2017B). Therefore, it can be argued that India sits at the 'heart' of the 'learning crisis'. Tackling India first should make it easier to deal with smaller, less complex education systems.

This research is important, because recommendations will impact approximately 260m students in over 1.5m schools across India (KPMG, 2017). This research also has potential for global impact. UNICEF (2014:7) promote the idea of a 'continuum of action'; recommendations can be shared globally to enhance the quality of education for students worldwide. This is around 617m students (UNESCO, 2017A) as stated above. According to WE Charity (2018), 171m people would escape poverty if all children in developing countries completed school with basic literacy, that's a 12% decrease in global poverty. UNESCO (2011) supports this argument, explaining that one additional year of quality education grows income by up to 10%. However, the importance of this research goes beyond economics. Children are 50% more likely to survive over the age of five if their mother can read (Education Commission, 2016).

The consequences of not educating children must also be considered. Without education, individuals work in low-paying jobs, which decreases tax revenues and negatively impacts the long-term competitiveness of economies (Albada, 2010). Current research in this area has typically focused on the concepts of jugaad innovation, EdTech and the 'learning crisis' in isolation. This paper intends to take the current research forward through bringing together the aforementioned concepts in a way that has not been attempted before. On that account, this unique investigation fills a gap in the existing literature.

Literature Review

The concept of education quality forms a crucial element of this study. However, defining quality in education is problematical. Quality is context specific, subjective, and challenging to measure, therefore, no single definition exists (UNESCO, 2017B; UNICEF, 2000). EdQual (2010) highlight two viewpoints relating to education quality, namely, Human Capital Theory (HCT) and the human-rights based approach (HRBA). HCT favours increasing cognitive success, through enhancing assessment grades, predominantly in maths and literacy. Seong and Patterson (2014) highlight that education within HCT improves a variety of cognitive skills, which help raise productivity; greater productivity leads to increased wages, thus alleviating poverty and improving economic growth. In contrast, the HRBA supports a broader range of learning objectives, beyond simple maths and literacy, to include practical skills, life skills, social attitudes and an understanding of HIV and AIDS prevention.
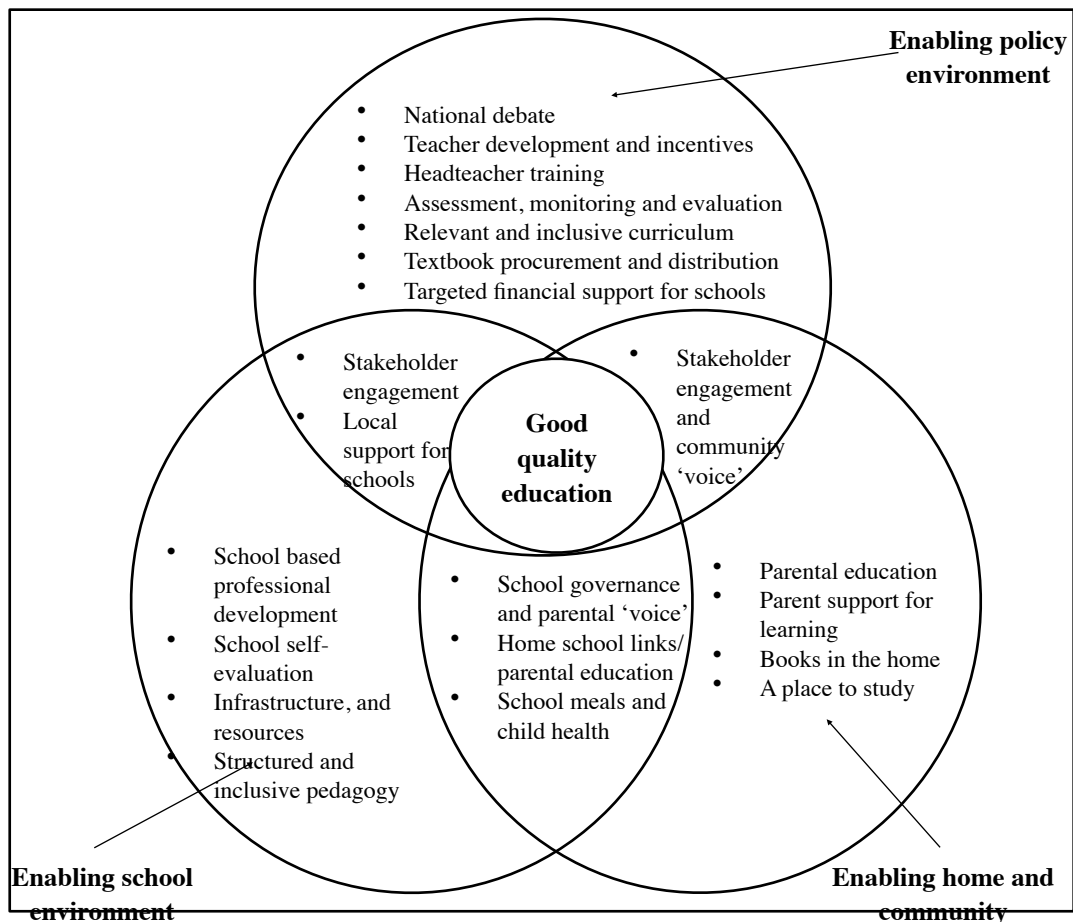
Figure 1 (Adapted from EdQual, 2010)   Marginson (2017) identifies a key limitation of HCT, in that it fails the realism test because it only acknowledges cognitive skills. UNICEF (2007) suggests HRBA provides a more holistic view of education, through recognising several dimensions of quality. It can be argued HRBA is more appropriate to education quality in developing countries; studying life skills and disease awareness would be of greater value to students living in these draconian environments (Epstein & Yuthas, 2012). EdQual (2010) suggest a framework for implementing education quality in low income countries:

EdQual's (2010) framework indicates that good quality education derives from three interrelated environments, namely, the policy, school and home/community. EdQual's framework demonstrates the complexity of delivering good quality education; quality is in fact multidisciplinary (Epstein & Yuthas, 2012). The framework highlights a significant limitation of using EdTech to solve the 'learning crisis'. In reality, EdTech cannot support all inputs within each environment. For example, EdTech cannot directly influence government policy or school meals and child health.

Notwithstanding this limitation, EdQual (2010) give the impression that two inputs are decidedly important, namely, suitably trained teachers and appropriate learning materials. UNESCO's Institute of Statistics (2018) support this inference, in presenting teachers as the primary driving force behind quality education; teachers are futile without appropriate learning materials to deliver instruction and make knowledge accessible. According to Bauman & Tuzhilin (2018), EdTech can provide suitable training for teachers and appropriate learning materials for students. However, improving the quality of education using EdTech requires effective innovation. Traditionally, organisations have institutionalised their capacity to

innovate, through establishing internal R&D departments and creating structured, homogeneous processes necessary to commercialise new ideas (Prabhu *et al*., 2012).

However, scholars have questioned the effectiveness of Western-centric innovation (Ganapathy, 2015; Sharmelly, 2016; Tournois, 2017). Radjou & Euchner (2016) criticise the Western approach for being expensive, slow, and insular.

According to PWC's Global Innovation Study (2017), the 1000 largest corporate R&D spenders spent USD $702 billion last year. Therefore, Western-centric innovation is expensive. The global business environment is becoming increasingly volatile, unstructured, complex and ambiguous (Johansen & Euchner, 2013). Globalisation and digitalisation are key trends leading this change (Jain, 2017; Yuksel & Sener, 2017). As a result, organisations must innovate quickly in response to new market entrants and disruptive business models. Nevertheless, Western-centric innovation is structured and slow. The best innovations can come from external partners or even customers. However, institutionalised R&D departments thwart collaborative innovation. Consequently, Western-centric innovation is overly insular.

The Western-centric approach is not appropriate for organisations innovating within developing countries (Prabhu *et al*., 2012); resources are limited, environments are highly complex, and innovations must include low income, marginalised consumers (Prahalad & Mashelkar, 2010).

Jugaad directly contrasts with Western-centric models of innovation. Jain & Prabhu (2015) define jugaad innovation as frugal, flexible and inclusive; jugaad describes the innovation process itself, and the process outcomes. However, jugaad is a complex theory; numerous definitions exist. The Economist (2010) argues jugaad does not mean substandard, but rather simplified products through using resources sparingly. Prabhu *et al*. (2012) portray jugaad as an innovative fix; simple and effective solutions are built from cleverness and ingenuity. According to Harvard Business Review (2014), jugaad innovators engineer low cost solutions of good quality. Ganapathy (2015) maintains that jugaad involves solving a problem through improvising an effective solution with limited resources. Ajith & Goyal (2016:6) interviewed 132 rural Indians aged between 18-25, asking: 'What do you mean by the Hindi word jugaad?' The responses were analysed. Key dimensions are presented in the table below:

Dimensions of jugaad	Split of 132 interviewees
Flexibility	20%
Developing something through self-effort	14%
Solve/fix something	12%
Alternate options (in the absence/shortage of original products and services)	12%
Fast/agile/shortcut method	11%
Modify things/develop customised solutions	10%
Manage all situations	9%
Use locally available resources and talent	8%
Affordable/low cost	4%

Figure 2 (Adapted from Ajith & Goyal, 2016)

This paper builds on existing definitions, to define jugaad as solving a problem through creating frugal, flexible and inclusive solutions of good quality, through a frugal, flexible and inclusive innovation process.

Existing literature to date is equivocal as to the true meaning of jugaad (Ajith & Goyal, 2016; Brem & Wolfram, 2014; Ganapathy, 2015). Indeed, while scholarly research has been growing, the concept of jugaad is not well understood (Jain & Prabhu, 2015). As a result, there remains much to learn regarding jugaad theory (Agnihotri, 2015). Moreover, there has been no attempt in the existing literature to bring jugaad and EdTech together, within the context of the 'learning crisis'.

In contrast to jugaad, the existing literature surrounding EdTech is generally well researched; scholars believe that educational reform should leverage technology to drive innovation in learning (Arokiasamy, 2017; Lucas, 2018; Shih & Huang, 2017).

In furtherance of understanding the mechanics behind jugaad and EdTech, the researcher initially outlines the key theories and principles that underpin this topic. Proceeding critical analysis aims to support the creation of research objectives, and semi-structured interview questions.

Fortune at the Bottom of the Pyramid

Firms have often disregarded the poorer segments of society because of their supposed low purchasing power (Kansal, 2016). The theory of fortune at the bottom of the pyramid (BOTP) contends that solving the 'learning crisis' represents both a social and economic opportunity (Hart & Prahalad, 2002). Approximately 4 billion consumers live at the BOTP in developing countries, a market worth $5 trillion (Expo, 2014). Consumers at the BOTP live in relative poverty on annual incomes below USD $3,000 (WRI, 2007). Organisations can educate these consumers through combining jugaad with EdTech.

Jugaad and EdTech both sit within the theory of leapfrogging. In education, leapfrogging is defined as 'any practices, new or old, that enable skill inequality and uncertainty to be far more quickly addressed than the current 100-year time frame would suggest' (Stanford Social Innovation Review, 2017:1). Therefore, leapfrogging brings jugaad and EdTech together, within the context of the 'learning crisis'. Implementing four principles will enable leapfrogging in education:
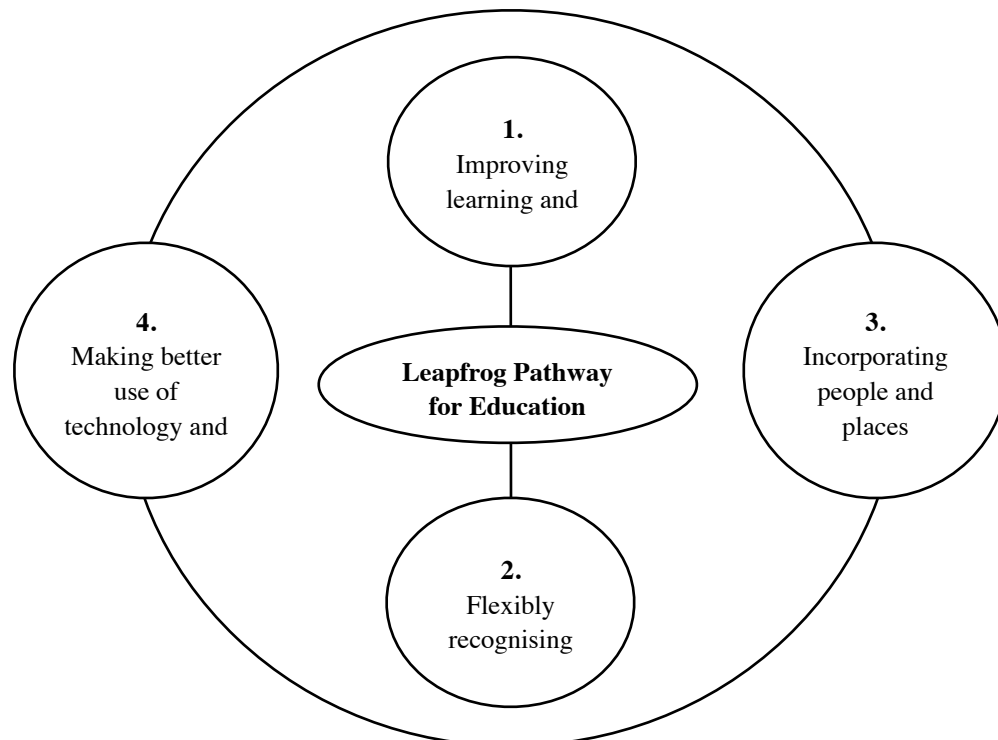
Figure 3 (Adapted from Standard Social Innovation Review, 2017)

The six principles of jugaad somewhat align with those stated in the Leapfrog Pathway for Education:

Resilience

1.
Seek opportunity in adversity

Empathy & Passion

6.
Follow your heart

2.
Do more with less

Frugality

Jugaad innovation

5.
Include the marginalised people

3.
Think and act flexibly

Inclusivity

4.
Keep it simple

Adaptability

Simplicity
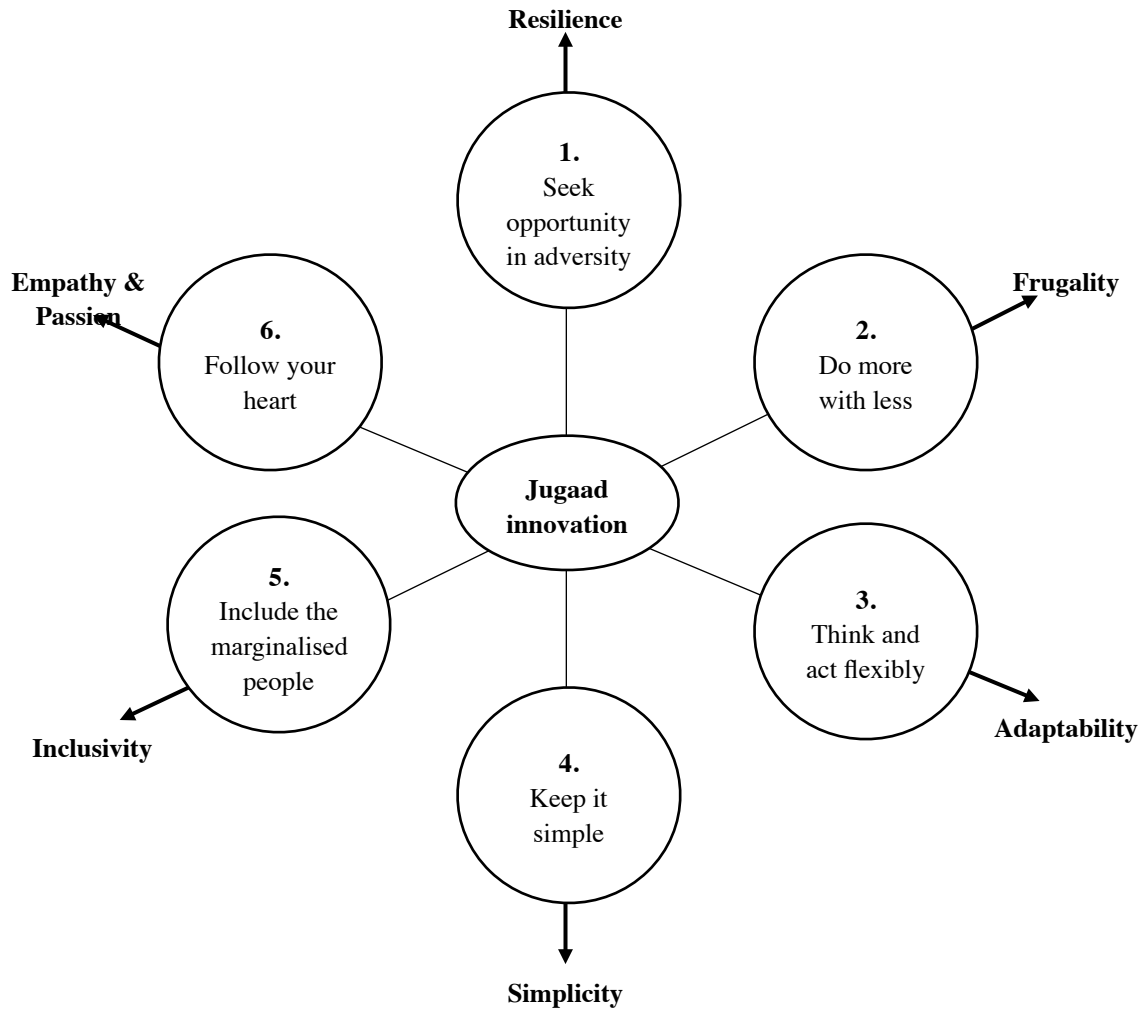
Figure 4 (Adapted from Ajith & Goyal, 2016, and Prabhu *et al*.,

Pioneers of jugaad seek to improve learning and teaching within the adverse environments of developing countries. Agnihotri (2015) argues jugaad innovation entails using existing technologies in new ways, to create affordable solutions for marginalised consumers. In line with Rogers (1995) Diffusion of Innovation Theory, jugaad practitioners use already diffused technologies; their aim is not to develop new, radical innovations. Livingston (2016) advocates that low cost mobile phones and computers are the most effective diffused learning technologies. Eighty percent of consumers in developing countries own a mobile phone (Santos, 2016), whilst 41.3% have access to a computer (ITU, 2017). Mobile phones and computers are advantageous because they do not require much literacy or numeracy for basic use (UNESCO, 2016). Indeed, the growth of diffused learning technologies is confirmed by estimated ICT spending from consumers at the BOTP (WRI, 2009:128). Prabhu *et al*. (2012) suggest that optimising diffused technologies will enable jugaad innovators to deliver frugal EdTech solutions to combat the 'learning crisis'.

However, scholars have raised concerns over frugal innovations (Ghemawat, 2017; Peterson, 2016; Rambe, 2016). EdTech solutions under jugaad can be of low quality because they emphasise frugality (Ganapathy, 2015; Kumar & Puranam, 2012; Prahalad & Mashelkar, 2010). Therefore, a trade-off exists between quality and cost (Moges, 2013; Stoddart, 2015).

The quality argument is developed further through Communication Channel Theory. Belch & Belch (2004:193) state that personal communication entails direct face-to-face contact, whilst non-personal communication involves no interpersonal correspondence. Ghemawat (2017) postulates that technology cannot entirely replace social interaction because it's a vital element of the learning process. To a large extent, EdTech delivers learning materials using non-personal communication techniques (Abrahams *et al*., 2016). Therefore, it's questionable whether EdTech can improve education quality without social interaction.

Nevertheless, a study from Harvard University and the Massachusetts Institute of Technology (2011) revealed low cost computer and mobile aided instruction enhanced learning for students within developing countries. Similar conclusions have been reached in other studies (Arkorful & Abaidoo, 2014; Hrastinski, 2008). This is evidence to suggest combining jugaad innovation with EdTech can help solve the 'learning crisis'. Moges (2013) opines that EdTech can improve teaching and learning, both from the instructivist and constructivist theories of learning:

| Instructivist (traditional)	Constructivist
Teacher driven	Student driven
Solo	Collaborative
Summative assessment	Formative assessment
Teachers 'give' knowledge	Students build (construct) knowledge
Teacher is expert	Students' knowledge is valid starting point
Regurgitation of information; memorisation	Analysis, exploration, synthesis of information (higher order thinking skills)
Content based	Process based
Passive	Active
Clear end point	Ongoing

Figure 5 (Adapted from California State University, 2018)

According to Moges (2013), EdTech's strength resides in its student driven approach to teaching and learning. In line with the constructivist learning theory, EdTech can deliver ongoing, active learning. Therefore, EdTech improves education quality through enhancing learner engagement and motivation, and by enabling individuals to discover and explore rather than listen and remember (Moges, 2013). Within the context of the 'learning crisis', EdTech helps solve the challenges of facilitating the attainment of basic life skills, and achieving minimum proficiency standards in maths and reading. Frugal EdTech, developed through jugaad innovation, will help reduce the annual financial deficit of US$39 billion needed to deliver quality pre-primary, primary and secondary education for everyone in low income countries by 2030 (Global Partnership for Education, 2018). Therefore, combining EdTech with jugaad innovation supports the notion of lifelong learning to drive economic and social participation for consumers at the BOTP (Moore & Martinotti, 2016).

However, the integration of EdTech into developing countries is in its infancy (Malczyk, 2018). Indeed, literature to date is unclear about how jugaad innovators can optimise diffused learning technologies such as low cost mobile phones and computers (Jain & Prabhu, 2015). Moreover, current EdTech studies have not considered education quality through a jugaad lens, meaning the true extent of the cost quality trade-off is unclear (Lucas, 2018). Therefore, existing literature is inappropriate because it fails to answer a pivotal question: To what extent can frugal EdTech solutions, created using jugaad innovation, improve the quality of education for learners in developing countries (research objective 3)? In addition, the jugaad innovation process is inherently ambiguous; jugaad is a verb to describe the innovation process itself, and a noun to characterise the process outcomes (Jain & Prabhu, 2015).

Govindarajan (2012) suggests jugaad innovators implicitly practice co-creation during the innovation process, to deliver cost-effective learning solutions to low income, marginalised consumers. Hamidi & Gharneh (2017) define co-creation, as working alongside consumers during the innovation process; consumers participate in co-ideation, co-design, and the co-development of solutions. Ultimately, the needs of marginalised consumers can only be fully understood and fulfilled by working alongside them.
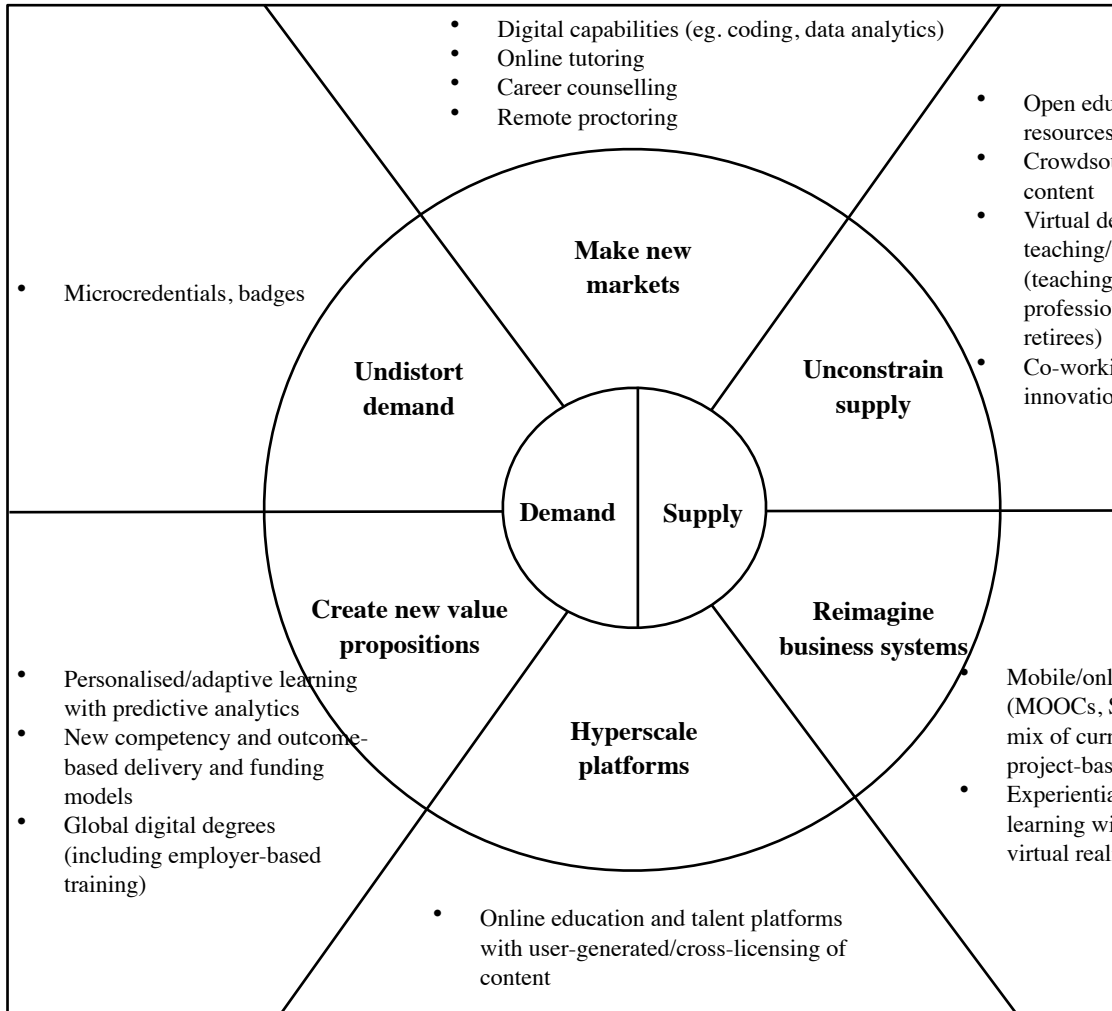
Ajith & Goyal (2016) proposed the Jugaad Innovation Model (JIM) to depict the jugaad innovation process:
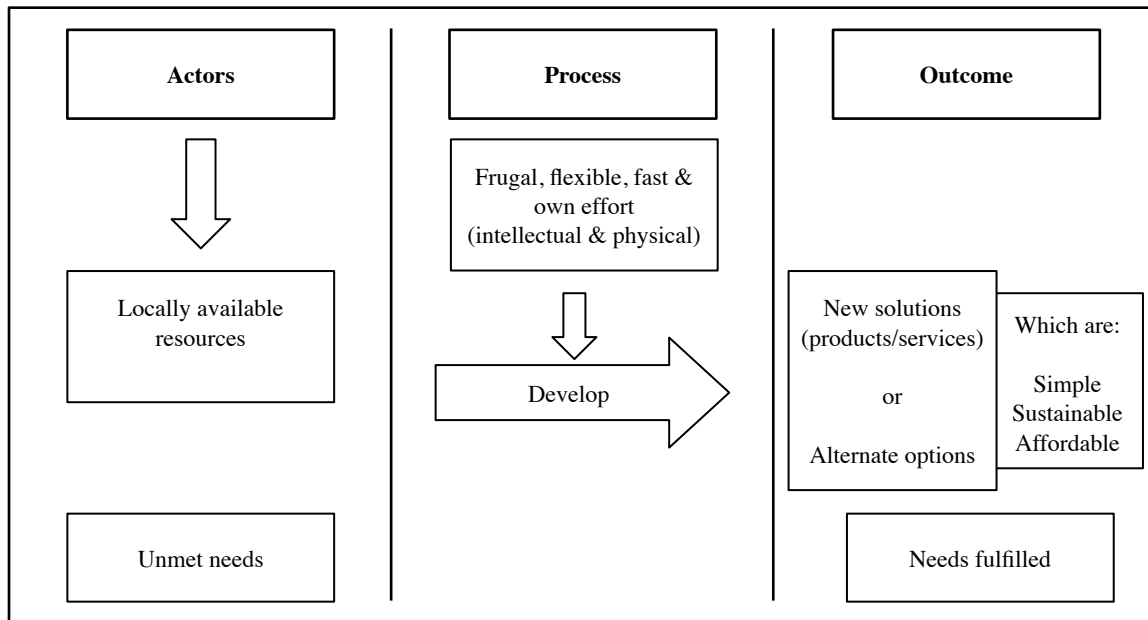
Figure 6 (Adapted from Ajith & Goyal, 2016)

JIM is inappropriate because it's far too generic; current literature provides no explanation as to how an organisation can implement a frugal, flexible and inclusive innovation process (Ajith & Goyal, 2016). JIM is also problematical because it fails to outline in any detail how jugaad solutions are commercialised (Jain & Prabhu, 2015). Therefore, further research into the jugaad innovation process is needed (Agnihotri, 2015). On that account, a second crucial question remains unanswered: How does jugaad innovation work with EdTech in practice (research objective 2)?

Ajith & Goyal (2016) suggest the jugaad innovation process is non-linear. Prabhu *et al*. (2012) state this is because jugaad innovators think and act flexibly, through persistently questioning the current state of affairs, and ensuring all strategic options remain open to rapidly counter unforeseen environmental changes. However, scholars have criticised jugaad's flexibility. Agnihotri (2015) and Ganapathy (2015) suggest jugaad innovations are not easily scalable or sustainable; unlike Western-centric innovation, jugaad utilises a flexible, unstructured process. Nevertheless, EdTech addresses the scalability and sustainability limitations of jugaad. According to Christensen (1997), EdTech shares a close relationship with Disruptive Innovation Theory. Lyons (2017) states EdTech innovations are easily scalable and sustainable, because they utilise low cost, digitally led business models. Moore & Martinotti (2016) suggest Demand and Supply Theory can help explain the mechanics of EdTech:

- Digital capabilities (eg. coding, data analytics)
- Online tutoring
- Career counselling
- Remote proctoring

- Open edu
  resources
- Crowdso
  content
- Virtual de
  teaching/
  (teaching
  professio
  retirees)
- Co-worki
  innovatio

Make new markets

Microcredentials, badges

Undistort demand

Unconstrain supply

Demand | **Supply**

Create new value propositions

Reimagine business systems

Hyperscale platforms

- Personalised/adaptive learning with predictive analytics
- New competency and outcome-based delivery and funding models
- Global digital degrees (including employer-based training)

- Mobile/onl
  (MOOCs, S
  mix of curr
  project-bas
- Experientia
  learning wi
  virtual real

- Online education and talent platforms with user-generated/cross-licensing of content
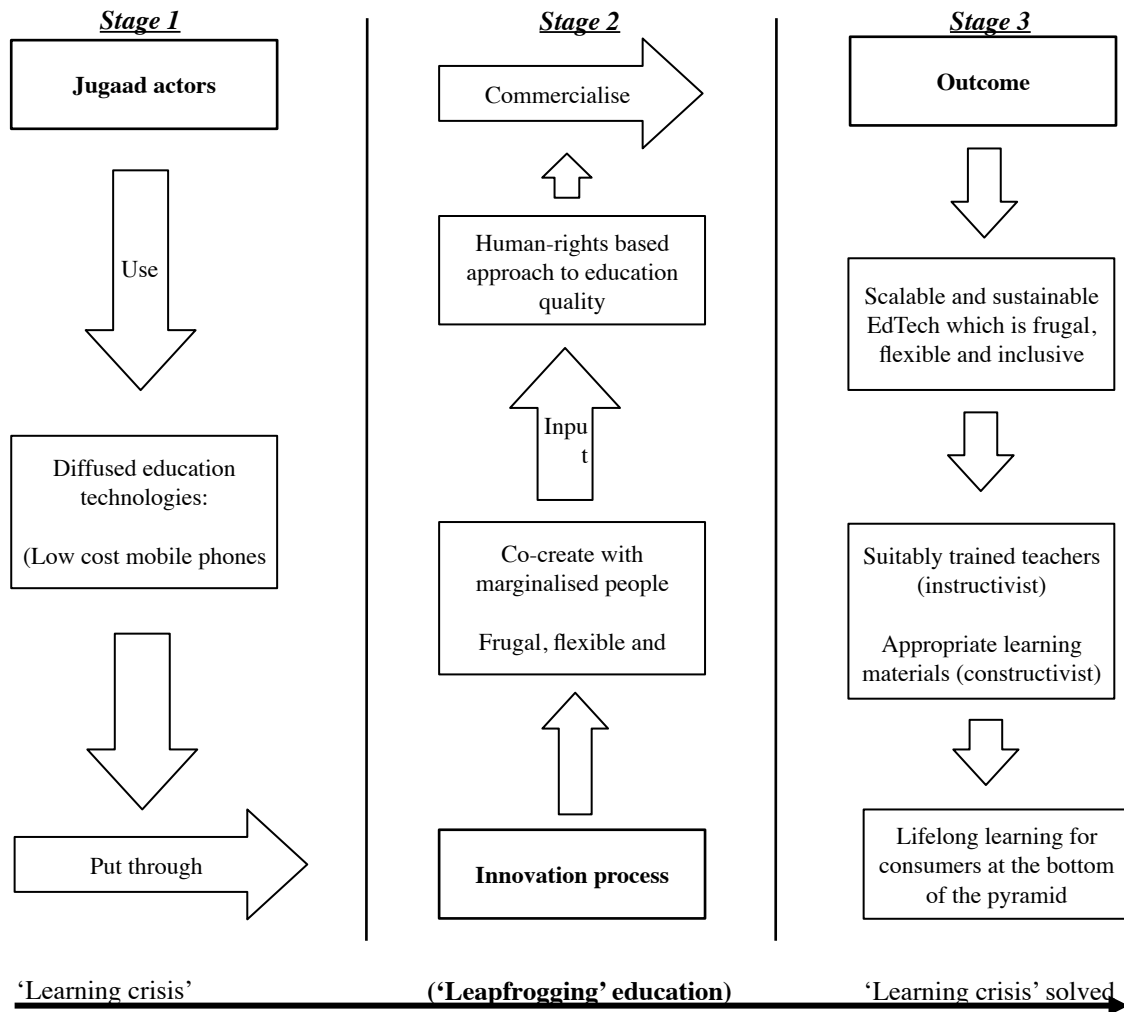
Figure 7 (Adapted from Moore & Martinotti, 2016)

Akin to jugaad, Moore & Martinotti's (2016) framework highlights the tremendous flexibility of EdTech concerning how a human-rights based approach to education can be delivered (UNRISD, 2017). Flexibility with reference to costs, location and time, including the personalisation of content for different learning styles (West, 2015). Therefore, developing countries can leapfrog in education, through using EdTech to flexibly recognise learning.

Moore & Martinotti's (2016) framework does not fit with the outlined problem, because it was designed to show the mechanics of EdTech in Western markets. Indeed, Bourezgue (2016) suggests that EdTech launched in developing countries have, to a large extent, been designed around Western principles. Western principles are inappropriate because they do not fit with the nature of education in developing countries (Gasaymeh *et al*., 2017). Ganapathy (2015) maintains that the future of innovation for successful global organisations will be polycentric; R&D operations are based in developing countries to effectively serve local markets (Radjou, 2009). Therefore, whilst the aforementioned theories provide an insight into the mechanics underpinning this topic, they offer little contextual understanding (Jain & Prabhu, 2015). Consequently, a third question remains unanswered: What does EdTech look like within the context of jugaad innovation, and education quality in developing countries (research objective 4)?

To a large extent, the human-rights based approach to education quality, EdQual's quality framework and the Leapfrog Pathway for Education do help this study. However, the six principles of jugaad do not help that much because they present jugaad as a mindset (Jain & Prabhu, 2015; Radjou & Euchner, 2016; Schomer, 2014). Consequently, the concept of jugaad is not well understood in practice (Agnihotri, 2015; Ajith & Goyal, 2016; Jain & Prabhu, 2015). For the most part, existing jugaad and EdTech literature is inappropriate to help solve the 'learning crisis'.

Based on the literature review, the researcher proposes a conceptual framework to elucidate how jugaad innovation and EdTech combine to solve the 'learning crisis' in developing countries:

Stage 1

Jugaad actors

↓ Use

Diffused education technologies: (Low cost mobile phones

⟶ Put through

Stage 2

⟹ Commercialise

Human-rights based approach to education quality

↑ Input

Co-create with marginalised people Frugal, flexible and

↑

Innovation process

Stage 3

Outcome

↓

Scalable and sustainable EdTech which is frugal, flexible and inclusive

↓

Suitably trained teachers (instructivist) Appropriate learning materials (constructivist)

↓

Lifelong learning for consumers at the bottom of the pyramid

'Learning crisis'   **('Leapfrogging' education)**   'Learning crisis' solved

⟶

Figure 8 (Researcher's creation)

Research Objectives

Aim

To investigate how combining jugaad innovation with EdTech can help solve the 'learning crisis' in developing countries.

Objectives

1. To explore, critically review, and apply the existing literature concerning jugaad innovation and EdTech in developing countries.

2. To investigate a case study combining jugaad innovation with EdTech in a developing country, to understand how it's played out in practice.

3. To determine the extent to which jugaad innovation and EdTech can improve the quality of education for learners in developing countries.

4. To understand how key findings refine what EdTech looks like within the context of jugaad innovation, and education quality in developing countries.

5. To discuss the implications of jugaad innovation and EdTech within the context of the 'learning crisis', and formulate strategic recommendations to EdTech companies and schools.

Methodology

According to Saunders *et al*. (2016) this research study takes an inductive approach, through building a theory on how jugaad and EdTech work together within the context of the 'learning crisis'. This study was approved in line with Pearson College London's research ethics policy.

The researcher adopted a subjective interview approach, using the interviewee's views and interpretations, and asking questions, responding to the interviewee's views, and interpreting findings through qualitative analysis (Heyl, 2005). The research interview entails a reasonably free flowing exchange of thoughts between two or more individuals (Townsend & Saunders, 2016). Informal semi-structured interviews and a case study were the chosen research methods to allow a focused exploration into the topic (Singh *et al*., 2017). Semi-structured interviews address predetermined themes and questions, but not always in the same order, to maintain flexibility and support the answering of additional questions (Crocker *et al*., 2014). A case study is a detailed investigation into an organisation within its real-life setting (Yin, 2014). The case to be studied is Slate2Learn. Case studies provide the ability to develop theory from a practical standpoint,

whilst uncovering rich, empirical evidence to answer 'how' and 'why' questions (Ridder, 2017). A single, holistic case was selected to explore and contextually analyse Slate2Learn as a whole (Yin, 2014). Whilst a single case cannot provide generalisations, combining it with a series of semi-structured interviews helped confirm the validity and credibility of findings (Zainal, 2007). The case study resided in the form of a semi-structured interview.

A case study and semi-structured interviews were selected because they provide rich and detailed qualitative data to understand the interviewees' experiences, how they describe them, and the meaning behind those experiences (Rubin & Rubin, 2012). Therefore, semi-structured interviews are appropriate for the nature of this study; jugaad is not well understood (Agnihotri, 2015; Ajith & Goyal, 2016; Jain & Prabhu, 2015) and EdTech literature does not fit within the context of this study (Bourezgue, 2016; Gasaymeh *et al.*, 2017; Moore & Martinotti, 2016). Moreover, semi-structured interviews allowed the streamlining of discussions into key areas of the conceptual framework designed through the literature review. This supported a deep investigation into complex areas, particularly around the jugaad innovation process and the commercialisation of new ideas. The case study helped answer research objective 2. The semi-structured interviews helped answer research objectives 3 and 4. Review Appendices One for the questions asked to each interviewee.

Questionnaires were discounted because they are unsuitable for research that asks a considerable amount of open-ended questions, and they stop the researcher following up ideas and clarifying issues (Saunders *et al.*, 2016). Focus groups were also discounted because they are difficult to control and manage, meaning they can hinder the main focus of the discussion (Ohio State University, 2012).

The first interviewee was Dr. Jaideep Prabhu, a professor from the University of Cambridge who has been an academic for nearly 25 years. Jaideep is a specialist researcher of innovation within emerging economies. Jaideep proposed the theory of jugaad in his book 'Jugaad Innovation: Think Frugal, Be Flexible, Generate Breakthrough Growth'. Jaideep was chosen for his specialist knowledge on jugaad innovation. This interview was conducted on 08/04/18 at 12am, and lasted just under 60 minutes. Review Appendices Two for the full transcript.

The second interviewee was Clémentine Vignault, Founder & CEO of Slate2Learn. Clémentine has been working on Slate2Learn for the past 3 years, developing adaptive EdTech for learners in India. Clémentine was interviewed to develop a research case study; Slate2Learn actively combine jugaad innovation with EdTech. Clémentine is trained as an Engineer and an Economist, and has undertaken a lot of research in developing economics in various countries. This interview was conducted on 10/04/18 at 4pm, and lasted just over 90 minutes. Review Appendices Three for the full transcript.

The third interviewee was Priyanka Agarwal, MD of Connect2Teach who have been in business for around a year and a half. Connect2Teach helps connect both industry professionals and academics with opportunities to teach at organisations around the world. Priyanka was chosen to explore the Connect2Teach approach to innovation, which closely follows the principles of jugaad. Priyanka's background is in company turnarounds; devising and implementing new business strategies. This interview was conducted on 14/04/18 at 9am, and lasted just over 60 minutes. Review Appendices Four for the full transcript.

The fourth interviewee was Ritchie Mehta, MD of Learn *et al.* who provide digital learning solutions for corporates, universities and business schools. Ritchie was interviewed for his role as a fellow at Cambridge Business School, which involves him developing an understanding of how to create innovation within

school environments. This interview was conducted on 14/04/18 at 11am, and lasted just over 60 minutes. Review Appendices Five for the full transcript.

The fifth interviewee was Neville Mehta. Neville is the Managing Trustee of Boys' Town School & Junior College based in India, which is owned by his family. The school teaches 2900 students from nursery up to A Level. Neville was chosen to provide an insight into how jugaad innovation and EdTech could be applied within a school setting. Neville has been running this school for 12 years. This interview was conducted on 15/04/18 at 9am, and lasted just over 60 minutes. Review Appendices Six for the full transcript.

A sample size of five was chosen based on the assumption that sufficient insight could be obtained to answer the research aim and objectives (Fischer *et al*., 2014; Patton, 2015). Nevertheless, Saunders *et al*. (2016) argues against researchers making generalisations about whole populations when research is based on a small, non-probability sample. This highlights a key limitation of this study.

All interviewees were chosen using purposive sampling, a form of non-probability sampling, whereby selection is based on the researcher's judgement (Laerd, 2012). The case study was selected using critical case sampling, whilst all other interviewees were selected through expert sampling. Both approaches are types of purposive sampling. Existing literature is complex and inappropriate to deal with the outlined problem; purposive sampling allowed the researcher to hand-pick opinion leaders from within their network of contacts, who can help move the research forward.

To mitigate against data quality issues, the researcher followed the interview preparation advice from Fischer *et al*. (2014) and Saunders *et al*. (2016):

A sufficient knowledge level concerning the 'learning crisis', jugaad and EdTech was obtained, through devising the literature review, searching the university library website and the wider internet. A pilot interview was carried out to mitigate against risks of bias through non-verbal behaviour (Castillo-Montoya, 2016). A cultural reflexivity approach was used to overcome potential cultural differences between the interviewer and interviewees (Brinkmann & Kvale, 2015). This was important because all interviewees were from the Indian culture. Reflection was based on the nature of the relationship between the interviewer and interviewee, and on the possible impacts of cultural differences and similarities (Court & Abbas, 2013). Cultural reflexivity helped initiate rapport and secure acceptance. An interview guide was created to outline the nature of this research, and key interview themes and questions to be asked to participants. The same interview guide was sent to all interviewees prior to each interview. This enhanced data validity and reliability, through informing the interviewees about the key areas of interest in advance to give them time to prepare. Jaideep and Neville received the same questions worded differently because they do not run an EdTech company.

Semi-structured interviews create potential for interviewer and interviewee bias (Alshenqeeti, 2014) which can compromise the validity and credibility of results (Dörnyei, 2007). To mitigate against such biases, the researcher followed the interview conduct advice from Fischer *et al*. (2014) and Saunders *et al*. (2016):

The interviewer started with obtaining informed consent, outlining the interviewee's rights and describing the nature of the research project (Edgley & Ibrahim, 2015). Each interview utilised open, probing and specific question typologies, to explore answers further and guide the conversation into formulary unconsidered areas (Britten, 1995). Probing questions helped to compare and contrast the interviewee's experiences. Abstract and philosophical questions were avoided. A dictaphone was used to provide audio recordings of each interview. Notes were taken to compose points to encapsulate back to interviewees to check understanding, and create follow-up question probes. Notes also helped document interpersonal

dynamics to assist with interpreting answers. Synchronous (real-time) electronic interviews were conducted using Skype. Skype was chosen because of its convenience in terms of access, distance and time considerations, whilst allowing visual interaction (Hanna, 2012).

All interviews were transcribed verbatim by the interviewer. Interview transcript summaries were used to help qualitative analysis. Thematic data analysis was adopted because of its flexibility, richness, and detail to identify common themes across interviews (Vaismoradi *et al*., 2013). Martins *et al*. (2014) highlight a limitation of thematic data analysis, in that views are interpreted without a feedback loop to verify the accuracy of interpretations. Analysis was conducted in line with the best practice advice from Braun & Clarke (2006) and Saunders *et al*. (2016):

Data familiarisation, which was achieved through listening and re-listening to audio recordings; transcription of audio recordings; coding data sets; looking for themes and identifying relationships; and refining key themes and testing propositions.

Findings

This section presents the key findings from the case study and semi-structured interviews. Thematic data analysis explores the Slate2Learn case study, and thereafter key questions across the semi-structured interviews.

Research Objective 2 – Case Study (Slate2Learn, 2017):

Slate2Learn are a microfranchise of digital learning centres in India.

(Slate2Learn, 2017)

There are three Slate2Learn centres in Delhi; ten more centres are preparing to open this summer. Students come to a centre and use the Slate2Learn learning app on a tablet for 40 minutes each day, for less than $4 per month. Students receive individual attention, tailored to their learning needs. For the first time, parents understand what their children do, how much they learn and what they learn through a digital classroom monitoring tool. Centres run offline and on battery backed-up technology.
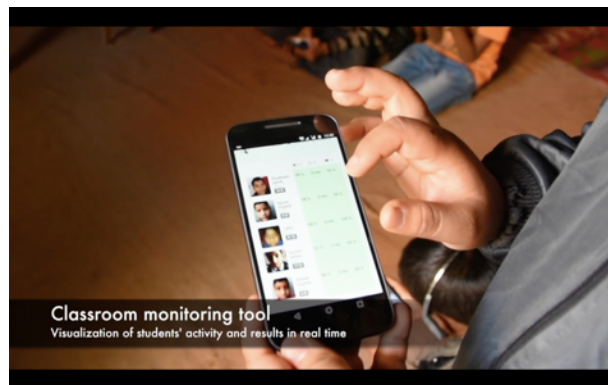
(Slate2Learn, 2017)

Slate2Learn implement 3 innovative technologies:

1 - Intelligent digital tutor

Slate2Learn has developed an innovative learning technology based on micro learning components and memories.

2 - Tuition centre in a box

Our classroom technology enables tutor-entrepreneurs to monitor each child's learning progress in real-time, and share progress reports with parents.

3 - Management platform

Our business management platform allows our managers to visualise financial, and learning indicators for each digital tuition centre in real-time.

(Slate2Learn, 2017)

Theme 1 – operating models	
Sub-themes	**Quotes**
Digital learning centres (old model)	'We would find people in slum areas who were delivering after school education, and recruit them into operating digital learning centres'. 'We would come with a box, with a certain number of android tablets, a micro server and headsets, some documentation, train them in using the software and running a class, then they would run a centre from their own house and it would be their business'. 'It's very difficult to scale the digital learning centres model'. 'People employed in digital learning centres have a very unpredictable life; you need to recruit new people all of the time'. 'We reach 2-3 thousand learners'.
Partnerships (new model)	'We now deal with organisations who are big and already handle learning environments, it can be a state department of education, an NGO who runs a lot of learning centres or a big organisation that runs schools'. 'We don't want to deal with individuals, the micro entities, these are very difficult to manage, and it's not a good use of our organisation's skills'. 'Physically borrowing someone else's network; if you're a not for profit organisation that's the best way to do it'.

Figure 9

Theme 2 – education quality	
Sub-themes	**Quotes**

Assessing current knowledge	'We use something called scaffolding in education'.
	'We tailor knowledge to the needs of the child'.
	'You need to know the current knowledge of the child and to be able to measure at what stage the child is at'.
	'We take data on every click and you measure that data'.
Learning through EdTech	'You can learn on low cost hardware, we've done it, it works'.
	'A touch screen gives a richer interaction, we do a lot of drag and draw, so it feels more natural'.
	'The improvement in learning doesn't come from the model of tablet, it comes from what you put on it'.
	'Software typically focuses on practising a certain skill, not on acquiring that skill from scratch'.

Figure 10

Theme 3 – jugaad innovation process	
Sub-themes	**Quotes**
Frugality	'Testing solutions as early as possible limits your costs'.
	'There are certain things you can do low cost, others you can't'.
	'Graphics are not that important'.
	'Content design cannot be low cost'.
	'You can't cut costs on pedalogical insights or on getting the right content for the context'.
Flexibility	'The children across our digital learning centres experiment with some kind of virtual manipulative'.
	'We use rapid prototyping'.
Inclusivity	'We quickly design a prototype and give it to children who fit with our target socio-economic and language group'.
	'We measure and assess whether the prototype is clear and if they understand it'.
Iteration	'We have a process which is iterative and very experiential'.

Figure 11

Review Appendices 7 for the jugaad learning solutions (innovation process outcomes).

Research Objectives 3 and 4 - Semi-structured Interviews

Theme 1 – education technologies	
Sub-themes	**Quotes**
Devices	'Desktops are difficult to operate because of the electricity problem'. 'Laptops are too expensive'. 'What you can do with non-smart phones is pretty limited and low end'. 'Tablets have really become the medium of choice'.

Figure 12

Theme 2 – education quality	
Sub-themes	**Quotes**

Teachers	'Good quality education starts with teachers; how do we improve their standards and engagement?'. 'If you can make changes in conjunction with the teacher, it will work'. 'Can mobile phones and computers replace a teacher? The answer is categorically no'.
Measuring quality	'I don't think anyone in education has successfully been able to measure learner outcomes in a holistic way yet'. 'How could we measure learner outcomes in a way over and above just marks?'. 'How can we actually determine whether people are learning the right skills to help them tomorrow?'.
Content	'We are not user funded. If you target the bottom of the pyramid you can't produce quality, because the market is geared towards low quality content'. 'Someone will come with cheap content and undercut you'.

Figure 13

Theme 3 – operating models	
Sub-themes	**Quotes**
Learning centres	'Poor people end up sending their kids to private school, which are not very grand schools, on the contrary they are pop up booths in urban slums'. 'The after-school learning system is mainstream in India'. 'Look at the quality of what we are getting out, not the input'.

Partnerships	'We work with the institutions that help the learner'.
	'We don't work with learners directly because that's harder to scale'.
	'Start-ups or social enterprises don't have either the capabilities or resources to scale solutions'.
	'Larger organisations have resources to scale, but often not the time or motivation to really understand individual communities'.
	'Opportunity for partnerships between the government, private sector organisations, NGOs, social innovators and local communities'.

Figure 14

Theme 4 – operational challenges	
Sub-themes	**Quotes**
Scalability	'How do you manage to address the cost at such low revenue potential?'.
	'Scaling is the major challenge'.
	'Don't just look at jugaad innovation as a way to develop the technology, but as a way to take that technology to market'.
Technology adoption	'User adoption is a big problem'.
	'It's really important to define that what will get this product faster adoption'.
	'A teacher who has taught for ten years finds it very difficult to change their method'.
	'We don't run the programme, we don't deal with hardware, we don't deal with convincing teachers to use it'.
Technology optimisation	'Tablets are only used once a day for half an hour because the teachers want to go home earlier'.
	'Content is not delivering the efficacy aspect (learning the right skills) and it's only delivering the marks aspect'.

Figure 15

Theme 5 – jugaad innovation process	
Sub-themes	**Quotes**

| Frugality | 'Work backwards from the need, then see what can be done using existing resources'.

'We can reduce our costs ten-fold by adopting the borrowing concept as opposed to the building concept'.

'We borrow third party platforms at minimal cost per month'.

'We use existing course templates to shorten the product lifecycle, and free-lance developers'. |
|---|---|
| Flexibility | 'We believe in failing fast, if somebody comes up with an idea, they have to come up with a reason why their idea might fail'.

'You have got to empower your people and give them the ability to make changes'.

'Flexibility can only be in infrastructure and methods of teaching'. |
| Inclusivity | 'All jugaad solutions require engagement with the community or beneficiaries'.

'Everyone is part of the process, including our customers, we are constantly taking feedback, constantly involving the community, every single team member is part of the same discussions'. |
| Iteration | 'Keep iterating that process, keep iterating that technology; part of jugaad is the process never ends'.

'You offer a solution and you iterate that solution'. |

Figure 16

Review Appendices 8 for the jugaad learning solutions (innovation process outcomes).

Discussion and Recommendations

This section answers the research objectives. The primary research findings are discussed in comparison to the literature review to formulate recommendations. See page two for the outlined problem.

Objective 2:

'*To investigate a case study combining jugaad innovation with EdTech in a developing country, to understand how it's played out in practice'*.

Due to the amount of research collected, this section does not discuss the jugaad learning solutions (innovation process outcomes). Therefore, discussion focuses on the most important elements of the Slate2Learn case study, namely, the operating model and jugaad innovation process.

Operating Model

Investigating the Slate2Learn case study has revealed a major finding. A partnership operating model is required to successfully combine jugaad innovation with EdTech to combat the 'learning crisis'. '*We now deal with organisations who are big and already handle learning environments'* such as a '*state department of education'* or '*an NGO'* (Figure 9). Findings from the semi-structured interviews support this judgement. '*We work with the institutions that help the learner*' (Figure 14). A partnership model '*physically borrows someone else's network'* (Figure 9), meaning an organisation can access a far greater number of learners. Serving low-income consumers in volume would mitigate against the problem of ultra-thin per consumer margins (Kansal, 2016). This finding supports the literature on fortune at the bottom of the pyramid (Hart & Prahalad, 2002). As a result, partnerships are the best way to '*address the cost at such low revenue potential*' (Figure 15).

The Slate2Learn digital learning centres model is '*very difficult to scale*' (Figure 9). Findings from the semi-structured interviews support this judgement. '*We don't work with learners directly because that's harder to scale*' (Figure 15). Therefore, partnerships provide the most effective way to scale and commercialise jugaad innovations. '*Social enterprises don't have either the capabilities or resources to scale solutions; larger organisations have resources to scale, but often not the time or motivation to really understand individual communities*' (Figure 14). This finding contrasts with the literature from Lyons (2017) and Moore & Martinotti's (2016) Demand and Supply framework (Figure 7). EdTech innovations are not easily scalable when created through jugaad innovation, because social enterprises need the capabilities and resources of larger organisations. The research on partnerships contributes to the literature on how to scale and commercialise jugaad and EdTech innovations, to help solve the 'learning crisis' (Jain & Prabhu, 2015). Partnerships also refine the commercialisation aspect of the conceptual framework (Figure 8) developed through the literature review.

Jugaad Innovation Process

Slate2Learn use a frugal, flexible and inclusive innovation process to develop EdTech (Figure 11). This finding supports the literature from Jain & Prabhu (2015) in their definition of jugaad innovation, and Ajith & Goyal's (2016) Jugaad Innovation Model (Figure 6).

Slate2Learn '*test solutions as early as possible'* to '*limit costs*' (Figure 11). Therefore, resources are not wasted developing flawed solutions. This delivers the frugal aspect of the innovation process. Findings

from the semi-structured interviews contrast with those of the Slate2Learn case study, in that frugality primarily involves '*using existing resources*' (Figure 16). '*We can reduce our costs ten-fold by adopting the borrowing concept as opposed to the building concept*' (Figure 16). For example, '*we borrow third party platforms at minimal cost per month, and use existing course templates to shorten the product lifecycle*' (Figure 16). This finding supports the literature from Agnihotri (2015) and Roger's (1995) Diffusion of Innovation, in that jugaad innovation involves using existing resources in new ways to reduce costs.

Slate2Learn use '*rapid prototyping*', and '*experiment with some kind of virtual manipulative*' (Figure 11) to maintain a flexible innovation process. This means solutions are designed and quickly changed in response to learner feedback. Findings from the semi-structured interviews support those of the Slate2Learn case study. Flexibility involves '*empowering people, and giving them the ability to make changes*' (Figure 16). Moreover, flexibility includes a notion of '*failing fast, if somebody comes up with an idea, they have to come up with a reason why their idea might fail*' (Figure 16). These findings support the literature from Prabhu *et al*. (2012), in that jugaad innovation involves both acting, and thinking flexibly.

Slate2Learn operate an inclusive innovation process, through '*designing a prototype, and giving it to children who fit their target socio-economic and language group*' (Figure 11). As a result, learners are included in the innovation process through co-creation, to fully understand and fulfil their needs. Findings from the semi-structured interviews support those of the Slate2Learn case study. '*All jugaad solutions require engagement with the community or beneficiaries*' (Figure 16). These findings support the literature from Govindarajan (2012), in that jugaad innovators practice co-creation innovation.

This research has identified a new, holistic principle of the jugaad innovation process, namely, iterative design. Slate2Learn's '*process is iterative*' (Figure 11). New literature explains this concept. The Interaction Design Foundation (2018:1) present six steps of iterative design:

1. Identify a user need.
2. Generate ideas to meet that need.
3. Develop a prototype.
4. Test the prototype of see if it meets the need in the best possible way.
5. Take lessons learned from testing and amend the design.
6. Create a new prototype and start the process again.

Iterative design by definition is frugal, flexible and inclusive. Prototyping is low cost (Medlej *et al*., 2017). Iteration amends designs in a flexible way (Lizarralde *et al*., 2016). Testing the prototype with end users is inclusive (Humphreys, 2015).

Findings from the semi-structured interviews support those of the Slate2Learn case study. '*Keep iterating that process, keep iterating that technology; part of jugaad is the process never ends*' (Figure 16). These findings contrast with the literature from Agnihotri (2015) and Ganapathy (2015), in that jugaad utilises an unstructured process. Iteration entails following a sequential process (Interaction Design Foundation, 2018). Therefore, when using jugaad within the context of EdTech, the innovation process is not unstructured.

Research on the jugaad innovation process contributes to the literature through explaining how an organisation can implement a frugal, flexible and inclusive innovation process to develop EdTech solutions that help combat the 'learning crisis' (Ajith & Goyal, 2016). Another contribution is the identification of a

new, holistic jugaad principle, namely, iteration. This research also refines the jugaad innovation process aspect of the conceptual framework (Figure 8) developed through the literature review.

Objective 3:

'*To determine the extent to which jugaad innovation and EdTech can improve the quality of education for learners in developing countries*'.

Education Quality

Quality education for learners at the bottom of the pyramid focusses on bringing '*a higher level of skills and knowledge in children*' (Appendices 9). This finding supports the literature from EdQual (2010), in that a human-rights based approach to education quality is most appropriate for learners in developing countries. Nevertheless, '*how can we determine whether people are learning the right skills*?' (Figure 13). Moreover, '*content is not delivering the efficacy aspect (learning the right skills) and it's only delivering the marks aspect*' (Figure 15). Therefore, a significant research gap exists in the measurement of learner outcomes '*over and above just marks*' (Figure 13). Fulfilling this research gap is vital to understand the extent to which the 'learning crisis' is being solved.

Devices

A key finding is that '*tablets have become the medium of choice*' (Figure 12) to deliver quality learning. '*A touch screen gives a richer interaction, we do a lot of drag and draw, so it feels more natural*' (Figure 10). This finding contrasts with the literature from Livingston (2016), in that low cost mobile phones and computers are not the most effective learning mediums. '*What you can do with non-smart phones is pretty limited and low end*' (Figure 12). '*Desktops are difficult to operate because of the electricity problem, and laptops are too expensive*' (Figure 12). This finding contrasts with the conceptual framework (Figure 8), in that tablets should be used to deliver content that helps solve the 'learning crisis'.

Content

Delivering good quality education requires high quality content, that fits the learner's socio-economic and language group. '*You can't cut costs on content design, or on getting the right content for the*

context' (Figure 11). This finding supports the literature from EdQual (2010), in that appropriate learning materials are decidedly important to improve the quality of education.

However, a major finding is that jugaad and EdTech cannot improve the quality of education for learners at the bottom of the pyramid, through a user funded model. '*We are not user funded. If you target the bottom of the pyramid you can't produce quality, because the market is geared towards low quality content; someone will come with cheap content and undercut you*' (Figure 13). This finding supports the literature, in that frugal solutions can be low quality (Ganapathy, 2015; Kumar & Puranam, 2012; Prahalad & Mashelkar, 2010). Therefore, organisations must target '*state departments of education*' or '*NGO's*' (Figure 9), because these organisations can afford to purchase higher quality content (Appendices 10) to improve the quality of education, and help solve the 'learning crisis'.

Scaffolding Education

The ability to assess current knowledge is vital for delivering good quality education. Slate2Learn implement the '*scaffolding in education*' (Figure 10) learning theory. New literature explains this concept.

'Scaffolding refers to the steps taken to reduce the degrees of freedom in carrying out some task so that the child can concentrate on the difficult skill she is in the process of acquiring' (Bruner, 1978:19). Therefore, scaffolding involves bringing knowledge of the learning experience that's most appropriate to the current knowledge state of the child (Sawyer, 2006). '*You need to know the current knowledge of the child and to be able to measure at what stage the child is at*' (Figure 10). Slate2Learn '*take data on every click and measure that data*' (Figure 10), using their digital classroom monitoring tool. Scaffolding supports the constructivist learning theory, and Moore & Martinotti's (2016) framework (Figure 7), in that EdTech delivers personalised and adaptive learning experiences based on the needs of the student. Scaffolding will help improve the quality of education, and help solve the 'learning crisis'.

Technology Adoption

Technology adoption is preventing jugaad and EdTech solutions from improving the quality of education for learners in developing countries. '*User adoption is a big problem*', therefore, '*it's really important to define that what will get this product faster adoption*' (Figure 15). New literature explains how technology can receive a faster adoption.

Innovations Diffusion Theory (IDT)

Rogers (1963) outlined five perceived attributes of innovations that determines the rate of adoption:
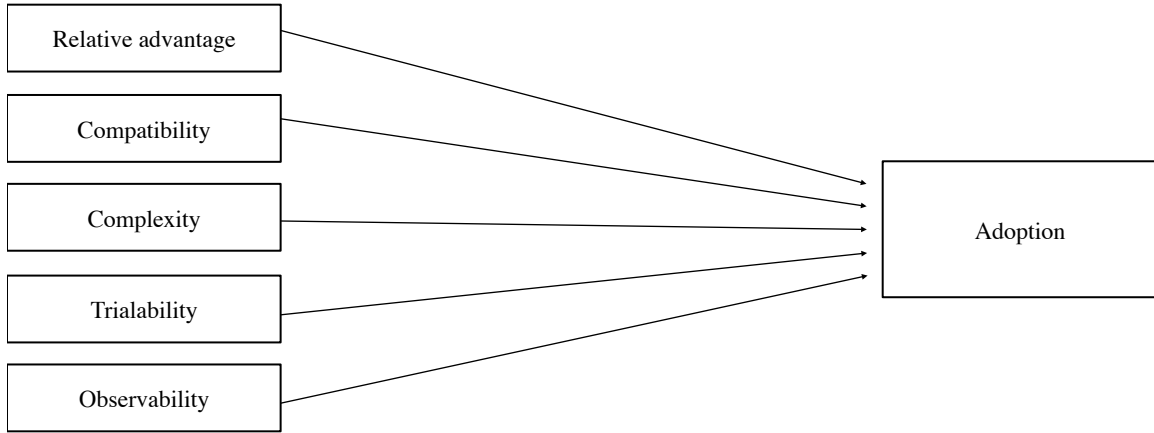
(Adapted from Rogers 1963)

Technology Acceptance Model (TAM)

TAM illustrates the determinants of computer acceptance (Davis *et al*., 1989). Davis *et al*. (1989) argued that perceived usefulness is a more influential indicator of usage intention than perceived ease of use:
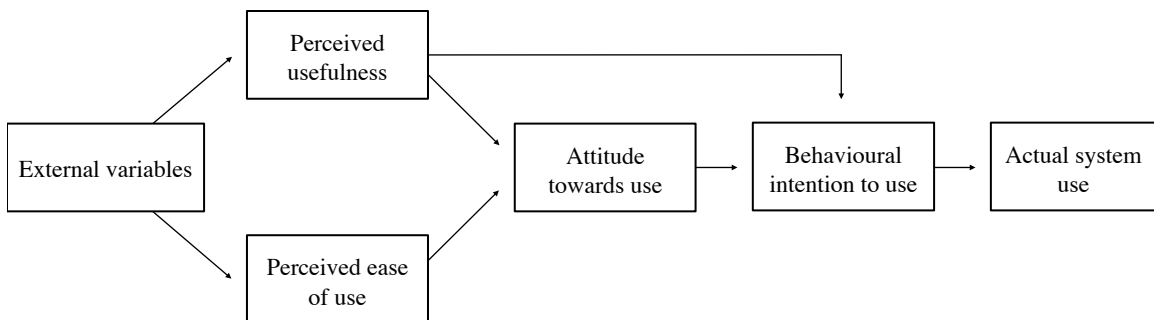
(Adapted from Davies *et al*., 1989)

Jugaad innovators should incorporate the IDT and TAM theories when building and promoting EdTech solutions to help solve the 'learning crisis'. This should increase adoption rates.

Teachers

A key finding is that jugaad innovation and EdTech must combine with traditional teaching methods to improve the quality of education. '*Good quality education starts with teachers; how do we improve their standards and engagement*?' (Figure 13). This finding supports the literature from EdQual (2010) and Ghemawat (2017), in that suitably trained teachers and face-to-face contact are vital elements to deliver quality education. Nevertheless, suitably training teachers using EdTech is '*very difficult*', 'w*e don't deal with convincing teachers to use the programme*' (Figure 15). This finding contrasts with the literature from Bauman & Tuzhilin (2018), in that technology adoption is hindering EdTech from providing suitable teacher training.

To a large extent, jugaad innovation and EdTech can improve the quality of education for learners in developing countries. Achieving quality requires a human-rights based approach. However, the conceptual framework (Figure 8) was incorrect because it omitted four additional considerations of delivering a good quality education, namely, high quality learning content, educational scaffolding, an understanding of technology adoption, and the use of traditional teaching methods. These four considerations contribute to the literature on how to improve the quality of education to help solve the 'learning crisis'.

Objective 4:

'*To understand how key findings refine what EdTech looks like within the context of jugaad innovation, and education quality in developing countries*'.

In furtherance of answering research objective 4, a new, empirically based conceptual framework is proposed. The new framework focuses on the key insights within the findings section, and refines the key elements of the conceptual framework developed through the literature review (Figure 8).
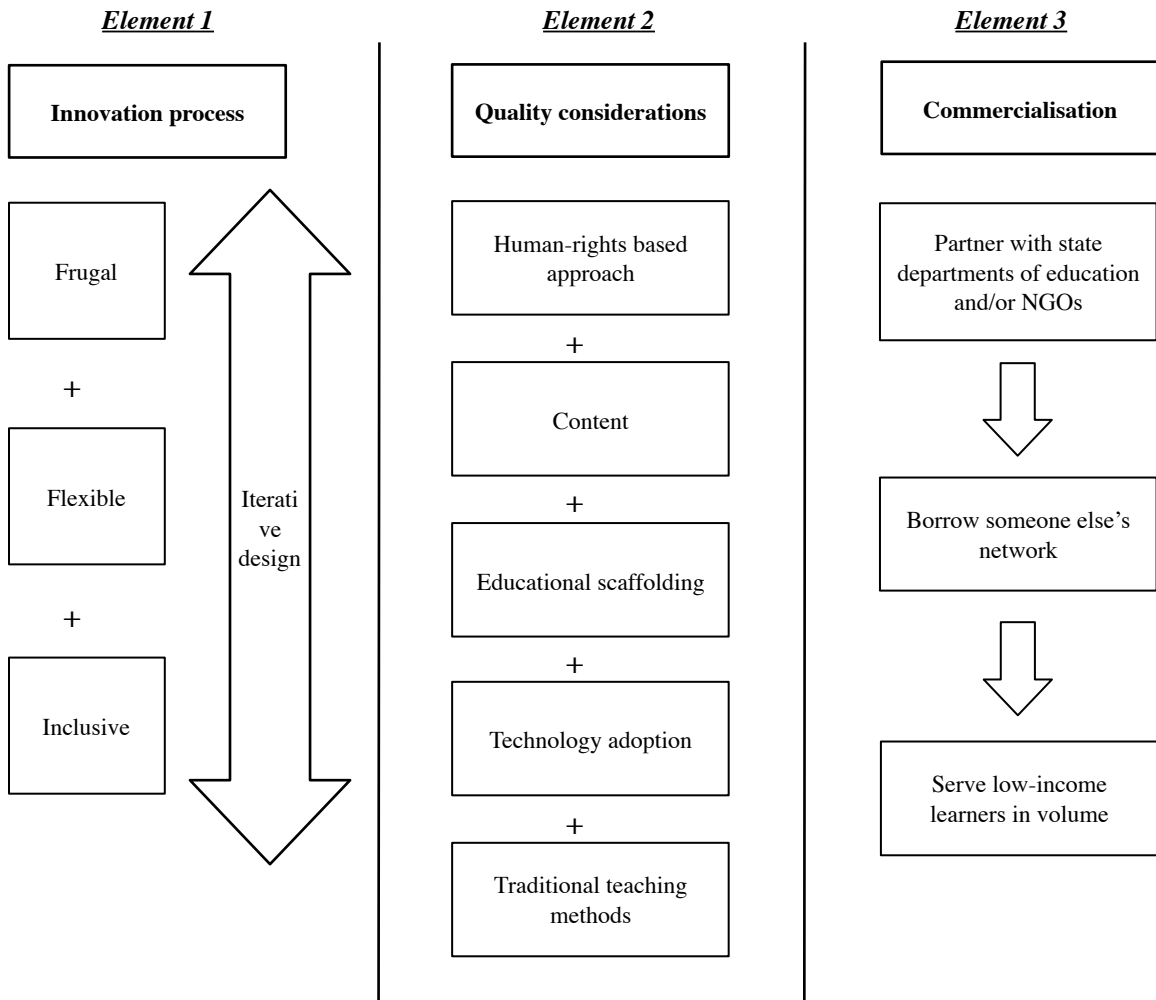
(Researcher's creation)

Practical Recommendations to EdTech Companies and Schools to Help Solve the 'Learning Crisis'

Operating Model:

- Utilise a partnership operating model to combine jugaad innovation with EdTech, and to scale and commercialise innovations.

- Work alongside state departments of education and/or NGO's to access their network of learners, resources and capabilities. This will serve low-income learners in volume to mitigate against the problem of ultra-thin per consumer margins.

The Jugaad Innovation Process:

Frugal:

- Use existing resources in new ways to reduce costs.

- Test solutions as early as possible to ensure they fit with the target learner.

- Adopt the borrowing concept as opposed to the building concept.

Flexible:

- Act flexibility through using rapid prototyping and experiment with a virtual manipulative. Empower people through giving them the ability to make changes during the innovation process.

- Think flexibility through cultivating a failing fast mindset; if somebody comes up with an idea, they have to come up with a reason why their idea might fail.

Inclusive:

- Spend time engaging with the beneficiaries of the innovation to fully understand their needs, and co-create the learning solution with them.

- Design prototypes, and give them to children who fit the target socio-economic and language group.

Iteration:

- Keep iterating the innovation process and technology, through adopting the holistic principle of iterative design.

Delivering Good Quality Education:

- Tablets should be used as the diffused learning technology to deliver content, because they give a richer interaction.

- Focus on implementing a human-rights based approach to education quality, to support the improvement of academic grades, and the learning of basic life skills.

- Create high quality content that fits the learner's socio-economic and language group. Target state education departments and NGO's who can purchase higher quality content to reach learners at the bottom of the pyramid.

- Use educational scaffolding to bring knowledge of the learning experience that's most appropriate to the current knowledge state of the child. This will help deliver personalised learning experiences.

- When building and promoting EdTech solutions, focus on the technologies relative advantage, compatibility, complexity, trialability, observability and its perceived usefulness, to help increase adoption rates.

- Jugaad innovation and EdTech must combine with traditional teaching methods.

Recommendations to Academia:

- Scholars should examine how jugaad innovators can effectively work in partnership with state departments of education and/or NGO's. Research should therefore seek to provide guidelines for best working practice.

- Empirical research should explore how educators can measure learner outcomes over and above exam marks. Further research is also needed to understand what basic life skills students in developing countries should be learning, and the extent to which EdTech, developed through jugaad innovation, can effectively teach such skills.

- Findings have revealed a key limitation of this study; jugaad innovation and EdTech alone cannot solve the 'learning crisis'. Primary research into India's education system has revealed a plethora of complex issues that go beyond the capabilities of jugaad innovation and EdTech (Appendices 11). Therefore, further research is essential to understand the government policies needed to reform education systems, and improve the quality of education.

Appendices

Appendices 1 - Interview Questions Asked to Participants.

1. How would you define quality education in developing countries?

2. How would you describe the current state of education in India?

Probe - What are the key issues facing organisations?

3. How do you measure learner outcomes?

4. How does your operating model work in practice?

5. What are the key challenges you face in delivering your operating model

6. What low cost EdTech do you use to train teachers and deliver instruction to learners?

Probe - How do you optimise the use of the aforementioned education technologies?

7. How are your learning solutions 1) frugal, 2) flexible and 3) inclusive?

8. An obvious trade-off exists between low cost and high quality. Do you think low-cost EdTech solutions can improve the quality of education for learners in developing countries?

Probe - How?

Probe - What evidence can you provide to support your answer?

9. EdTech doesn't always support social interaction. How important is social interaction during the learning process to deliver quality education?

10. What does the innovation process you go through look like to develop EdTech solutions?

11. How is your innovation process 1) frugal, 2) flexible and 3) inclusive?

12. Do you work alongside learners during the innovation process (i.e. do learners participate in co-ideation, co-design, and/or the co-development of solutions)?

Probe - If yes, how?

13. How do you commercialise your learning solutions?

14. Can you think of any examples when you have used jugaad innovation with EdTech?

15. What do you think are the key limitations of using jugaad innovation and EdTech to solve the 'learning crisis'?

Appendices 2 - Dr. Jaideep Prabhu Full Interview Transcript.

Interviewer: To begin, I would like to start by asking for your informed consent to partake in, and audio record this interview? I will be using the recording to write a full transcript of today's discussion, which will be used for educational purposes only, forming a constituent part of my final-year dissertation research [Jaideep agrees].

You also have the right to confidentiality and anonymity. You also have the right not to answer any question if you don't want to, and the interview will be stopped if you so wished. I will happily provide you with a summary of the research findings. This will be around mid-May 2018.

The Research aim is 'to investigate how combining jugaad innovation with EdTech, can help solve the 'learning crisis' in developing countries'.

In terms of progress to date, I have completed the literature review and I'm now in the final stages of collecting the primary research.

Interviewer: Could you give me a background of yourself, who you are, what you do and how long you have been doing that?

Jaideep: Yes, I'm a professor at the University of Cambridge and have been an academic for nearly 25 years. I research innovation, and the first part of my career I studied innovation in large western companies. Then I began to look at innovation in emerging economies like India where I grew up, and that's when I became aware of this approach which in India is called jugaad. This is this ability to do more with less and has an aspect of inclusion. Trying to develop highly affordable solutions for large numbers of people who are otherwise outside the formal economy. We ended up writing a book about jugaad innovation which was intended to help western companies going into emerging markets, to learn how to innovate in this way for those markets. Subsequently I discovered that there was a lot of interest in frugal innovation for the west, so I ended up writing a follow up book with my cohort, called Frugal Innovation. This essentially did more or less the same thing, but this time looked at frugal innovation in the west, for western markets.

Interviewer: Excellent, thank you for that. I shall start with the first theme which is all around education quality. How would you define education quality in developing countries? What do you think is really important in terms of that aspect?

Jaideep: Well I'm not sure that it differs between developing and developed countries, I think education quality would be the same regardless. A quality education should help people learn how to learn. I think the most intrinsic and extrinsic aspects of this, intrinsically, quality education should teach people the joy of learning, how to learn, and extrinsically it should help them be able to apply that in their life situations, improving their employability and interaction and development. So, I'd say that that's what quality education is all about, whether they are talking about developed or developing countries, whether they have a primary education or secondary or tertiary education.

Interviewer: How would you describe the current state of education in India specifically What do you think are the key challenges that India faces, in terms of delivering a quality education?

Jaideep: Very poor so far. So, education is hugely important in any economy. It's particularly important in an economy like India which has a very young population, working age population. This is the so-called demographic dividend that India is hoping to exploit as it grows and becomes more developed. Something like 100 million people will enter the workforce over the next 10 years, about 10 million every year. These people will need to find jobs and employment, so without education, the economy will suffer and these individuals will not be able to achieve their potential. And so, in spite of that, the education that is being provided as of now is not up to par. At the primary level, there is an organisation in India called Prata which does an annual survey and assesses educational quality. Every year they find that year 5 level students, cannot read a year 2 level text so they are under performing. That is primary education, and if people leave school without basic literacy and numeracy, then subsequent education is going to suffer. It's a very patchy record. You see there are some institutions, particularly those in urban areas where you have high quality schools, you know, you have the curriculum, good teachers, parents are very pushy and the students put in a lot of time and so you have some people who get a great education and higher education institutions that are world class. But that reaches the minority of the population, so the vast majority, 70 percent get sub-standard education.

Interviewer: I think the next theme is a bit more around Education Technology and it's really what are the key elements of a jugaad operating model and have you got any examples of an operating model of jugaad which can explain that?

Jaideep: Yes so you know the idea of jugaad is being able to do more with less. In the case of education, the idea is, can you have better teaching outcomes? Can you teach more kids better with less resources? So that's what it's all about. Or putting it differently can you do more with existing resources, can you make better use of existing resources? One of the big problems, not just in India but in many emerging developing countries, is the problem of teacher absenteeism. Not so much student absenteeism, but teacher absenteeism. So many countries, like India have a state school system, they also have a private school system. The state school system often has infrastructure, they have schools even villages that they are building. They have a cohort of teachers and it's actually an attractive job because you get all the benefits of being a civil servant. You have a job for life, the teachers are trained and it's a pretty rigorous selection process. Students come to school because there is a midday meal, their parents want them to go to school and learn, but the teachers don't show up. So, the resources are there, the system is there but the teachers don't show up because often, they are from a different town or village, their families are in one place and the school is in another place. There is no accountability to the local community, including the parents. Because of that problem you find that a lot of poor people end up sending their kids to private school, these are not very grand schools, on the contrary they are pop up booths you can see these in urban slums for instance in India. Poor people will pay money to send their kids to these schools where the infrastructure isn't great, the teachers are not particularly well trained, however because they are paying, the institutions are accountable to them and the teachers show up. So that itself is a kind of a jugaad solution you might say, it's a market solution, very affordable, cheap solution to a problem. However, you see lots of attempts to address this problem of teacher absenteeism within the same systems. So, for instance NGO's have been working with governments to put in webcams in classrooms, so simple technology, put in webcams in classrooms, so simple technology putting in a webcam that increases accountability because the teachers know they are being monitored, so they have more intention to show up. Or you have attempts to encourage peer to peer learning, where the idea is that older kids can teach younger kids. Often these schools in villages are too small to separate them by years, so the kids of different years sit together. So the idea is that, I don't know if you've heard of the hole in the wall experiment where a person put a computer, just like an ATM machine, but a computer in a slot in a wall. In two days kids had taught themselves how to do PowerPoint, word and so on. These are relatively illiterate kids, so we know that kids can learn and teach each other how to use computers so, there have been many initiatives to help and encourage peer to

peer learning using cheap computers and cheap tablets that don't need to use the internet or Wi-Fi. They come preloaded with things like Kahn Academy which is the entire US school curriculum, which is available on YouTube for free. So you can load these cheap tablets with that kind of material and use these tablets in classrooms, where kids can share them and learn. In Cambridge, you have something called the Raspberry Pie which is a cheap computer which can been connected to TV so in many places, kids don't have access to the internet or pc's but have access to TVs. So you connect these cheap computers to TVs and you can load the cheap computers with memory devices with instructional design, so that's another way. A very interesting solution to the problem for reading is, having same language sub title. So we know that both young people and adults in countries like India are semi-literate. They have difficulty reading newspapers, they have difficulty reading forms that they have to fill out, even though they have been to school, but they watch several hours of television a day in several languages. One way to improve reading and has been shown conclusively, is to have same language sub titles. You are watching a programme in English, you have subtitles in English, if you are watching a programme in Hindi, you have subtitles in Hindi. You are watching two hours of TV a day you can improve your reading skills very dramatically. And so these are just some examples of what might be called a jugaad approach to a problem, where you take resources that are already there, people already have mobile phones, or they already have television, they already have school rooms, they already have teachers and you create some kind of system or solution, at very low cost, to enable better outcomes for poor people.

Interviewer: Excellent, that's very interesting. The next question is what do you think are the key challenges when delivering a low cost, frugal jugaad operating model?

Jaideep: There's a financial challenge of course. Often you are trying to reach remote communities, so we are talking about rural communities. The cost of reaching those communities tends to be high, because it takes time and resources to physically reach those people in remote areas. Equally it takes a lot but you cannot necessarily charge a lot, because you are typically reaching low income communities, so your margins tend to be wafer thin Even if it's not for profit, even if you're just trying to operate as a charity, for it to be viable there is the challenge of how do you manage to address the cost at such low revenue potential? Then of course there are the operational issues, even if you figure out a very low cost operating model that is able to deliver something of value, how do you scale up these operations? How do you do it not just in one or two or three communities, how do you do it in hundreds and thousands of communities. I think that is the big challenge that a lot of jugaad innovators face, many of them because of their commitment to a particular community, are able to come up with some kind of ingenious solution in their community and it works in that community. They are able to sustain it in their community, but find it hard to then extend that model to other communities. That is some of the big challenges.

Interviewer: OK, so this is quite a pivotal question really for my research, because we are talking about high quality education, or certainly improving the quality of education. It's really, a trade off clearly exits between low cost and high quality. Do you think it's possible that a low cost jugaad solution can actually improve the quality of education for individuals, in places such as India, and if you think it can, how do you think it can?

Jaideep: So let us go back to the same language subtitling example. We have schools, we have very large parts of the national budget at the centre and states which goes towards setting up physical infrastructure, hiring teachers, training teachers, all that kind of stuff. Yet the outcomes are abysmal, huge amounts of money are being spent, there is infrastructure, and the outcomes are abysmal because of poor management and accountability. The teachers don't show up and so on. So getting to spend lots of money and getting little from it. Quality, what is quality right? On the face of it, you could have beautiful classrooms, well trained teachers, it appears the inputs are great, but the output is poor. In contrast you could have poor

infrastructure, ramshackle school rooms, you could have teachers who perhaps are not very well trained but are motivated to show up and the kids are motivated to show up, and the kids learn despite their environment. So I think we should look at the quality of what we are getting out, and not the input and that's the misconception of this medication. People confuse the appearance of the inputs and the amount of spending on the value you will get, the value you will generate. The question is how can you get better outcomes? How can you get people who are in year 5 to be able to read in the way that you would expect someone in year 5 to read? And that's where you think of a clever solution, for instance same language subtitles. It doesn't require a whole lot of investment, people are in any case watching television, there is a whole lot of content produced, it doesn't cost that much to get someone to translate into subtitles and then you can scale it, but that solution is key. So for a very little investment, you can get hundreds of thousands of people practising reading as a matter of course for two hours every day. You are bound to get a better quality outcome than you would even after spending vast amounts on the infrastructure. So you know the question is not to replace the system, but how can you do a tweak, how can you leverage what's already there? Another obvious solution is the ubiquitous nature of these devices, so you don't even need a smart phone and you have all kind of applications now for future phones and even basic texting phones. So even in remote parts of India now, practically all households have access to mobile telephony. Somebody in the household will have a device like this, which is somehow connected and smart, and there are tens of thousands of apps to help people with all kinds of things, learning language, arithmetic, getting information. So the question is, how do you make those available to kids, to resources they already have access to, mobile telephony? So for instance learning languages, there is an app called Duolingo where you can download a free app to learn a second language. So there are all these tools and resources, many of which are high quality available for free, and you have kids even in remote areas who have some kind of information technology connectivity. The question is how to put the two together? Just joining the dots of what is already there, you can achieve a high quality outcome with relatively low levels.

Interviewer: Excellent. I think you have answered the next question actually which is, you're suggesting really they're optimising diffused technologies that already exist and just making small tweaks throughout?

Jaideep: Yes, it's joining the dots, and tweaks, and you are asking yourself very different questions, you're not saying how am I going to create all the education from scratch, no you don't have to do that. You are saying how can I get better outcomes using what's already there, that's the difference. And actually it's also another question of saying, what can I develop that I can push out to people to help them learn, but rather what are the learning needs, what are the gaps of people? Then having understood that, how can I combine what's already there in terms of potential solution, to solve their problems to get a better outcome?

Interviewer: Excellent, the next question is, how do jugaad innovators engineer, fugal, flexible and inclusive solutions?

Jaideep: I began to answer that in what I previously said. So the method of working backwards from the context, from the problem, from the need, from the user, understanding that thoroughly. Then designing, looking around to see what are some of the possible resources that I can draw upon that are ubiquitous, and how I will combine those resources to come up with a solution, so that's really what it's all about.

Interviewer: The next theme is around the actual process of jugaad innovation. How is the process frugal, flexible and inclusive? What does the jugaad innovator do to actually achieve those three things?

Jaideep: You start with the context, you start with the beneficiary. So in the case of education, if you were thinking of primary education in a rural community, you would spend time in the schools there, you would assess the quality. There are organisations that could assess the quality of their numeracy and literacy etc,

you don't need to do it yourself; you could try and understand what their problem was, if they are not able to read to the level of their age why is that? Is it because the children are not going to school, maybe they are under nourished, maybe there are pressures at home to work? On the other side are the teachers not showing up, why are they not showing up? Are there no facilities in the school, are the class sizes too big? You need to understand what the nature of the problem is, and when you have understood that, then you work backwards to see what can be done using existing resources to solve the problem. So you try out the initial solution as quite likely to work first time around, you integrate it, this is consistent with all other principles of customer centric design, user centric design, design thinking. It's also consistent with lean start up, where you come up with a reliable solution.You offer it to the beneficiaries, see how they respond and on the basis of that, you improve. So all these jugaad solutions require that engagement with the community or beneficiaries, close engagement. In the process you are figuring out how to get the outcome you want to improve quality outcomes, while reducing costs. So doing this in a frugal way and inclusivity, you are reaching people who wouldn't have the benefit and needs satisfied, and you're figuring out how to do that in a frugal way, and that requires flexibility. So all these ideas of user centric designs, design thinking, minimum viable product, lean start up, all these come together to ensure that you come up with what's needed, that's at the heart of the jugaad approach.

Interviewer: During the process, what can they actually do specifically to be frugal in that sense, how can they strip costs out?

Jaideep: So you are constantly having to ask yourself the question of how do we keep this viable? One way you strip costs down, in principal very broadly, don't try to use resources. Your solution should not require resources that a scarce. You should at all points try to use resources that are available in that context, to substitute for things that are not available in that context. So if technology is not available in that context, what can you use to substitute? If people are available in that context, can you use people to substitute for technology. If the teachers are not available in that context, can you use parents and students to substitute? Can you use some kind of teaching assistant? That is the question you're constantly asking yourself, your solution would not be sustainable and will not be frugal in that sense, won't be sustainable or viable if it requires resources that are not available at the point of delivery. So a very big component of a lot of these frugal solutions, regardless of the context of whether they are in education, or energy, or financial services or whatever, involves using local people as part of the solution. A classic example is micro finance, where the women from the village form a self-help group where they jointly pool their resources and they jointly police each other. They jointly ensure that they repay any loans that they have taken. It's a huge cost saving which improves the quality of the outcome, there are fewer defaults on loans but it reduces the costs of monitoring the loan. So there are principals like that, but the overarching principal is one of using resources that are available there, instead of those that are not. Another example would be again for a school, a bank, often having to create physical infrastructure is expensive, setting up a bank branch in a village is expensive. Setting up a school in a village is expensive. You take advantage of assets that are already there. Banks for instance use local corner shops, similarly with schools you can imagine using the local government offices, or use a mobile company to deliver additional training to kids or teachers. So there are all kinds of ways that you might use resources that are available, to substitute for resources that are not.

Interviewer: Sure, I wanted to dig a little deeper into the flexibility side of things as well. What do they do that is flexible, because reading the book the principle of flexibility is not vague, but I wouldn't say I understood it that well?

Jaideep: The word flexible, is about lateral thinking, it's not about linear thinking, not about doing things from scratch, it's about lateral thinking, it's about improvisation. Thinking differently, outside the box. A classic solution to the problem of poor reading advances, would be throwing more money at it, hiring more

teachers, spending more time with students, that would be a linear approach, which is not going to work in this case. Even if you hire more teachers, they may not show up, so you have got to think laterally. One flexible solution is you have parents help, or you have peer to peer learning, or you have webcams in the classrooms to monitor. So you have to think outside the box. Operationally, whether instead of actually putting in a supply chain of teachers or monitors who go from the city to the village, you work backwards, you have people in the village itself doing a lot of that work. So flexibility is also about responsiveness, when we talk about lean start up principles, there is that as well. It's non linear thinking and non linear acting, what flexibility is about. It's also about modular design to some extent where you can move things around, so you can also think of it as agile, that's another word that is used, so you can move parts around. Flexibility is shorthand for all those things.

Interviewer: Sure, I think we have covered inclusivity well. Do jugaad innovators work alongside the marginalised individuals when they're doing the process of innovating and developing these solutions, so if they didn't they wouldn't fully understand their needs? So I was wondering do they, and if so how, and do you have any examples of that or how would you explain that?

Jaideep: Absolutely, You have to work in the co creation process, working backwards from the needs of people. You are understanding their context, you then offer a solution and you iterate their solution with them. So you are absolutely doing it side by side. Which is why you see a lot of people who are committed to a community.

Interviewer: So the short answer is yes they definitely do work alongside?

Jaideep: Yes, it's a crucial part of the approach.

Interviewer: The next one, is around this idea of commercialisation which obviously for jugaad innovators can be quite difficult. I was wondering how do they go about actually commercialising their innovations, because by definition, that is what an innovation is, the commercialisation of a new idea. How do they actually do that?

Jaideep: That's a good question, that's the sticking point. This is linked to the point about scale as well. Often, if you think about start-ups or social enterprises, they start with a particular community they have a commitment to. They develop a solution in that community and it may work in that community but then if it has to scale and commercialise, it has to go beyond that community. And that's when they often struggle because they don't have either the motivation, or the capabilities, or resources to do that. So this is where you tend to have many opportunities for partnership. If you look at larger organisations on the other hand, they have almost the opposite problem, they have the resources and motivation to scale, but often not the time or motivation to really understand these individual communities and develop the solutions around them. You have the possibility for interesting partnerships between NGOs, the social innovators and local communities, these little pool solutions and the bigger organisations that can scale them. So that's really how one could go about doing this is that, it could be the government too, it needn't be private sector organisations. It could be bigger NGOs or governments that are seeking to leverage the ingenuity and deep knowledge of these individual entrepreneurs, to find ways to scale, taking government apparatus and scale up. So same language subtitles for instance is something that could easily be scaled by a government, TV company things like that.

Interviewer: What do you think are the key limitations of using jugaad, and in the sense of my research question in terms of jugaad and EdTech to solve the learning crisis? If you were thinking about key limitations of taking that approach, what things would you say?

Jaideep: First of all I would say it takes a lot of time and commitment, the approach requires people to be really committed to solving a problem in a community against the odds. You do see a lot of people trying solutions all over places like India. The next problem becomes how you scale them, how you identify the ones that are really working? Scaling is the major challenge because individual entrepreneurs can't do it themselves, you need larger organisations. The way in which large and small work together is not a trivial exercise, you still have operational challenges.

Interviewer: I know you have talked about examples of jugaad innovation with EdTech, do you have any more examples, in any other context around that?

Jaideep: It's very interesting that you can have the same kind of approach in the west to address a similar problem. So if you don't know about the Raspberry Pie story, you should read about it, the Raspberry Pie was developed here in Cambridge by people in the University in computer science, who noticed fewer kids were applying to study computer science. Even the ones who did apply had no experience of tinkering with computer hardware or coding. So they set about trying to address this problem and developed a device for them to play with. If it broke it wouldn't be a big deal because it's so cheap, and equally because it's so basic, they would have to tinker with it and learn how to cope. So they developed this, initially for about 30 dollars, about £20 and now they have a £5 equivalent. Initially they thought they would sell a few thousand, but they sold 7 million. They developed side by side with that a full network of code clubs, these are volunteer clubs where in schools in the UK, U.S. and Ireland and so on they teach kids coding using volunteers. This is a classic example of a jugaad solution, it's trying to solve a problem. In the Indian case we were talking about how kids in year 5 can't read and so you can have subtitling to help them to read. Here you have kids who are learning coding, and coding will be a vital skill that we will all need. They are solving this problem highly affordably, using very cheap computers, but again using volunteers. This is a point we were talking about in India, where you use the resources you already have, people in local communities, parents, coders, who then volunteer to go into schools and teach kids coding. The Raspberry Pie Foundation now reaches about 20 percent of UK school kids between the ages of 9 and 14. Often these are pre-existing code clubs, that they have co-opted. Keeping things asset light, acting flexibly, all these principles of jugaad we were talking about, can work even in a US/UK context and a developing country context.

Interviewer: I'd like you to expand on something, to go back to question 7, specifically for each part: How does a jugaad innovator engineer a frugal, flexible and inclusive solution? Specifically for each bit?

Jaideep: Frugal and inclusive are achieved by being user centric, by using design thinking principals and really understanding the problem that you're trying to solve. That helps with the inclusive bit, do you really know why people are being excluded, why the school kids are not getting the education they should? Then understanding that problem helps you to think about a solution that solves a problem, that addresses the inclusive bit. But equally in order to solve the problem systemically and sustainably you need to think frugally, you need to think cleverly. You need to find ways to economise, you need to find ways to make this viable. And those are some of the principles we were talking about like with the lean start up. The idea that having understood the problem, you come up with a solution that takes existing, pre-existing resources and connects them in some way. The model often to make that work, you need to think flexibly and organise flexibly so that's how the three intercept.

Interviewer: Thank you very much.

Appendices 3 - Clémentine Vignault Full Interview Transcript.

Interviewer: To begin, I would like to start by asking for your informed consent to partake in, and audio record this interview? I will be using the recording to write a full transcript of today's discussion, which will be used for educational purposes only, forming a constituent part of my final-year dissertation research [Clémentine agrees].

You also have the right to confidentiality and anonymity. You have the right not to answer any question if you don't want to, and the interview will be stopped if you so wished. I will happily provide you with a summary of the research findings. This will be around mid May 2018.

The Research aim is 'to investigate how combining jugaad innovation with EdTech, can help solve the 'learning crisis' in developing countries'.

In terms of progress to date, I have completed the literature review and I'm now in the final stages of collecting the primary research.

Interviewer: So I think to start with if it is alright with yourself, could you give me some background information on yourself, who you are, what you do and how long you have been doing it for?

Clémentine: Yes, so I'm the founder of Slate2Learn. I have been working on this for the past 3-4 years. What we do is develop Education Technology in India, especially adaptive learning technology. As far as I'm concerned, my background, I'm trained as an Engineer and an Economist. I've been running an IT company in India for three years and I've also done a lot of research actually in developing economics in various countries, including India, roughly that's about it.

Interviewer: Excellent. I think we shall start with theme one which is all around education quality really and how would you define what education quality is in a developing country such as India, what do you think constitutes that?

Clémentine: That's a very complex question, to be honest, because it's contextually driven. It depends what the goal of education is, and various people see different aims in education in India. So in that way, if you want to measure quality or to be able to describe quality, it's related to an aim somehow. And so broadly speaking, I would say there are two ways to look at education. One is the middle class and aspiring middle class way to look at education which is, getting the highest possible grades and getting to a good university. So education, the purpose is sorting people, getting through this huge mass of people who are struggling to get into the best institutions. If you go from a middle class perspective in India, this is the

most important, it's like getting the highest grade possible at every single level to get into the best possible school, so in the end I am going to get a good degree that's going to have value and get me a good job. That's not the perspective we take, it's the perspective most people in India take, but not us. The perspective we take is the perspective of the rest of the population which is, what do I need to know to be more skilled in my life, to be able to do the things that I wouldn't be able to do if I only learn what my socio-economic background may lead me to learn. It's a very different perspective here because you are talking about knowledge, the value of knowledge and skills like broadly speaking skills, I'm not talking about using a screwdriver, I'm talking about key things like key skills like mental abilities. These perspectives are important to be taken as well, for the people who are not going to go to the top universities in India, but still need to be educated because we need to increase the level of skill in the Indian workforce. So that way I would say quality is going to be how much more will they will be able to know and understand than if the children go into work in a firm The usual educational background, which is still today mostly based on work learning. So that's the way we define quality, being able to bring a higher level of person centred understanding, a higher level of skills and a higher level of knowledge in children. So at the level we work, we focus on primary education, for instance, if you take an area like mathematics, it means getting the first foundations and concepts right. Have you been educated in the UK Tom?

Interviewer: Yes I have.

Clémentine: OK, so in the UK I'd say something which is not really a problem so much because I would say most children will go to primary school, and then go on to secondary school and the concept is the foundation of mathematics will be acquired. In a country like India it is not the case, you have children who go through their entire schooling and do not acquire those concepts. So it's very tough for them, it's a huge number, so that way, focussing on those concepts in India doesn't mean you educate primary school children, it means you make sure everybody has the primary education concepts right at any age.

Interviewer: Right, I will move on to the second question now. That is, how would you describe the current state of education in India? What do you think are the key issues facing educators?

Clémentine: In India, We have government schools and private schools. I'm going to focus on government schools and low end private schools. There are different types of private schools. The government schools have a lot of problems, one of the most basic ones is the attendance rate of the teachers. They are still struggling with the teachers being there in the classroom. That's problem number one. Then when the teachers are there, there is another problem, you have a lot of poorly qualified teachers. Some of the teachers are not especially very capable themselves or have the old school approach to education. There have been curriculum changes, but some teachers can never immediately understand it, so they teach it in the old fashioned way. Then there's the fact that the government are employing a lot of contract teachers, to avoid hiring public sector, which is more costly. These don't go through the same training programme, so a lot of them are almost like trainees which causes a problem. The third problem is the fact that you have a high difference of levels in the classrooms. Say you go into a grade 4 level class, you will have some children who are still at grade 2 level in it, and you will have some children who are very good and could be in grade 5. The percentage of children at level 2 will be at 30-50% so it's very difficult in the classroom as there is a policy of not failing children. So what happens is you have a teacher who is going to teach a class of 40-50 children and a big chunk of them don't understand what's going on. For example he is teaching division and they don't know how to do a subtraction. So this is a huge problem in India. So there's 50 children and say 25 can't understand, so he needs to teach subtraction to others. So they carry on not understanding year after year which is why in the end, you have a big chunk of children being failed from grade 2 and who never catch up and never learn grade 5.

Interviewer: I understand. So the next one along the last theme is, how do you measure learner outcomes, is that purely through assessment marks, say Maths or English, or do you measure it in a different way? I know you initially were focusing on building skills, so I'm interested to know how you actually measure that?

Clémentine: Yes, we measure learning outcomes through a system of knowledge competence which basically every curriculum can be divided into a micro learning competence and knowledge competence. We have assessment systems for each of those. Generally speaking measuring learning outcomes, you have a standard way to do it. You can do it roughly at a level you can identify what are the key ABD's or knowledge that they should to know at this age and a list of questions to assess that. Or you can do it a level like unit or knowledge perimeters, we do it very kindly in our system because we need to have a very granular understanding of children's knowledge state. I don't know if you've heard of an organisation called ASER? They are the biggest Education organisation in India, non government organisation and they carry out massive learning assessments throughout India. They assess and have a representative sample of every district in India, every type of school, and they publish that every year which gives a very good benchmark. We use those results to get information on what the knowledge will be of the children we are going to work with.

Interviewer: Very interesting. I think we will move onto theme two now which is around education technology. The question I'm really interested in is, how does your operating model work in practice, Slate2Learn, your company, how does it actually work?

Clémentine: So that's tricky because we are changing it. We've been experimenting with a lot of models in fact. One of the models which we used from the beginning has been to create some kind of digital learning centres. So people in their house would rent an after school learning centre and the kids come and would catch up with their school in the centre after school has finished. School finishes at 1 or 2 pm in India in most places.

Interviewer: It's an additional, after their main school?

Clémentine: Yes, yes. Digital education is not something that's very mainstream as of today, so parents don't take it very seriously. Sorry to be messy here, going after school to do some more learning is very common, I would say almost all kids do that. So that way the after school learning system is not at all marginal, it's like mainstream in India. However the way it's being done is, they will have a book in which they are going to do their multiplication tables again and again. That way it's very difficult to introduce an alternative learning system in this context. If you're going to do that you need someone, the person who is going to run the place, to be able to explain to the parents what the benefit of it is. We found that the target population running those centres is not able to do that, and not really able to explain what is different and how it works and why it's better. That means parents are not willing to pay for it, or engage in this kind of education and these centres are very difficult to sustain. So if you want to have them running, you really need to finance them entirely, that's one of the problems. The other problem is it's very difficult to scale such a model.

Interviewer: Sorry, the centres you are talking about, are they the digital centres that you run or the ones students go to now?

Clémentine: Generally speaking about the people who run those centres.

Interviewer: Is that the centres you operate?

Clémentine: We pick people who are already in the education sector, so it's the same profile of people. Another problem is they have a very unpredictable life. A lot of these people are generally young people who cannot finish high school, and who are doing part time studies, these are the most common profile of the people who teach in these places. They are very unpredictable in the sense that you can plan something with them, and then three months later it all falls apart because they are doing something else. There's a very high cost of running it because you need to recruit new people all of the time, and you need to shift children from one place to another. There are high recruiting costs, so we are moving away from this because that we thought that we are never actually going to be able to really scale this model. We can get it running, but running costs are very high.

Interviewer: So you are moving away from that Digital Learning Centre model?

Clémentine: No. We still have some centres running for the purpose of testing of software because it's a very direct environment, we have direct contact with people who run the centres so we can easily control the learning environment, which means the testing is good. For scaling it doesn't work. So now we are starting to work with people, with intermediaries in fact, people who already deploy education technology. It can be a government agency or an NGO, who already has a network of educational places, so that's the model we are focusing now on.

Interviewer: Sorry can you speak more clearly please as I am having trouble understanding what you are saying.

Clémentine: We are moving to a model where we are working with intermediaries, people who already run educational places on their own, or who work with the Government to implement education and technology projects in government schools. So that's a new model we are working on. If you want to do both developing technology and implementing, it's very challenging as both things themselves are very challenging, so it's difficult to take on board both at once.

Interviewer: Excellent: I think you have answered some of the key challenges in running this model which is good. So what low cost education technology do you use, computers, phones?

Clémentine: You mean devices? We use Android tablets.

Interviewer: What is it about the tablets, is it just low cost, what's the rationale?

Clémentine: Yes low cost, portable, what we do also works on all android devices that way, it's just that kids generally don't have access to a phone. Some do, in that case, they can also do it at home with phones potentially. Tablets have become the thing in India, everyone is using tablets.

Interviewer: How do you optimise the use of those tablets, how many do you have, how do you use the tablets the best way?

Clémentine: We do a slot system in our centres, the kids have 40 minute slots and that's it, then the next kid has it. So that's what we do when we have full control. It doesn't always work like this because the government doesn't want to have slot systems for the government schools. It's one of the key challenges actually, optimising device use. I've been involved with a lot of projects in India with education technology and I've seen so many situations where tablets are only used once a day for half an hour. The rest of the day no-one uses them.

Interviewer: Why is that, if they are there to be used, why are they not using them?

Clémentine: Why? Because government teachers only want to allocate 30 minutes of their schedule where kids are free use the tablet and that's it. They have a massive education technology programme which they have deployed themselves in government schools, I think across several thousand government schools. They are piloting it at the moment. I went to visit in September and the reason why they are only using it for half an hour a day, is just because the teachers wanted to go half an hour earlier home. They only allocated the last slot of half an hour at the end of the day, where they could just leave, and get someone else to run over the whole thing, it's convenience.

Interviewer: So this new model you are working on, is around working with intermediaries, just so I can understand, the old model you were running was effectively digital learning centres where you would run it just yourself, and students would come in and use the tech to effectively learn?

Clémentine: No sorry there is a misunderstanding. We were not running it ourselves, as in it's not our staff. We were recruiting someone who we would call teacher entrepreneurs, they would be running their own centres, but we had an agreement with them. We were lending the hardware to them and software, and they had some guidelines on how to use it. It was not our staff, it was a private business if you want. Our staff were only there to open the centre, train the teachers and solve technical problems.

Interviewer: So that was the old model, and the new model is where you are working with intermediaries, so can you explain a bit around the new model again please?

Clémentine: Yes there are several things we are exploring. One is we are going to release an app in June. We are going to work in diffusing it, so that way we don't work with the end user, we work on making sure we have a maximum number of end users, and that they are satisfied with the experience they have. Another model is we go and see an organisation, say for instance Prata and we say, do you think you could use this app in your context? We can deliver some training on how this app can be used and how it fits in the curriculum and all these things. But we don't run the programme, we don't deal with hardware, we don't deal with convincing teachers to use it because that's another level of intervention.

Interviewer: How are your learning solutions frugal? What is it that your company does, that means you keep everything to a low cost, very simply the bare basics, what do you do to keep the costs low within your company?

Clémentine: The hardware is low cost, it's the most obvious thing. We have a lot of ways of thinking through cost aspects. One of them is, it should not use too much data, for instance, internet. In our centres for instance, the model we have is, we have an off line server, and the apps download everything from the off line server, so it's local server level, so that it's low infrastructure meaning low cost as well. One of the main differences beyond cost is low infrastructure, which is linked in fact. Because you are working in a low cost environment, which means that the infrastructures are shit. So it actually adds costs to you, the provider. This is one of the challenges. For instance you cannot take electricity for granted. So when you are using technology it's a big problem because you could have no electricity in a school at all. A lot of them are not connected to the grid, that means they have no electricity at all. If you want your tablets to be charged you need a solar panel solution or someone coming and going with the tablets.

Interviewer: So that's roughly what you do to keep things low cost, do you think those are the main points?

Clémentine: It's not low cost for us it's high cost, it adds costs, you need to deal with low cost environments. So I think it's a very important point, I'm not sure your question covered that, but you should definitely think about it. Another aspect of low cost, is in the development of technology itself. For example the expectations of the end user in terms of the graphics, would be much lower, it doesn't make sense to invest a lot of money in high graphics design, if the end user doesn't expect high-end graphics.

Interviewer: Sure, I think we will move on to the next question if we may. How are your learning solutions, the tech you have, how is it flexible? What do you do that's flexible about how you work?

Clémentine: Flexible, in the sense that we are flexible to different environments, typically we don't take electricity or internet for granted. We are flexible in the sense that we cater to several use cases, but at the same time it's very difficult to cater for an infinite number of user cases, because it becomes very messy, so that will be not that flexible either. We have picked a set of number of user cases and we deal with those, and the rest we don't deal with. So I don't see anything else to say on that.

Interviewer: How are your learning solutions inclusive, how to they actually include these people, so the models you run, do they pay for these solutions? How does it work that the people you want to educate get educated in terms of it's inclusive, it includes the people who need to learn?

Clémentine: So for us, our philosophy as a company is we want to teach everybody as much as it's possible. So we are very inclusive, as opposed to a lot of other players, because we are trading as a not for profit. So what we do is try and subsidise as much as possible, by getting grant money actually. So I would say we are as inclusive as can be. In terms of the previous model that I was describing to you, the teacher. We didn't want to pay the teachers to do the job, so we wanted the teachers to get paid through their activities. So they wouldn't pay for the hardware or anything, so we wouldn't get any money. But we didn't want to, on top of not getting any money have to pay them.

Interviewer: So who paid them?

Clémentine: The parents, just the way they pay the teachers as normally, it was even a little bit cheaper than normal tuitions were.

Interviewer: Excellent, I think we will move on to the next question now, this is the pivotal question of the interview, well certainly one of them. An obvious trade off exists between low cost and high quality, and do you think personally that low cost education technology can improve the quality of education for learners in developing countries such as India? Do you think it can, and how do you think it can? And that's a really important question for this whole interview really.

Clémentine: So it depends what you call low cost. There is low cost, it depends what costs you cut. So that way my answer will be yes, if you don't cut the essential bits.

Interviewer: And what are the essential bits?

Clémentine: The essential bits, you can't cuts costs on typically pedological insights of the person, you can't just have a random person you pay nothing to do content design work. Actually in India there is a lot of that. If you look at what content is available locally, there are a lot of people who know nothing about education. That's a problem. So that way you can be low cost when you design and develop it because, you can cut on graphics. You can't cut on pedagogy, you can't cut on getting the right content for the context.

Getting the right language that they can understand, and getting the right learning progression. In terms of the hardware, can you learn on low cost hardware and my answer is definitely yes, we've done it, it works. A bit more annoying of course than high end devices because you have a bit more intervention.

Interviewer: More what, sorry?

Clémentine: More intervention to do like things to be replaced.

Interviewer: Because it's low cost technology?

Clémentine: The tablets we use in our centres are about 3000 rupees, about £30, works well enough definitely.

Interviewer: Do you have any actual evidence to say you have used these tablets and what have been the results of using them, do you have any actual hard evidence of improvement in learning?

Clémentine: The improvement in learning doesn't come from the model of the tablet that you use. It comes from what you put on the tablet. What I can tell you about the use of the low cost tablet is, in terms of them doing the job, kids being able to access the content, its been very good. We've had maybe one tablet replacement out of 20 in 18 months in average. So not bad, and they work. The touch screens are functional, they don't crash. So using low cost tablets can work, you have to be careful picking the right tablet for the right context, you have to choose which features are important in your project. For instance, a high-end camera is definitely not important for us. After learning outcomes, this is linked to the content.

Interviewer: So the whole point around quality is solely based on content you think?

Clémentine: Yes, this is really the main issue, content. First is Pedagogy and second, does your design fit your context or not? Context means, is it appropriate for the target, the socio-economic background of the kids, is it appropriate language that they can understand? You have to get something that fits with the environment and still have perfect pedagogy.

Interviewer: When you say actual pedagogy, which is teaching, actual learning isn't it. Can you explain what you mean because you said around the user experience, in terms of content, there was a second point, actual pedagogy. Can you explain what you mean by that?

Clémentine: Yes, what I mean is the speciality of what we do is there, the core of what we do. There are lots of ways of using education technology for learning. I suppose you must have experimented with a certain amount of software yourself?

Interviewer: Yes.

Clémentine: Maybe you have tried something like Duolingo, maybe you have tried something like Kahn Academy. Education technology per se, has various different goals. Each software has it's own objective. A lot of this software, the more high quality ones, they have an objective. A lot of software typically, they focus on practicing for schools. They will focus on the children practicing a certain skill, not on the children acquiring that skill from scratch. This means if you take a child who does not know this thing, he will not learn it. If he has already understood the concept, he is then going to practice it, he's going to be fine, he's going to improve. If he has not learnt it, he is not really going to improve, so very few education

technologies work on teaching children new concepts. Very, very few. Very, very few are successful at that, because it's very tricky.

Interviewer: Why do you think they are not successful, what are the reasons for that?

Clémentine: Because teaching through education technology is difficult, because you don't have this human interaction that you have when you have a teacher. When a teacher, say in the UK, the teacher will interact with a child. They will teach something and then they will try and understand what the child has not understood. Then they will adapt the course to the level of understanding of the child. A good teacher is able to grasp at what level of understanding the child is at, and then adapt. They can give examples etc. When you are developing a technology, the biggest shortcut people take, is to create a video where you explain concept. A video that explains a concept does not have this potential at all. If the child is going to watch the whole video, but does not understand at some point, then she can watch it again. A lot of children might not even watch it again, they will get bored, that is actually how it happens and that's it. Having this interaction, this questioning, adaptivity that the teacher can bring. Building technology where you really want the children to learn, means you have to go beyond that and go beyond a video. So you have to basically do two things, one is map out what are the different knowledge states that the children can go through, two is measure. So bring knowledge and measure at what stage the child is, and adapt whatever you are going to deliver to the child, to the level that the child has reached.

Interviewer: Can you repeat those two things one more time please to make it clear. You said the first one was map out knowledge?

Clémentine: Yes.

Interviewer: In the sense of what, what do you mean by that?

Clémentine: I will give you an example, say I want to teach children to do maths and be good at calculating 7 + 5. It might seem simple but it's not. In fact there are a lot of strategies associated with calculating mentally 7 + 5 which a child needs to acquire. The most effective strategy for calculating mentally 7 + 5 is to be able to take 5 as 3 + 2 and add 3 to 7 to make 10 and have 2 units left. Someone with good mathematical abilities, we like to do that type of thinking, it's good mathematically. So what does it mean being able to do that, it means you have to know how to create a 10, and to get to 10 you need three. You need to know how to get 5 into 3 and 2 and you need to know how to associate 3 with 7 and keep 2 and that you have one 10 and 2 units which makes 12. So there are actually a lot of smart answers behind that. If you want to be very effective at teaching maths additions, subtractions is going to be very similar, you need to have methods, concepts and check that the children have understood and gone through these individual small concepts, before assessing whether they are able to do the whole thing.

Interviewer: So you're saying it's knowing all the possible combinations of how to do something to be able to do it?

Clémentine: You don't need to invent them, they already exist, people have already done those things, a good text book already has that embedded in it, a good maths text book at primary school level will already have that. So you don't need to reinvent that, but you need to go and have a very fine grain base of concepts where you shouldn't just think broadly relating to addition. That means you know, I'm going to add one unit at a time so I do 7 plus 1 plus 2 plus 3 plus 4 plus 5. You need to go beyond that, you need to think the way text books are going to think. Very few education technology content developers do actually think through those things, it's surprising.

Interviewer: I'm still struggling to understand what you are saying for mapping out knowledge, I'm not understanding it fully. I'm not sure what you mean by mapping out knowledge? I don't know if there is a succinct way of saying what that is? Is it that the technology can't explain it well enough, is that what you're saying?

Clémentine: No I'm not saying anything is limited by technology. Technology has infinite potential in my opinion, my point is I'm not trying to tell you technology can do that, I think that it can be better than teachers in fact because, with machine learning eventually it will do it better. The problem is we need to invest in creating a learning programme that handles those things. Not just a mac programme that's going to teach you at a very proficient level. This is costly. You can do that low cost as well.

Interviewer: Yes, I'm just trying to understand. Just going back to the mapping out of the knowledge. I don't know if you can try to explain that one more time in a really succinct way, you were talking about going beyond the video, this is the point related to how we can do that, which is mapping out the knowledge, I'm just trying to really understand that.

Clémentine: Have you gone on our website? There is information on our website. We have not invented the whole thing, there is theory on that. If you're interested you can have a look. I suggest you would read that, I will send you the link.

Interviewer: Also going back to the bit around your models that you mentioned at the beginning, is that also there?

Clémentine: Our model?

Interviewer: The operating model, how your company works?

Clémentine: Very succinctly, however, from the context you will have a lot more information, these bits of knowledge, it's quite well explained.

Interviewer: On the mapping out the knowledge?

Clémentine: Yes.

Interviewer: OK, there was a second point, which was measuring learning outcomes?

Clémentine: Yes, so if you want to give the right information to the child, have a look at our website for that, there is something called scaffolding education which means that, you bring to the child the knowledge of the learning experience that's the most appropriate, to the current knowledge state of the child. So to be able to do that, you need to know the current knowledge of the child. You need to be able to measure at what stage the child is all the time, continual assessment. So that whatever you bring, it's working with the knowledge state of the child.

Interviewer: So how do you do that?

Clémentine: You measure, you take data on every click and you interpret that data.

Interviewer: So it's data analysis?

Clémentine: Yes.

Interviewer: I see, excellent. I think at the end we'll go back to the operating model briefly so I fully understand that, because I think that is going to be a crucial part of this interview. So now we will go onto the next theme, which is the innovation process. You talk about developing content that's relevant and all these different things, how do you actually do that? What does the process you go through actually look like to create the content that you display on these tablets, how do you go about doing that?

Clémentine: So that's a very good question. We have a process which is iterative, in the sense that we create, one aspect what we do that we haven't gone through, so what we do is very experiential in that sense, the children are going to experiment with some kind of virtual manipulative and construct their knowledge through their experience. So this kind of learning environment is a micro learning environment, there are many of them for a programme. They require a lot of iterative process to be designed, so the way it works is that, we have some ideas that are mostly raised from looking at research on a topic or text books. Then we design a scan of experimental environment. We can design as quickly as possible in a rapid prototyping type of thing, then we try and get some kind of learning path through it quite quickly. Then we go and get it into the hands of some children who fit with our target, socio-economic group and language group, so that's through our digital learning centres. Once it's in their hands, we measure a number of things. We measure and assess whether the environment is clear, they understand it, they are comfortable playing around with it. We see whether there are some particular misconceptions that they raise and how we can tackle them through the environment. So once we have measured the first thing, we create a new version which incorporates those things, then we do as many loops as required, sometimes 2 is enough, sometimes 2-4.

Interviewer: That's really interesting because that fits perfectly with what jugaad innovation actually is. Because it's inclusive, you are involving the learner who is going to be using it, it's flexible, because you are iterating all the time because you can chop and change. There is one more question really and that is, how is that process frugal? Because it sounds as if it could possibly involve some higher cost, because you are constantly changing it, so what is your consideration there?

Clémentine: Experimenting in a local setting in India is cheaper than experimenting somewhere else, just because the environment is cheaper, it's frugal in that sense. The design process, whether there is anything low cost in it, no I'm not really sure. In the end it comes to a lower cost than if you're starting to do something and investing a lot of money in it, and then not testing it and then figuring it's wrong and having to restart it from scratch. So that way, by trading and testing it as early as possible, you limit your costs.

Interviewer: Yes that is a very good point, I didn't think of that.

Clémentine: That's what software developers do, that's not specific to us.

Interviewer: I think that's pretty good, is there anything else you would want to say around your innovation process to develop your solutions, or do you think you have covered the main points?

Clémentine: I would say that's the main things. One of the main points I would like to make in your overall enquiry, is that there are certain things you can do low cost, others you can't.
Interviewer: OK.

Clémentine: If you are trying to do everything low cost, including the creative process, like the actual design part, it's not going to work.

Interviewer: Is that content design?

Clémentine: I mean, content meaning everything which I have explained about mapping out to knowledge competence and designing these learning environments that fit with the particular learning objective. You can't just do that low cost, as in low cost, as in low skill. I mean low skill, you can't get low skill to be able to do it. You might be able to get high skill and lower price, but not so much because, when it comes to high skill, salaries even now throughout the world. You take someone very highly skilled in Bangalore, you have to pay them almost as much as someone of the same skill set as the UK.

Interviewer: OK so the creative process, the actual design cannot be low cost really?

Clémentine: I don't think so.

Interviewer: So what on that front, what do you think can be low cost, if not that, would you say low cost in terms of the delivery of it and the overall model of operation is low cost, or what do you think are the key elements of low cost?

Clémentine: There are a certain number of things you don't have to pay as much for, as when you develop education technology say for an American child for instance. What I was saying, delivering graphics that are expected to be for the child to be able to attain is much lower, the children don't have much experience. I think a lot of the children have never used education technology before, so that they don't expect the design, they don't care about that.

Interviewer: So the graphics are not that important. What else do you think could be low cost, we've got the model and the graphics, is there anything else you think that's important for low cost, you can do low cost in that sense?

Clémentine: No you have to think also of frugal innovation, as it's a lot about objects, like designing low cost objects and I'm meaning like, a health care kit or sanitary pad or whatever. So there is a unique cost to that. So it does matter that when you produce it, it's cheaper. With education technology in India, if you have an indication that Education technology say for instance in Hindi, which is our number one language focus, you are dealing with 300-400 million kids. With one technology, it's infinite the number of distribution, this isn't the cost for each, but it's not the same thing, it's not a unit cost, it's one cost for everybody. So that way it's different, unique economics. You also need consider that, you're developing something that's potentially going to be used by 300 million kids. Per child cost is going to be very low.

Interviewer: So you're saying because it's Ed tech it's hugely scaleable, yes?

Clémentine: Yes because it's infinitely applicable it's not a physical object, however the cost of the tablet matters much more. Because there will be a tablet in the hands of every child, if you have 20 million children or 300 million children, it's not the same number, so it does matter.

Interviewer: Ok so the next one we will go onto is around, during your innovation process which we just spoke about to develop the content, the learners do participate in the idea, because you are always iterating it and you're always getting them to test out what you're learning to make sure it's applicable and works, yes? So the next question is, how do you actually commercialise your solutions? How do you take this

piece of content which you've just developed and how do you get it up and running within the market for EdTech?

Clémentine: You mean, how do you reach children? Or how do you make money from it, that's a different question?

Interviewer: Could you answer both?

Clémentine: We don't care about making money from it, from the end user, because as I was telling you we are focusing on being grant funded, so that way it's a very deliberate choice we made about a year ago. For the first two years we were not sure how we would end up, but we have realised that if you try and do a product which is going to be user funded, and you are targeting the bottom of the pyramid market and up, you can't produce quality. Because the market is geared towards placing low quality content for the reason that, the user is not able to judge by themselves what is good content, what is not. Therefore commercially speaking, if you invest more into producing more high income, you are going to loose out in the market, because someone else will come with cheap content and undercut you, and not choose you, because they want the cheapest.

Interviewer: So just to reiterate that, the idea is you're grant funded because that means you won't be undercut by going for lower content produced?

Clémentine: For us that's the only possible way to produce quality content. In a commercial environment, if we were user funded, if we are for profit, you are going to have to produce cheap crap.

Interviewer: That's really interesting. Is there anything else you would like to talk about regarding the commercialisation?

Clémentine: No, we made a clear decision we don't want to go through the commercial route and so the way we do reach is, in the future going to be through working with organisations who understand the value of what we bring.

Interviewer: So is this your future model you are talking about?

Clémentine: Yes so that's the main objective, to reach out to learners, is to go through learning routes, probably mostly government school routes, but potentially also some big NGO's who employ education technology and that's going to be via their own network for reaching the learners. Physically borrowing someone else's network. If you're a not for profit organisation, that is the best way to do it. If you are for profit, it doesn't work so well, because people need to make money out of us.

Interviewer: There is one more theme that I've got, then we will go back to the bit around the operating model so I really understand that. The last theme is around examples and limitations. So you have talked about using tablets, do you use anything else, or can you think of any more examples where you use jugaad and EdTech, so jugaad around frugal, flexible and inclusive which is what you do definitely. Can you think of any more examples of EdTech you use apart from the tablets, or are the tablets the main thing?

Clémentine: It depends what you define as education technology because, if you go beyond digital devices, then yes there are people who do other things. For example there are some people who do very interesting things with creating small experimental labs for children which are portable like I can think of Acastia, that's another organisation in Rajistan for instance for more high school students. They have some kind of portable experimental kits or models for example, models of the body, or physical experiments and then

they have those kits which they give to teachers, which are low cost which are pretty cool. You can think of that as education technology, if you think broadly about technology. In terms of digital, I would say the only alternative to what we do is, to use a laptop or desktop. Desktops are difficult to operate in Indian context because of the electricity problem, and you need a room for it, which is space. Schools are not very big, so you need to find a space for them, then you have dust and humidity. If you rely on a desktop model it's going to be a struggle. Laptops are easier, but a bit more expensive, there is a choice. I know this distinction is going to be available soon but, it's kind of a different thing to have a proper keyboard and a screen versus a touch screen. In the context of what we do, we find the touch interaction gives a richer interaction, we do a lot of drag and draw, so it feels more natural for them on a touch screen than it would feel with a mouse I think, and a keyboard. That's one thing, but I have nothing against laptops, except they are more bulky and generally their battery lasts less, and they are more expensive. Tablets have really become the medium of choice in education technology in India.

Interviewer: I would like to know a bit more around mobiles. Because mobiles in developing countries are becoming more common, why do you not use mobile phones?

Clémentine: I didn't say we don't use mobiles, what we do works pretty well on android phones, android phones are the most common type of smart phones in India by a big margin. But however, it doesn't work on a non-smart phone for sure. Non-smart phones, what you can do with it is pretty limited. So I know a lot of projects where they are trying to do things with non-smart phones for instance via voicemail services, but it's pretty low end what you can do. Given that smart phones penetration is really growing a lot, I would say your best bet is really to try and go android tablets and android smart phones.

Interviewer: And is there a growth in smart phones in India, obviously most must be android, but I suppose the people you are targeting won't have access to smart phones?

Clémentine: No, the parents have access to a smart phone, a lot of them, lower middle class, lower class. In our digital learning centres in Delhi, there is almost always one member of the family who has a smart phone, however, the children don't always have access to it, the father may have it and be away from home working, so doing something where the children need to use a smart phone isn't easy. You will have some people where the mother also has a smart phone, but it's more uncommon, mothers tend to be less well trained.

Interviewer: The final question, then will go back to the operating model. The final question is, what do you think are the limitations of what you do, in the sense of jugaad innovation and EdTech to solve the learning crisis? So using education technology to enhance the quality of learning, what do you think are the absolute limitations of what you do? I know you've talked about human interaction and that's important, but can you think of any other major problems of doing what you do to educate people?

Clémentine: So I'm pretty optimistic on technology. I do believe that it's not a limitation of technology or what technology can do in that sense. I think as things will develop in the coming years, we will use more AI stuff. Internet access will be better and all, technology has the potential to do much better than teachers in the context without. If technology is used properly, I would say the main limitations in what we do, is that it's not easy to get education technology to fit in the learning environment. In the sense that it's a human limitation in a sense that, people do not create the correct environment for the technology to do it's job properly.

Interviewer: Ok, can you explain that a bit more?

Clémentine: For instance you might have a brilliant educational programme, and there will be say 50 tablets in school. Instead of making full use of those and creating a lab, and you will have a lab where you create a slot every hour, which class can go and learn. They say ok we don't use it at all for the whole day and when we go home we can use it. This is a big limitation, if no-one makes the effort to use the technology properly, the children won't believe in it.

Interviewer: So it's actually the people who are running and in charge of the technology, are not utilising it properly?

Clémentine: I think a lot of the problems will come from that yes, of course there is a lot of work to be done to get the right programme in the hands of the right people. In the sense that if you don't develop correct user interface or user experience, it doesn't fit with the way they want to use the technology, it's not going to work. This is solvable, with a little bit of testing, iteration and all this. What is difficult to solve is, if you have two or three schools out of four who don't care about it, it's very difficult. From my experience, from all the projects I have seen this is the biggest limitation today.

Interviewer: It's actually the people behind it who are using it?

Clémentine: On the ground, yes. It's often a top down approach. Often one of things which is difficult to grasp, especially when you come from the UK, for instance we are at the moment working with the state of Chitisgar, which is one of the 36 states of India. It's not a particularly big state, but they want to implement a digital learning programme for all the government schools. So the people we interact with is the state government of Chitisgar Education Dept. Under them, there are more than 100,000 primary schools. You will have a hierarchy, you will have a district level person, a sub district level person and ward level person, between admin department, the education administration and primary school teacher. The person who decides on the programme, a civil servant, a pretty bright person, young, very interested in pushing education technology. They will handle 30 head of district for education people. That person, she is a woman actually will conduct a meeting, explain to them what the project is about to these 30 head of district education people. Most of these cannot get it, then each of them individually have to pitch to the sub district level person. Each of the sub district people will teach the work people and these work people will explain to the teachers. By the time it's reached the teacher, already the information is completely different. A lot of them they will not have the time at the meeting, and they won't know. So one day this will be there, and the school will have no idea why it is there. It's like you are really dealing with an elephant system, it's massive, huge numbers, a lot of people, a lot of levels, hierarchy, it's super difficult, a top down approach.

Interviewer: It's a top down approach you would say?

Clémentine: Yes it's very difficult to deal with huge numbers, when you are dealing with hundreds of millions of children at a time, it's very difficult to get an even level of quality in your programme, because of the numbers.

Interviewer: I'd like to go back to the operating model because to be honest, I didn't quite understand it. What I would like to ask is, you had an old operating model, and now you have a new one. Very succinctly, can you take me through both please?

Clémentine: The old operating model was, we would recruit people, in slum areas, who were involved in dispensing after school education. We would recruit them into operating digital learning centres, in their own house.

Interviewer: In whose house, in the person who you have recruited house?

Clémentine: Yes, after school education happens in people's houses, so that way it's a small business using our digital technology. We would come with a box, like a jugaad box actually, pretty jugaad with a certain number of android tablets, micro server and headsets and some documentation. We would train them in using the software and running a class through that, and then they would run a centre from their own house, and it would be their own business. That was our previous model.

Interviewer: OK, I just want to ask a few questions around that. So in your model then, all Slate2Learn is, is an intermediary to distribute the technology and the content?

Clémentine: Yes, you can think of it as a franchise.

Interviewer: So you're a group of people who get some tablets, create the content and take it to these people, and you then recruit some people in the slums. You take it to their houses and they effectively run a small business, whereby the learners who want to be educated come to. They use this laptop or the tablet that you have created the content on, and they pay the people in the slum who they have gone to, for the education that gets delivered?

Clémentine: Yes, so if you look at the video on our website this will explain, did you watch the video?

Interviewer: I'll be honest, no I didn't watch the video, but I will take a look at it. So to move onto the new model, would you mind taking me through that again please?

Clémentine: The new model is just that we don't do the direct delivery, we work with organisations that already have, already manage learning environments. So being a school or after school learning centres or whatever, we deal with organisations who are big and already handle learning environments themselves. It can be a state department of education or can be a big NGO who run a lot of learning centres or big organisation that run schools.

Interviewer: And these learning centres, how would you define a learning centre, would a learning centre be classed as in what you said previously, as in a person's slum house and they have the technology there, is that a learning centre?

Clémentine: Any place, whatever, wherever it is, it can be very diverse. For instance these low cost private schools you have heard of in India, they run in people's houses.

Interviewer: And you would go through those places as well?

Clémentine: We don't want to deal with individuals, the micro entities, these are very difficult to manage. We don't want to do that any more, because it's not a very good use of our organisation's skills to do that.

Interviewer: OK so it's more scaleable the one you're going through now. Effectively using what's already there. In terms of your tablets and your content, has that changed from the old to the new model or has that stayed the same?

Clémentine: That's a good question. So the old model we had is still available and in some settings it will work, in some settings it doesn't work, so that way we are more flexible, in that we offer several models.

We offer an app as well which is online, online instead of having this offline server only. In terms of technology we have had to broaden the range of user experiences.

Interviewer: OK, can you tell me more about this new app that you have developed?

Clémentine: Yes, what do you want to know?

Interviewer: Is that launched on the tablets that you have?

Clémentine: No the new app is not really used, it's going to be via the android Play-store.

Interviewer: Another question I should ask is how many learners do you actually reach at Slate2Learn?

Clémentine: Since the beginning, maybe 2-3 thousand.

Interviewer: OK. And how many people work for the organisation?

Clémentine: Not many, we are very small, at the moment 2 full time and quite a few people who work on contracts and a few part timers as well.

Interviewer: Do you partner with anyone else, I suppose the new model you have is all around partnerships, would you agree?

Clémentine: Yes.

Interviewer: That's very interesting, I tell you what, there have been some things in this interview that have been really interesting, especially around this new versus old model and some of the things you have talked around EdTech, so it has been absolutely fantastic, really insightful so I am incredibly grateful for your time.

Clémentine: I'm glad to hear this

Interviewer: Really interesting so many, many thanks to yourself.

Clémentine: Feel free to spend some time digesting the interview and coming back to me with some questions, you know, fire me any questions that I haven't answered.

Interviewer: Excellent thank you and I shall send you a copy of my report which should be around mid May.

Clémentine: Brilliant I look forward to it. Good luck with everything.

Appendices 4 - Priyanka Agarwal Full Interview Transcript.

Interviewer: To begin, I would like to start by asking for your informed consent to partake in, and audio record this interview? I will be using the recording to write a full transcript of today's discussion, which will be used for educational purposes only, forming a constituent part of my final-year dissertation research [Priyanka agrees].

You also have the right to confidentiality and anonymity. You also have the right not to answer any question if you don't want to, and the interview will be stopped if you so wished. I will happily provide you with a summary of the research findings. This will be around mid May 2018.

The Research aim is 'to investigate how combining jugaad innovation with EdTech, can help solve the 'learning crisis' in developing countries'.

In terms of progress to date, I have completed the literature review and I'm now in the final stages of collecting the primary research.

Interviewer: So I think to start with if it's alright with yourself, could you give me some background information on yourself, who you are, what you do and how long you have been doing it for?

Priyanka: Sure, I am Priyanka Agarwal. I run a company called Connect2teach which helps connect both industry professionals and academics with teaching opportunities at both universities and corporate and other learning organisations around the world. We have been in business for around a year and a half, but spent quite a bit of time researching the concept before that. My background is in turnarounds of companies that are not doing well. I have to figure out a strategy and implement, it while leading change or help them to profitability. I have worked outside of the family business at companies like KPMG and TATA.

Interviewer: Excellent, I shall start with theme 1 if we can and it's all around education quality. I'd be interested to hear how you would define education quality in developing countries. What do you think constitutes a good quality education?

Priyanka: I think this is two parts, one is what people think is quality, and the other what I think as quality. So I think the perception of quality in developing countries, I can't speak for all developing countries, just in the context of India, is that it is seen by what outcome it can deliver. When you look at the higher education segment, it means can I get a job right after? When you talk about the secondary school system, it could either mean can I get a job right after, can I get a job from college right after? When you look at the primary education system again, will this help me raise my income levels in the future or get me into the right schools or colleges in the future, to help raise my family income? So everything is sort of connected in terms of measurement of quality, education is the perception of employment. What I think is quality education is the ability to teach people how to learn, so that no matter what you do in life, you are able to pick up the skills and pick up the knowledge required to do it. And I think that's the transition that developing countries need to make when they look at quality education, they are not just looking to get to the next step, the next step, the next step.

Interviewer: Excellent, that's really interesting. The second point is how would you describe the current state of education in India? What do you think are some of the key issues facing organisations who are trying to provide a quality education?

Priyanka: So again, I think education is a really big topic, which goes through primary, secondary and continuing education etc. So I will try to focus on a few things, when you look at education, you also have to look at who is accessing the education. Is it someone at a basic income level, is it someone from an

affluent family etc? Just for the sake of discussion I will take people who are in the example of the basic income level because that is the multitude and that's the person you want to come up with jugaad innovation for also.

Interviewer: Sure.

Priyanka: In that case I think it starts with parents realising the importance of education and prioritising it when they prioritise the needs of their child for survival. So food is one, safety is one, but education is also an important skill that they need to have their child focus on in terms of survival. The second is that people are talking about creating access for that strand of society that can think about digitisation, and you are bringing in a tablet knowledge etc. But something like the internet is not always going to be easily available, something like electricity is not something that's always going to be easily available. Creating a scaleable model you have to think about how we provided the basic amenities of life at scale to everybody in India, so how did we get food to everybody, how did we get electricity to everybody, how did we get water to everybody? And the same thinking is how do we get education to everybody? So you can't have technology to enable that thinking, you have to have a primal way of surviving to enable that thinking. The last part is I think, the approach to education. So you've created access, you've created motivation, but you have not created approach to education. So what is it that I should be educating my child in, or how do I make a choice about my education? Even as people who are privileged enough to know what to study, even we don't know always what the right approach to education is. Somebody has to make a decision about it, but have no role models in their community most likely. So with no access to any consulting or information on how to make a decision about it. Even at a very young age you have told them you need to get educated, but what should they get educated in, and why is that important? How do you assess that is being done or not being done? So I think I can put it into these three brackets, it's motivation, access and approach.

Interviewer: The last bit on theme one is, how do you, in your company measure learner outcomes, so how much people are learning?

Priyanka: So this is a topic very close to my heart. The whole focus of Connect2teach is to actually help increase learner outcome, and this can be done in multiple ways. The way that we focus is that the person who you put in front of somebody to teach, has one of the highest impacts of student satisfaction. So that person knows their area really well, or if that person is motivated to teach, and is able to teach and facilitate discussion, he can actually have one of the highest impacts of student satisfaction. A higher impact of student satisfaction automatically means that person has learnt better. It automatically means that he is going to remain a motivated learner, and the third is that he is going to now sort of put forward to other people, the joy of learning. I think those three metrics to measure learner outcomes is really important. Now how do we go about measuring this learner outcome? It's a work in progress, so we have certain metrics in place, like student feedbacks, institutional feedbacks, and comparing it to previous years how things have been done. But I'm sure you know, how to measure learner outcomes is a really big topic and I don't think in education anyone has successfully been able to measure it in a holistic way yet. But our attempt is to figure out and research around that and be able to measure it and show that outcome.

Interviewer: Excellent, that's really interesting, thank you for that. I think we shall move on to theme 2 now which is education technology. The first question is how does your operating model work in practice, the Connect2Teach model, how does that actually work, what happens there?

Priyanka: Basically we curate the experts that are on the network. We curate the institutions that are on the network, and we help them connect with each other based on their requirements. Whether that is short term,

like a guest lecturer or a long term requirement like an adjunct faculty. Or this could be in the University space or in the corporate space. We connect them, and it's the curation process and the measurement of the curation process where we have really created innovation.

Interviewer: So you're the middle man almost? It's a platform that connects teachers to the people who want learning with deliverer really?

Priyanka: We don't work directly with the learners, we work with the institutions that help the learner. So we are an online network. Everything happens through an online platform that has been created, and we work with learning institutions, some of the most senior people there. We work with experts who have the ability to go on and share their knowledge on this basis. What we try and do is try and change who is teaching and how they are teaching, and how that is measured to ensure the student outcomes are improved significantly over a period of time.

Interviewer: How do these experts or the people who are delivering the learning, how do you find them, do they come to your platform? How does that work?

Priyanka: Just like any business, it's push and pull. So people come to our platform and then we go and find them too.
Interviewer: That's interesting. The next question is what are the key challenges you face in delivering that model?

Priyanka: I think all the challenges that one faces while running a business in general. But I think from our perspective, I think it hasn't been done before, what we're doing, so there is a big education piece to it before we actually enable change. And that lead time is probably one of the biggest challenges we face in delivering our operating model. The second, is that for scalability, automation is really important and automation takes time.

Interviewer: When you say lead time, what do you mean by that, is that the time it takes to find these people?

Priyanka: Is that for the first part or the second part?

Interviewer: For the first part.

Priyanka: No so the lead time in being able to convert somebody to not do things the way that they have been doing it traditionally, and to do them differently while using Connect2teach.

Interviewer: Ok, so a different way of learning, is that what you are saying?

Priyanka: No a different way of finding the right expert to teach. So universities have been doing it traditionally in a specific way, corporates have been doing it traditionally, having found the right experts in very traditional ways for donkey's years. What we are now telling them to do is actually, take an alternative process through us, find them through us, and manage everything through us. There is an education piece involved on child interaction outcome, there is an education piece involved on how to change habits and behaviours, of how you discover these experts, and there is an education piece involved in how do you measure the impact of having gone to an expert from Connect2Teach, versus traditional methods.

Interviewer: OK, and how successful have you been in those things that you have just said? Or are you still researching that, is it an ongoing thing?

Priyanka: It's an ongoing thing, I think we have a fairly good handle on it now and we have been doing it for some time and been in the market for some time now. We have done around 100 matches, delivered about 1000 hours I think, don't hold me to that! So we have a good handle on it now but of course it's like everything in life, it's work in progress.

Interviewer: Sure, so the next question is, what low cost education technologies do you use at Connect2Teach? I don't know how relevant that question is?

Priyanka: I don't think it applies to us.

Interviewer: Sure I will move on then. How is the way you do things frugal, what do you do to cut costs and keep things low cost?

Priyanka: I think it's the fact that we are trying to take a part of how work is done in the education industry and try and figure out how to optimise it at scale, automatically makes it a frugal option. So using Connect2Teach should reduce your costs of discovering the right expert and engaging them, by about 60% and should be able to increase your learning outcomes by at least 80%. So automatically, you are taking an entire business function, the way an entire industry has operated and trying to do that under one institution separately. So almost think about it as if Dell had offices all over the world, and put all the purchasing into one company to centralise the entire process, by doing that by economics of scale, you are making it frugal to do it, while trying to deliver extremely high learning outcomes.

Interviewer: I see, so it's basically putting everything under one roof, instead of having lots of different facets everywhere? Everyone can just come to you and that's automatically a frugal way. Is that the only thing you can think of in terms of frugal or is there anything else that springs to mind?

Priyanka: I think the idea of the solution is to make it frugal in terms of how we do things frugally, we are a young company so everything we do, our entire learning solution is frugal. So I think we are extremely cost effective by being able to say that we are able to reduce cost by 60%, while increasing learning outcomes in fact by 80%, so automatically that's the most frugal thing. And there is flexible and inclusive in there also right. So I think just by nature of having it in house under us, we've featured a lot of flexibility. Before if it was one person at the institution who went hunting for these people it sort of democratised access to the best experts. So just about anyone whether they have a personal network or not, whether they have the time or not, whether they are motivated or not, can actually go onto Connect2Teach and find the best experts to lead their classroom. In terms of inclusive, the two things we focus on is credibility, and diversity. The way we have made in inclusive, in terms of gender, we have made it inclusive in terms of geography, we've made it inclusive in terms of strands of society, so we are saying that the best person to teach will be in the classroom and that person can literally come from anywhere in the world.

Interviewer: I think you did talk about flexibility a little bit there, can you expand on any of the points you made there on flexibility?

Priyanka: The learning solution is flexible by definition of what we are doing because, supposing block chain comes up as a topic next semester to teach because it's popular now. You don't have someone for example for next semester, you can get someone from Connect2Teach for that topic. You might decide to

teach cyber security the next semester instead, that's the flexibility of finding somebody else to teach this next semester. So you have reduced your overhead costs significantly without compromising on quality.

Interviewer: And inclusivity, you did touch on that but can you expand on that a little bit in terms of how you are really inclusive in what you do?

Priyanka: I'm not sure what you meant by inclusive?

Interviewer: In terms of my report, it's inclusive in terms of including low income consumers who want to learn, so I don't how direct that it for you?

Priyanka: Absolutely, the fact that we have democratised access to the best experts, that means any institution in the world can now access this. So before it was only somebody who had the network within their alumni or professor network would be able to invite such high profile people, or such, in that expertise from around the world. But the fact that we have created a centralised space for access to these experts. If you care about learning outcomes to deliver the best learning outcomes to your students, no matter what kind of institution you are, you could be a government run college or a private institution, you can access those experts on the Connect2Teach network. For instance, a Harvard can get us and a local school in India can access us. The only thing is we are currently catering only to the higher education system.

Interviewer: OK, so you are not serving low income schools and things like that, it's mainly higher education?

Priyanka: It could be lower income, higher education institutes which is something that we also do.

Interviewer: OK, excellent that's really interesting. The next question is quite a pivotal one really, one of the most important questions. Obviously a tradeoff exists between a low cost model and delivering high quality. Do you think that low cost education technologies can improve the quality of education for learners in developing countries, and if you think they can, how do you think they can? I know it's quite a broad question.

Priyanka: Yes I definitely think that they can, I think that it depends on what you define as high quality and that could change that balance and trade off a lot. I think that that is a possibility and the way to survive in any business is how do you continuously offer something of a low cost at a much higher quality, because you're always delivering more value than you're charging? So the switching costs reduce also because when you have an EdTech solution, you also have to be sustainable for ever and ever, so that's what makes it a good business. If you ask me how, I think one of the things people think about when you think of EdTech solutions is actually of hard technology. I think what a lot of people don't think about is they don't do innovation on the business side, about how you take the solution to market and I think that's where the answer lies because that's what enables scalability, and that's what enables you to be able to charge a low price and deliver a high quality. So of course you can be making some great learning gains and personalisation tools that you can put into a tablet, but if you are not thinking about how I'm going to distribute this and scale across the country, you've eliminated the low cost option automatically.

Interviewer: You raised an interesting point around actually taking it to the market and not necessarily looking at the technology, could you expand on that a bit more? Was it taking to market you said, can you talk about that a little bit more, maybe how do you take your solutions to market, how did you take that perspective that you just explained as an answer in your company?

Priyanka: It's a little bit hard because for me the perception of what I wanted to do in education is always about scalability because I do believe that you could have the best invention in the world, but if you don't know how to take it to market, you haven't really innovated. That's the difference between invention and innovation where people miss out in the middle. So for me it was from the get go, was always about I want to do this at low cost, I want to do this at high quality and the only way to achieve those two, was to do this at scale. That's why Connect2Teach was built as a global network. It was built as a global company from the get go, and we do work with organisations across the world. We do work with organisations in the top tier and in the bottom tier, so we can focus on learner outcomes, and they are actually willing to invest in that.

Interviewer: I see what you're saying. But in terms of actually taking it to market?

Priyanka: So instead of going b to c we get the company b to b, so hence we don't work with learners directly, because that's harder to scale and takes a lot more money.

Interviewer: So you work with learners directly?

Priyanka: We don't work with learners directly.

Interviewer: Yes of course, b to b. Why don't you do that, because it wouldn't be scaleable?

Priyanka: Because it's really expensive. When I say that low cost and high quality, an element of that is how you take the technology to market? I think it's really important to define that, what will get this product faster adoption, how will it make sure that when you hit one person it multiplies automatically? The thought is that, how much time will it take to do that? And I think, I will give you an example outside of Ed Tech in manufacturing, if I decide I want to make 5000 pencils, if I'm making pencils, I am looking at the cost to make these pencils. 5000 pencils is $10 each, then automatically I'm trying to find a customer that will give me $10 for say 5,000 pieces. And nobody in this world is going to give me $10 to buy a pencil. So if I suddenly start thinking ok, instead of selling for $10 to 5000 people, how do l sell it for 10c to x number of people, I've automatically changed the way I think of my strategy, now I have made pencils accessible to everybody, just by not putting costs as one of the variables there. I am now thinking automatically about scale. You are not letting only the need of the customer define how you define your business model, it should also be how am I going to scale this and make this affordable for my user, defining the business model.

Interviewer: Excellent, very interesting. Thank you for that. There is another bit, which is, do you have any evidence from your company, I remember you talked about a 60/80%? Was it 80% better learning outcomes and what was the 60%, was it lower cost?

Priyanka: We target for at least a 60- 65 % savings in cost by using Connect2Teach verses doing it internally as an organisation and we aim to help improve learning outcomes by at least 80% at the result of using a Connect2Teach expert.

Interviewer: OK and how successful have you been in both of those aims?

Priyanka: So far we have been very successful but I think the numbers will speak better once we do things on an even higher scale than what we are doing right now.

Interviewer: OK, so what are the numbers as we speak now, if you're happy to share this information?

Priyanka: I know that the cost savings are absolutely in line, I think the learning outcomes have been much higher, but I think we are very much still involved in the manual process right now, which is why I think that when you start doing this at scale and get a fully automated process that's where the real test lies.

Interviewer: Right, so it's sort of in the infancy stages right now? The next question is, which may not be relevant to you, but you may have a personal view on it. Ed Tech does not always support social interaction and how important do you think social interaction is during the learning process to deliver a quality education? For example, people using tablets to learn on, it doesn't always involve social interaction, and how important do you think that is?

Priyanka: I have a very biased view on this. People always think in the limited view of our own perception based on the experiences you have had up until that point. So if you give me a mobile phone and ask me to go on Youtube and do stuff, it will be the exception of a child who is going out and looking at things they have never heard or seen before. So I'm not going to go on Youtube and automatically look for videos on cyber security for example. So I think where social interaction comes into play is actually heightening exposure levels and changing perceptions of what to get out of EdTech. Even if you and I go for dinner and we go for Peruvian food which you haven't eaten before, and I haven't eaten before, just because I haven't gone to Peru, I might have a different perception of the Peruvian food, or I have read about Peru in school or my best friend is from Peru, I may have a different perception. You know she may have said pineapples are used a lot and I'm actually registering that pineapples are used a lot as an ingredient in Peruvian food. You have had no exposure whatsoever to Peruvian food so your first perceptions would be, this is interesting, it tastes different, it's as spicy as food I normally eat. It might just change the level of what you take back from that experience.

Interviewer: OK so in short you think it's pretty important still?

Priyanka: Yes, I hope you are going to make me sound more articulate than I sound right now.

Interviewer: Thanks a lot, so I think we will move on to theme 3, it's all around the innovation process, and I suppose the question for you is, what does the innovation process you go through look like at your company? So when you built this platform, when you're organising all these things, how do you go about doing that, how did you go about actually innovating to create Connect2Teach?

Priyanka: For me there is always three things, how do we increase learner outcomes in everything that we are doing, that is actually going to better the learner at the end of the day? Second is what does the world of my customer look like, how does the decision making happen? How do they do things and how does my business model fit to develop a solution? And the third is, what are the resources that I have, to be able to come up with innovative solutions to be able to deliver to that business model, and to that goal of improving learner outcomes?

Interviewer: Ok so that's three points that you can think of and those are the three main things that are always in your mind when you were building Connect2Teach?

Priyanka: Yes.

Interviewer: Excellent, and do you have anything else to expand on that?

Priyanka: Do you want to know the operational process?

Interviewer: Yes if you wouldn't mind sharing it, that would be interesting.

Priyanka: I think we do a lot of different stuff, we have a very different recruitment process than any other company I think, where just from the moment where we pick people, we teach them how to think in a way differently. So we teach them how to actually think, instead of thinking about solutions, we teach them how to define the right problems. Because it's very easy to come up with solutions to problems nobody has or problems nobody is looking to solve. The number one thing that we do actually is help people ask the right questions, that what needs to be solved. The second thing that we do is, we help people understand that there's always a down side of implementing an idea and why it wouldn't work, and then actually working through those processes to define a better solution. The third is that we fail fast, so anything we want to test and do, we put it into implementation in our own branch and see whether it's working or not. We don't get attached to ideas, because that kills the innovation process a lot. In terms of how we do it, in an operational sense, all the Saturdays at work, we work on Saturdays, and we work on Saturdays because we innovate on Saturdays every single thing. It's not just like we need a good solution to help improve learner outcomes and that's the only point of innovation that is required. But it's the internal process and external processes that helps us deliver that goal, we are constantly innovating and Saturdays for us are dedicated to doing that, we see what is not working and how to come up with better solutions. We are a young company, we decided to not raise funds in the interim, because we didn't want to dilute our vision. That means that we are very frugal in our approach on how we implement these solutions and test them out and deliver the outcomes we want to deliver, and it's built into innovation process. It's very easy to say lets spend this much and do all these things and see what's working, but instead we really break them into small pieces on a weekly timeline to see what is and isn't working.

Interviewer: So you are saying you only innovate on a Saturday?

Priyanka: We innovate every day, we get together for innovation because everyone is so busy with their operational work so they are catching things all the time, but we dedicate Saturdays for people to just come up with very drastically different ways to do things. They put together that knowledge, they actually get time out on a Saturday to put together all the thinking over the week of how things could be improved. So we have these teaching sheets, it's about new ideas of doing stuff, so we are catching it in that. So you make sure the ideas don't go to waste and at the same time you still have dedicated time on these ideas.

Interviewer: So it's sort of an iterative process that you implement would you say?

Priyanka: Yes.

Interviewer: How is that process frugal by nature, can you expand at all, how is the process you explained frugal, how do you cut costs?

Priyanka: By not spending a lot on it and we try to make do with what we have as a resource to implement the solution. I think that's the frugal element of it, that they are low cost, they are using what we have to come up with a solution.

Interviewer: How would you say it's flexible?

Priyanka: So we believe in failing fast I think that's what makes us really flexible, so we don't get attached to ideas, if somebody comes up with an idea, they have to come up with a reason why their idea might fail. So it automatically keeps your mind flexible around those ideas and concepts.

Interviewer: That's interesting. That will be a really nice quote for my paper actually, thank you for that 'failing fast', that's fantastic. The last point is how is it inclusive?

Priyanka: The idea is that the best idea doesn't lie with one person. Everyone is part of the process, including our customers, including our clients, we are constantly taking feedback, constantly taking ideas, constantly involving the community at large. With every single team member whether it's the most junior or senior person, they are part of the same discussions. With the innovation process you don't know where the next best idea is going to come from. In terms of what you care about which is a low cost income, every solution and innovation process is checked against whether it's applicable to someone who's at a corporate or university or the bottom of the pyramid. It's really important in our innovation process that everybody is taken into account by coming up with solutions for it.

Interviewer: Do you work alongside the individuals who your business caters for during the innovation process? So do these lecturers or learners at all participate within the innovation process, do they help with co-ideation, co-design or the co-development of solutions or is that whole process done internally within Connect2Teach by the employees there?

Priyanka: The experts and the institutions we work with, they both do. I saw this question on your sheet and I thought, I wish it wasn't there because one of the things we want to plug into the system is working closer, more closely with the learners and that's in the pipeline, it's just that we are too young so we can't do these things already. Part of our initial ideation process for learners themselves, but currently since we have worked on the b to b model, we have worked with the institution on the innovation process, the institutions that are housing these learners, we work with them on the innovation process, not directly with the learners yet.

Interviewer: When you say you work directly with the learners, how is your plan to go about doing that? Is it an ideas platform or would you run workshops with them, how would you actually include that within the innovation process.

Priyanka: I can't answer that, that's part of the business.

Interviewer: Absolutely, not a problem, that was one of your rights at the start of the interview so that's fine. How did you actually commercialise your Connect2Teach platform which I suppose is the point around what you were talking about earlier with taking it to market, but I don't know if you've got anything else to add on commercialisation, how you actually went about doing it, what were the important factors to actually get Connect2Teach up and running in that sense?

Priyanka: So even though it is commercialised I think it is still work in progress to have the best model. Also I would be giving away a lot, not that I don't know it.

Interviewer: No that's absolutely fine. So on the final theme. Can you think of any examples when you have used jugaad innovation with Ed Tech? So obviously it's the whole point around frugal, flexible and inclusive, that is effectively what jugaad innovation is. Can you think of any examples where you have seen a jugaad EdTech solution, it may be more broadly within India or whether you can think of an example that you use yourself?

Priyanka: I've used ones which combine the two but I don't know how successful they have been at scale. Do you have an example?

Interviewer: Yes I do actually, so in one of my previous interviews, I was talking to a man called Jaideep and he said that in India, they have used the TV. Most people have a TV, they put subtitles in the language they want to learn on the bottom of the screen, so they are getting educated in the language that they are learning, in a very frugal way.

Priyanka: Do you want one that is at a secondary school level? It's not something that came out of India, it came out of the US. The app Duolingo, it created a translation app at a really low cost in a really flexible way by making it super inclusive. Because anyone can access it at your own pace, you can use this if you want to learn a new language. So part of EdTech is every aspect of education right and since the world is globalised, learning languages quickly on the go, and making it easy to do that without going into a classroom being a large part of that, is also EdTech. What they did was, if you know a language well, you will have to translate certain things in that language, and if you don't you're getting to learn a different language. So you want to learn Spanish you can share your insights for translating something in English and if you don't, you're learning Spanish. So they made language learning really easy but superb learning outcomes, in a very frugal and inclusive way and the guy that came up with Duolingo is actually a genius. He is one of my favourite Ten talks. There's a company in the US again called Newsella, they have done a really good job with putting news into the classrooms, but I think that it's definitely one of the innovative EdTechs, with Duolingo, it just amazes me that he did it that way, and the skill it reached very fast as a result of being frugal, flexible and inclusive.

Interviewer: Final question. What do you think are the limitations of using jugaad Innovation and EdTech to solve this learning crisis, which is around quality education? Learners in developing countries, not learning, they are going to school, but they are not learning what they should be learning at a high level. And you know, using jugaad innovation, about frugal, flexible and inclusive EdTech solutions in that sense, what do you think are the limitations of doing that?

Priyanka: I don't think there are any limitations of using jugaad innovation in EdTech. I think the limitation comes in the way people think about using jugaad innovation in EdTech. Again, I mentioned earlier, I think that if you don't just look at jugaad innovation as a way to develop the technology, but as a way to take that technology to market, I think that is the element that is missing a lot, when people come up with solutions.

Interviewer: OK so it's really around taking it to the market. I suppose that's been the point you have really pushed home is around the solution is only the solution, but it's all about how do you actually get it to the market and that's really key?

Priyanka: Yes.

Interviewer: Excellent. So do you have anything else to add to this taking it to market point that you can think of?

Priyanka: It comes back to what is the problem that you're trying to solve? Like you mentioned with the TV. So they tried to figure out how do we get kids to learn about new concepts, how do we get them to learn in their own time? How do we make it easy and cost effective for parents to access that learning? So these are the kinds of questions they have answered while coming up with the solution. It's actually more poignant than saying, ok well what is the best programme we can build to deliver the learning solution, so that came second. Also to figure out what's the best way to access the market, then when we've accessed it, you can create amazing solutions on top of that. So I think that you have to think about both those things simultaneously, and I really believe one could come even before the other, so if something is good,

automatically people will adopt it. But if you don't have a go to market strategy, and you're sitting with a really good product, nobody is going to adopt it. So definitely both of those things need to go hand in hand.

Interviewer: So just to reiterate those two points, the first you said is about understanding the problem and the second was around solutions basically to that problem?

Priyanka: What I mean about when you define a problem is you don't define it in the context of one particular learner, but also in the context of how you take it to multiple learners across the world. And you have to see every learner as a human being across the world, so it should be applicable to me, applicable to you also, right because everyone learns in a human way. I think when we limit our solution to think about only person, reaching out to one person you can't change and effect the business model out of it. But you can't make a business out of selling 5000 pens, you have to think how you will sell a pen at 0.1 dollars.

Interviewer: Interesting, do you have any answers to how can you better understand that problem in that context, what do you think are the important things to understand that are on a global level?

Priyanka: I think you have to spend time understanding the market and with emotional intelligence you can develop Connect2Teach, like I mentioned before we launched the company, we spent a lot of time in research. I always mention to people that we started the business one and a half years ago, but really started researching it two years before that. I think that's really important, if you have not spent time understanding your customers, you have not spent time understanding the business proposition for the end customer.

Interviewer: Excellent, I have one more question, what is the Connect2Teach go to market strategy?

Priyanka: I can't answer that, sorry.

Interviewer: Don't worry that's absolutely fine. I think that's everything. Is there anything else that you can think of that might be interesting to add, I think we have covered pretty much everything quite comprehensively there.

Priyanka: I think I have told you more than I thought I knew, if you have any questions do let me know.

Interviewer: Lovely to meet you, I shall send you a copy of my report and hopefully will touch base with you sometime in the future. Good luck with Connect2Teach and thank you for everything.

Appendices 5 - Ritchie Mehta Full Interview Transcript.

Interviewer: To begin, I would like to start by asking for your informed consent to partake in, and audio record this interview? I will be using the recording to write a full transcript of today's discussion, which will be used for educational purposes only, forming a constituent part of my final-year dissertation research [Ritchie agrees].

You also have the right to confidentiality and anonymity. You also have the right not to answer any question if you don't want to, and the interview will be stopped if you so wished. I will happily provide you with a summary of the research findings. This will be around mid May 2018.

The Research aim is 'to investigate how combining jugaad innovation with EdTech, can help solve the 'learning crisis' in developing countries'.

In terms of progress to date, I have completed the literature review and I'm now in the final stages of collecting the primary research.

Interviewer: So I think to start with if it is alright with yourself, could you give me some background information on yourself, who you are, what you do and how long you have been doing it for?

Ritchie: Sure I'm Ritchie, I started out in the banking arena I guess, then moved into insurance. I've been in education for about 5 years. I work at grass roots level with students on the ground and as well as run a digital learning company called Learn Et Al, where we provide digital learning solutions for corporates, universities, business schools etc. In terms of the background specifically for this, there are of couple of things you need to know. One that we actually work with a school in rural India, so that's very important that we understand that we can help and create content and curriculum for them, so that's part of where you are coming at this from. I also do a lot of work in driving markets around places like South Africa and Iran so working with people in those contexts as well. Bringing a bit of an international flavour to it, and then I think the third aspect is I do a lot of work with Delhi school principles, to understand how to create innovation within the school environment as part of my role being a fellow at Cambridge Business School. So I think the main thing, both my digital learning perspective, and also helping to create the next level of education in developing markets, both in India as well as other places.

Interviewer: Excellent, so I think we will start with theme one, which is around education quality. How would you define education quality in a developing country such as India, what do you think constitutes it?

Ritchie: I think traditionally, education quality has always been marked by results, so it's the extent to which students reach certain marks with exams. Culturally that is still very much the dominant method to judge quality of education, what results you get in your exam board equivalent with GCSE and A levels very much determines the quality of the school, and things around it. So I think that is the dominant logic that they basically hold. The problem you have in that environment, is the common bugbear that people have, is that people think that the education system is all about schools spoon feeding you to understand what's in the exam, and then basically students then muck up what's in the exam and then get the results. So the problem is the quantitive measure around marks which basically is output of education quality. But actually there is a much broader point here around are we truly training our kids to tackle the challenges of the modern world? I think for me for example it kind of encompasses through the work efficacy, and I think that actually as much as the quantitive aspect of marks is important, I think it's also around outcomes which become extraordinarily important in this competitive world. So it's the extent to which students can actually critically think and analyse the situation, be creative around the situation, and being well-rounded student beings that have a range of skills that can add value to the world. For me that's actually as important as the hallmark of education, as much as what the quantitive marking system is in the current context of India. And I think moving forward there has been the recognition that actually they need to do both clearly, so have the marks on one hand, but actually educators are rarely coming up with the thought that there needs to be much more work done to hone in those skills on advocacy, or outcomes in tomorrows world in developing markets. So I think those two sides of the coin are important in terms of education quality.

Interviewer: Excellent. The second question is more looking at the context of India. How would you describe the current state of education in India, and what do you think are the key challenges facing organisations who are trying to provide good education quality?

Ritchie: I think there are a couple of things you need to bear in mind first. India is an extraordinarily diverse country and to that extent, there is certainly no one size fits all in relation to the education situation. So you need to think about this across, I would almost segment your market across two dimensions. The first thing I would mention is a level of affluence so, the extent to which someone can afford to go to the top tier schools, like the equivalent of the Etons of the world which very much exist in the Indian context as well. And then filtering down, lower economic statuses of individuals who can afford a mid level education and going right down to the bottom of the pyramid, where the education system is very much run in a government way. So the education system is tiered largely speaking the bottom of the pyramid is run publicly and then when you go to the mid and upper echelons of the tiers, you will find private level education. So I think you will find those three factors to think about and that is one dimension. The second dimension to think about in the education system is around rural versus urban, so the extent to which the education is based on rural India is very different than it is in the urban areas of India. So you have got to cut it across this two landscapes and treat that very differently. For the purpose of this discussion and given the jugaad nature of things, I think that what you're really trying to attain is very much at the bottom two tiers, that's the mid and lower level schools, so I'm not sure that talking about the top level is a bit out of scope if you don't mind me saying so.

Interviewer: Yes.

Ritchie: So if we are thinking about the bottom tier as it were, I think there are a couple of key fundamental issues. The first big issue is teachers and teacher training around this. I think there is a lack of motivation at the bottom so teachers are not adequately equipped to deal with some of the issues they are facing in their schools, so I think that there's a supply issue on one hand, there's a lack of resources, there's a lack of funding, typically the class sizes in the bottom rung. You are talking of class sizes, up to 70 kids in one class and one teacher. There is no adequate technology to enable that teacher to teach adequately for example there's not even a projector in the room. Additional resources are scarce, so the ability to have internet connection to be able to reach these resources will be minimal and in those types of context, the predominant method of training will be through a book and I would say largely the students are not being engaged in that process. So much so, that what ends up happening at the end, is they pay for private tuition later. It's like there is a parallel universe where the education system in school is not delivering what it should, so you almost need an alternative view of the world which is the second you go home you have 5,6,7 hours of private tuition a day, just to make up for what you didn't do at school. Ironically the same teachers who taught you at school might be the private tutors, but they will be teaching you slightly differently because also that's the only way that they can afford a living, because basically they are not being paid enough to be teachers in schools. So it's a really complex issue, but to sum up you've got resource constraints in that environment, you've got lack of teacher training and engagement the classroom, you've got lack of technology, lack of resources. You would be surprised if every child had a text book, one text book per child, so again that's a big issue. So I think for all of those issues, the schooling system suffers. Even getting to school in the rural parts of the world, students have to walk for 1-2 hours to even get to a school in the first place, and that's only a primary school. So what happens when you get to secondary school and tertiary education, it becomes even less of an issue, and people will probably drop out when they are 13 and that will be it. So the level of schooling, even the ability to get to school, the logistics is an issue for young students.

Interviewer: The next question is how do you measure learner outcomes?

Ritchie: I think it goes back to the first question around education quality, because learner outcomes on the one hand clearly are determined by the mark you achieve in an exam. I think that in itself is a very good measure of learner outcomes in that sense. However I think there is a whole parallel universe that needs to

be explored in relation to learner outcomes which is not currently being explored. And that goes back to the notion of efficacy within the environment, so how do you measure whether someone is developing the skills they need to be employed later on in life? How do you measure whether they are actually adding value or being creative in their classroom environment? So I think the way to think about this, is you need to think about the framework as almost a 360 degree framework to measure those other side of things as opposed to simply measuring marks. And the reason why marks have been measured so avidly is because it's the lowest common denominator in terms of analysis, it's easier to measure. Whilst actually what's probably more important is the increasing framework of measurement in the school system. Interestingly now reflecting on it and thinking about your research, wouldn't it be amazing if you came up with a framework for thinking about how we could actually measure some of these outcomes in a different way over and above just marks. I think that would be quite revolutionary in that system. I think we can apply techniques from the corporate scene, in the way that you do a 360 appraisal or an evaluation framework on the corporate scene, and see how it applies in the education space. To see how can we actually determine whether people are really learning in the best way, learning the right things, learning the right skills to help them tomorrow.

Interviewer: The next theme is education technology. How does your operating model work in practice, but to be honest we are not doing a case study here, so I don't think, do you think it's relevant, would you like to answer that?

Ritchie: I think what it comes down to, what we try to tackle, fundamentally what we believe in, is that if you get the content right, amazing content, plus technology equals fantastic user engagement. So we are trying to bring the love of learning back to the world. To that extent to be able to revitalise the content so students are being able to learn in a different way, over and above just reading a book for example, which is what would happen in that context. To really excite them about the learning they are going through, that's what our entire business model is about. The simple formula of engaging content, plus compelling platform, equals user engagement. And we believe that if we do that in the right way, we basically then lead to greater outcomes around student quality in terms of the marks they will receive, but also with the level of engagement within the context. Then driving a range of those other skills that we talked about would be important. That's where we see that the play being completed through technology, because there is one other massive factor here. When we talked about logistics and we talked about teacher quality training, about the need to have technology in the classroom, all of this we believe we need to do in a scalable way. The only way that you can truly scale, is to basically be able to do a technology play. So I guess to sum up it's compelling content. We quote some of the quality outputs we are looking for from the student perspective, but also done very much in that scaleable way, to make sure that we can reach hundreds of thousands if not millions of students around the world.

Interviewer: Excellent. What are some of the key challenges you face in delivering that model do you think?

Ritchie: There are a couple of things, specifically for the Indian context. One, there is a complete rigidity in the curriculum that is currently being taught across the school system. So it's very difficult to change what the government determines to be the right content that students should be learning. As a consequence of that, we basically find that people are just mugging up the curriculum in order to pass the board exam. The board exam is basically a government-based exam like the GCSE you would have here. As a consequence to that, the type of content that is being delivered needs to change, but they are finding it extraordinarily difficult to make that change. So there is a big massive emphasis on technical skill for example, the maths and sciences of the world and there is not enough emphasis on creative skills for example. That's all borne at the national board level which is then basically filtering down across the school

system. So the biggest challenge is delivering amazing content which fulfils the learner outcomes, remember outcomes are marks, as well as efficacy. The problem is the actual content is not delivering the efficacy aspect and it's only delivering the marks aspect, so you are kind of cutting away 50% of your learner outcome and that's a big problem. So I think when we are thinking about changing the system, we need to place much more emphasis on the second part than we do on the first at the moment, if we are truly going to meet our student efficacy. We have a range of other challenges, as a technology company, being able to have great internet speeds, the hardware issue, most people won't have access to the hardware. All those type of things become a big barrier to us being able to penetrate a market like that. I also think user adoption is a big problem, becoming the standard form of thinking about it is a big issue, for someone like iTunes is a great example, they kind of do a similar thing to us, but they've got 60 million dollars invested by Mark Zuckerberg to do it. So they have got people like Shira Khan who is heading up their advertisement campaign and things like that. They are penetrating in a much bigger way than we can, because of the scale and size, but they will still come up against the same issues when talking about infrastructure, when you are talking about hardware problems, when you are talking about efficacy, they are very much teaching the board level curriculum, they're not really going into the other side of the curriculum. So again, they are trying to fulfil the first 50% but not the other 50% of the learner outcome. I think that's part of the that issues we face when going into a market like that.

Interviewer: What low cost EdTech do you use to train teachers and deliver instruction for example?

Ritchie: I think there's a couple of key things here. About 6-8 weeks ago I was speaking to about 30 Delhi school principles at Cambridge and one of the things I spoke really avidly about was actually using tools that already exist to basically help the education process. So we talked about free EdTech tools that they could use in their schools today. Things as simple as Youtube, Google Docs, being another big collaborate tool and what's that quiz tool that's often used? So in actual fact, the way I think about that is, it's a slow burn and because you are operating in a completely so scarce environment, the first thing we need to go to is understand what free tools are out there. In fact what I can do Tom is I'm sure I can dig out the top 10 EdTech tools you can use for free and send it across to you, and it will give you sense about the kind of things we have been discussing at Cambridge around what teachers can use as a resource. Simple things like Ted are a great example of being able to come up with great content which is largely built around efficacy as opposed to technical skills, and we can use those things to be able to bring that to life. I think the thing to note about what we do, is we are basically building on third party platforms, so that the jugaad aspect for us is actually, we can build quite cheaply and rapidly using tools that already exist. The framework that I think about is there was a time when you would build your own platform, there was a time when you could buy a platform, and now in todays world it's all around borrowing platforms. I think for me it's a key principle of jugaad to be able to understand what's currently in the market, and then being able to use those tools that are currently available in the market place, to promote that jugaad philosophy, there's no point in reinventing the wheel. We had a client engagement right at the beginning of the business, effectively what we tried to do was build something and we built the platform, the content, we built everything and it was probably ten times the cost of what we could do today. By simply building using third party platforms, and using other people's platforms when we just get licences to be able to do that. So we can actually reduce our costs ten fold by adopting the borrowing concept as opposed to the building concept.

Interviewer: How do you optimise the use of those technologies, I suppose you have sort of touched on that a little bit, but do you have anything else to add to that?

Ritchie: I think on a slightly related point, the mega trend that is seen from a jugaad perspective which is going to help the world profusely, is that of software and service completely from a technological

perspective. There is really great practice out there already. Software and service is extraordinarily important in our world when developing content. For instance, we can get access to world leading EdTech tools for 20-30 dollars a month. So suddenly we can be a world-class company very cheaply, whilst before, it was the reserve of companies with massive budgets to be able to get access to those type of tools. I think given software and service and it's about borrowing content, there's an opportunity for many companies to become world class organisations in a very cost effective way, so for me I think that is key. The second part is, it depends what differentiates you. If everyone can get access to the same tools, it kind of plays into your point about optimisation. So the first thing to think about is building an eco system of great people, great partnerships, to be able to then come up with a package which is completely optimised. So I think that process of co-creation is extremely important. So having the experts on one hand, having students on the other hand, having great insights on the ground from the people who are going to use that technology, and keep iterating that process, keep iterating that technology is what's going to lead to an optimised view of things. So part of jugaad is it's never complete, the process never ends, unlike a certain point in time, when you say ok this is Microsoft office and full stop. I think with the likes of jugaad innovation and the way we have to constantly go about doing things, we actually take the market much sooner, much quicker, so our product lifecycle is much quicker to get to market. What that means is we have to constantly optimise within the market place, so we have to come up with version 1, 2 and 3 pretty much as soon as possible. For me the optimisation is in the co-creation, in gaining access to the world's best tools available and then taking to market sooner to be able to understand how people are using your innovation, and then being able to iterate those innovations.

Interviewer: That's really comprehensive. Still looking at learning solutions in terms of the technologies you use, and from a jugaad perspective, which is all around frugal, flexible and inclusive, I would be interested to hear your view on each of those through your company. So what do you do to approach things in a frugal way, to strip costs out effectively to how your company works?

Ritchie: When thinking about frugal, everything in start up land has to be done frugally. One of the ways we do that, the first one I have already mentioned, dealing with third party platforms, which means we don't have to build our own, we just borrow at minimal cost per month. The second thing that has become quite dominant in the world is the use of templates, so whatever course we are developing or our own website assets or other platforms are creating, the starting point always has to be, can we use a template to do that? Because we have an amazing starting point where we can create a beta of our product, so that the product lifecycle becomes much shorter. So for instance we just created a platform and it took us the best part of 6 days to do that, and we did that by finding a template for 50 dollars. We then basically found a freelance developer to develop that template which cost around 150 dollars to do that, so we've actually created an entire platform eco system that we need to build on obviously, but it was done in around 6 days for 200-250 dollars. So when thinking about being frugal you have got to really understand what resources you have available and which resources that have already been created. If you start from ground zero, then actually the costs are going to build up rapidly. If you can start from say point 3 of 10 then you have already got somewhere to build on. It also means you can take to market faster, and part of being frugal is all around how you get to profitability faster, how you build revenue faster. If you're starting at ground zero it's going to take you longer, if you're starting at point 3 and are able to go to point 5 in 6 days, so if you started at 3 and within 6 days you can go from 3 to 5 it means you can start to make money sooner because you can make money when you hit 5, and you can iterate when you get to 7. You can even make more money and get more scale, that's basically part of the frugal way of doing things. Frugal for me comes across in two ways, one being how do you strip out costs from your business, but also how do you generate income quicker. People forget about that second aspect of things.Ultimately you must think about frugal across revenue generation as well as cost minimisation.

Interviewer: The next part is around flexibility, how do you maintain a flexible approach to what you do in Learn Et Al?

Ritchie: I think the principles around iteration are really important, being able to customise things. A really good example of this will be coming back to that template point, the ability to re skill things for different client requirements, so to customise things. So you build a template, you take it from a point 3 to a point 7 where you are taking money from that template and you have a new client requirement. Being able to reuse and duplicate the underlying infrastructure you have built, is extremely important. So what you are trying to basically do is, you have the ability to re skill something to meet another client requirement. Maybe you need to make a few adaptations, ultimately, again it's not ground zero and you already have gone up the learning curve, don't underestimate the learning curve. I assure you with every client, product and engagement, there is probably about 30% capability we have in-house. There's probably 30% we know where we can get it immediately, and there's probably a big chunk around 40% where we actually at the outset are not entirely sure how we are going to fill that requirement. So we are constantly learning and going up the learning curve as quickly as possible. For me the flexibility comes in, being a learning organisation, having the ability to understand, we know what we know, we know what we don't know and we need to very quickly fill in that gap of what we don't know. That's part of the entrepreneur challenge.

Interviewer: Understanding your own strengths and weaknesses as a company to know what you need to basically?

Ritchie: Exactly, and knowing when you are selling a particular solution or building particular requirements, even at the back of your mind understanding that, think about a road map for example. You will know that a client will want to see something within a relatively short space of time. So if you know that you can deliver the first 30% based on what you know, you know you then have the ability to then set the client expectation to see something in 4-6 weeks. That 30% will carry you forward to the next 4-6 weeks. It then means you are giving yourself time to understand what you don't know, and then during that 4-6 weeks you are able to build the next phase, so you can move on to point 2 when you're filling the gaps and giving yourself time to understand how to do the next thing. So when you're selling something, you need to be very conscious about what you do know, what could be a version wanted for the client and then also know how long it's going to take you, to be able to get up to speed or get up the learning curve, to see the requirements that are not so obvious to you at this point in time.

Interviewer: The last bit is around inclusivity, how are you inclusive? So in the context of a learner in a developing country, organisations are trying to provide a quality education for people at the bottom of the pyramid and that's how they are being inclusive, including them through a low cost solution. So in any perspective that comes to mind, how are you maintaining inclusivity within your learning solutions?

Ritchie: I think you have got to cut that across a number of dimensions. There is clearly a financial dimension, if you are doing something, how do you deliver that solution to a particular population at an affordable cost? So that's point A, point B being, how do you truly understand what exactly are their requirements because, when you sit in London it's very difficult to understand what happens in rural India. You have got to have your insight points as well to be able to be inclusive. So I think point C is understanding the assets you currently have that you can reuse, whether that's existing content, or existing infrastructure for example. In the Indian context, for example, the whole process of actually some schools in India paying big up front costs to be able to develop this content is probably quite minimal, compared to a university in the UK. So the UK will be able to give you a chunk of cash if they have the budget to do so, but in India what they will say is look we've got 5000 kids in our school and actually, every year, we've got

the same 5000 kids going through the system. So we don't actually have a budget for you, but if you build something for us, we will then be able to give you 20 dollars a year per child, so that's the way it works. You have to think about how their business model works, in order for you to be able to do it. You look to adjust your business model and take more risk than you would have taken on in say a western context, because in a western context they will give you the budget up front. In the Indian school perspective, you build it and you hope then it will reward you in the longer term. So you have got to shape your mindset in a different way to be inclusive around this. You've also to some extent got to be extremely passionate about what you are doing, because quite honestly, you could spend and build an extremely profitable company, but are you basing your business model in either the top echelons of the Indian market or you could stick with the rest of the market where you know you are going to be more profitable than what you are doing in India for the lower parts of India. So you have to be really passionate about why you are entering that space, because you see it's not just as a profit, but also see it much more as a social development area. So for me inclusivity comes under cultural aspects in changing the way that you look at that market place, seeing the commercial opportunity, but also seeing the social opportunity. In education that is what you have to do. Ultimately we are trying to help people. That's the cultural part of it. The business model part of it basically is, how do you actually penetrate in a way that you can make it scalable and profitable, but not in the same way that you do in the western context because they won't have the budgets for it. This aspect is, how do you get an understanding of exactly what is going on in that context and what you want them to get out of it. The only way to do that is to actually spend time with people on the ground, getting into different schools, understanding their requirements, understanding the national curriculum. For example, I work with Delhi school principals and have a great insight into the types of things that they have in the front of their mind and types of things that the students are being taught etc. So for me, three core aspects to that answer.

Interviewer: Thank you for that. The next question is the pivotal question really, an obvious trade off exists between low cost and high quality and do you think that low cost EdTech solutions can improve the quality of education for learners in developing countries, such as India? If you think they can, how do you think they can?

Ritchie: I think you have to look much further to see how the landscape of business models are changing dramatically around faster than cheaper. We already know this, in any industry that we look at, you can point out the sharing economy, you can look at Uber, Air b n b, everywhere we look, you are finding that solutions are being able to be delivered at a cheaper cost and actually in reality a higher level of quality. Uber is a great example of that, compared to a London black taxi for example, 30-40 % of the cost, you are minimising uncertainty because you know when they are coming. You know the driver's name, your wait time and know you are going to get a good experience from that. The answer is absolutely yes, the principals of jugaad play out extremely strongly across all landscapes, so it's a very positive view in the world that actually, lower cost can equal higher quality. For me the absolute simple answer there is a yes, it can work. In the EdTech space for example, you can point to things like MOOCS. A really good example of being able to reel off some of the biggest and best education content free, that's what it comes down to. Again from an education perspective, there are chimes of great content out there, and it can be done. The other thing about it is, actually not so much around redeveloping, but actually how do we integrate what currently exists in terms of content, into the current curriculum? What I mean by that is, this is the role of the teacher, the fundamental role of the teacher. How do you create a learning journey using completely free assets that are available to integrate to make the engagement at student level more compelling? What I mean by that is, how do you substitute a book in a classroom and reading from a book and actually create 10 really lovely assets that means, this is a YouTube video, this is a PDF case study, this is an interactive quiz that you're doing using technology, etc, substituting for that boring experience that you currently have? You could do that for free, all that takes sweat equity on the teacher's part. If the

teacher is completely engaged then they can go about doing that. For me that's around using what's currently there, business models are completely changing and technology facilitates that. So are schools, where a rural school in India has no connectivity, a rural school in India can have as much connectivity through good broadband connection to anywhere in the world and get world class resources, pretty much for free. The answer is yes, it can work, it just requires more effort and more sweat equity I call it, to be able to implement that, which I think is not currently happening. I think it fundamentally comes down to teacher issues actually. When we are thinking about this, to get good quality education, it starts with actually teachers, and we need to focus on how do we improve the teacher's perceptions of what they are doing? How do we improve their standards and engagement. How do we inspire them to take interest? I actually think the answer lies there, because we can get the students access to great resources which nobody would use, but actually if you convince the teacher to change the way they are doing things, that for me is actually the most powerful thing in the world.

Interviewer: What would you say to that, would you have any ideas about how you would do that or is it just a thought provoking response?

Ritchie: Wouldn't it be unbelievable, this thought has just occurred to me, where you take the national level curriculum, take a science curriculum that is currently being taught to millions of students in India through a book. And you come up with exactly how you could teach it in a classroom environment, but basically using technology. So you could say, a classroom, say class 1 of term this is what you go through, these are the three assets you get, these are the three YouTube videos you can show them, this is the PDF version you go through, these are the slides that you use, and you create a resource almost by a class by class type of thing, breaking it down for the teacher. Now that could be a lovely way of doing things to help them, from a teacher training perspective. So they just go through that and then they have the knowledge to learn themselves and kind of use those assets in that way. A teacher could clearly do this themselves. But if you created some sort of central bank of this, it could actually be of much more benefit to hundreds of thousands of teachers throughout the country as opposed to one or two who do it themselves.

Interviewer: It's interesting, because Connect2Teach, that's kind of what they are, a centralised place for that, a centralised bank of resources, it's an interesting idea.

Ritchie: If you could think about it, maybe a collaboration with Connect2teach and Learn Et Al.

Interviewer: Yes, maybe.

Ritchie: Are some of the thoughts that I'm suggesting that others have as well or are they quite different?

Interviewer: Yes, it is quite similar, every single interview has been around using what already exists in new ways and being innovative with that, it's all around using existing resources. In terms of education quality and looking beyond assessment grades and actually how you learn and lifelong learning and that dimension has been quite good. Up until now, you are definitely on the right track. We will go back to one more thing, around the cost, quality trade off. EdTech solutions improving quality of education yes or no. Do you have any evidence that you can think of in terms of statistical evidence, to support your answer that low cost can improve the quality. I will give you an example, so in the interview with Priyanka, she said that her model has basically reduced the cost of connecting the learner with the teacher by 65 % whilst increasing the learning outcomes by up to 80% in some cases. Can you think of anything around that?

Ritchie: I think there are a couple of things here. So one, we are generally a content generator, so to that extent we use jugaad in a back end way, an infrastructure kind of way to build stuff, but we are still

building content, so it may not be as applicable to us. I will go and look at MOOCS, look at research done on MOOCS because that's what I think is going to help you identify the trade off. Are MOOCS genuinely increasing learner outcomes? And I'm sure that in all the studies done, both in the Western and multi market context on MOOCS. I think that's where you will need to go to think about this.

Interviewer: I'm sure there will be lots of studies done on that.

Ritchie: Yes.

Interviewer: The next point is, EdTech doesn't always support social interaction. How important do you think that is during the learning process to deliver quality education? So the argument that EdTech can only really go so far, and what emphasis would you place on social interaction during that process, to deliver a high quality education?

Ritchie: How long is a piece of string? In the next ten years I think EdTech will genuinely be able to deliver that social interaction the way we do face to face. You don't have to look further that AR and VR to know that's the case. I think that argument is going to be slightly null and void in years to come, when you see more AR / VR technology coming into the education space. We have also got social learning tools, Fusion is a great example of a social learning element. So we are finding that there are some levels of EdTech solutions that are coming in, specifically around E learning. Again overcoming some of those barriers that were initially thought of. We have also got with the imbalance of video chat and group chat, say Google Hangout. It's very cost effective and a great way to interact socially with people all around the world, so you're limiting, so people at the moment are suggesting social interaction is less, but actually you are connecting with people all around the world, so surely that leads to a higher level of engagement? I think the thought around social interaction to technology and the limitations of it are actually to narrow minded people in that sense, it's not necessarily true. I was talking to Delhi school principals and what they do, they basically bring in experts from all around the world into their classrooms using Google hangout, so are you actually telling me that they can't have a professional talk to their students in India at the click of a button, and that that's not the great use of education to help pollinate those ideas around the world? Why do I need to be in South Africa right now, I don't? You can use technology to enable that, I think that modern education is going to change through those technology solutions. So the answer is I don't actually think that it's necessarily true. The one thing I would say is that you have to use the medium for what its intended to do, for example, if I said you are going to meet your best friend after six months and you want to have a very good night out and have this amazing conversation and go for a few drinks. And I said but do it over Google Hangout, you would probably look at me and say, you're kidding me, it's not realistic, there's no atmosphere for a drink. So it's appropriate that you go to the pub and have your drinks. Now at the same token, use the medium, use the pub as a medium to learn, so when you're in the pub with your friend having your drinks I want you to do a case study and understand what's the future of learning for example. By drink two you will have forgotten all about that and will have come up with a wishy washy answer at the end of that process, because the pub is not the appropriate place to do that. It is the place to catch up with your friends and be sociable, on the other hand use technology for what is good about technology. For example, if I said come up with 10 differences that you have between cultural dimensions around the world and you would be able to Skype in with 10 different people from all different continents. Suddenly I have a much richer answer than you sitting with three of your friends in a room. The point is, use technology for the advantages that it brings, as opposed to constantly putting it down and saying, actually there are certain limitations, of course there are certain limitations with the classroom environment, so you have to use technology in the right way.

Interviewer: Excellent. So theme three is the innovation process and you have already touched on this with the use of templates. What does the innovation process you go through look like to actually develop an Ed Tech solution, so your packages, what is the process you go through create that?

Ritchie: There are a couple of key stages here. The first starts with the learner, what are you truly trying to get the learner to understand, what are we expecting the learner to do at the end of that process? That is literally the starting point, be learner centric. The second point is, create a set of learning outcomes that match exactly what you want the learner to achieve at the end of that process. So those learning outcomes become your bible, to determine whether your course is any good or not. That's what you are judging yourself based on. Those learning outcomes are that correlation or relationship to what you want the learner to learn at the end of it. That's the learner centric, to learning outcomes. Once you have that, you have to try and design content that actually matches those learner outcomes. And be completely channel agnostic, the content needs to be the right content to achieve the learner outcomes. It doesn't matter at this stage how you are going to display that content. Once you have got all your content ready, you then say ok, so what's the learning journey that we are going to put people through?   Whether that's a complete distance learning journey or a blended learning journey, whatever that is, which is actually the best way to get people to learn the content you are trying to give them? So you craft up the learning journey, so the next stage is production. How do you produce that content in a compelling way, which basically brings the content to life and leads to a learning journey? As part of that, think about technology solution which we have as part of the production side of things. What technology are we going to be using, is it mobile compatible, which is extremely important today etc? Those are the key stages that we go through.

Interviewer: Excellent. The next question is linked to that, going back into the roots of jugaad being frugal, flexible and inclusive. I suppose when you go through that process, I would just like to tap into each of those if we can and say, through that process you have just explained, what do you do that is frugal, how do you achieve frugality through that process?

Ritchie: Well I think that at every stage you have got to understand how you can minimise your costs, thinking about how do you get the right people to develop the content at the lowest cost possible. What are the models, whether it's a revenue share, whether it's a fixed fee, whether it's basically using existing learning assets to develop the content and getting permission to use them? So that process, the production aspect is about how do you use third party systems, to be able to do that, to produce in a compelling way, reducing your costs. We don't call it jugaad, it's just start up mentality, we have minimal resources, how do we maximise the output of those minimal resources.

Interviewer: The next point is flexibility of that process. In creating these packages, how are they flexible?

Ritchie: Ultimately you have to have a flexible mindset, because there are things that always come up and it's about the situation, so the content will not always fit the medium you are trying to put it in. As you go along, you are creating a learning journey, but when you produce it, it actually doesn't fit a body and is much better in a video demonstration. So as much as you think it's a linear process, the process is actually much more circular. You are constantly going back to the principles and making it appropriate at every stage. You have got to empower your people and have all this chain in basically a range of experts and you have got to give experts the ability to make changes when you see things are appropriate. If you don't give them the power and try to come across a rigid framework, you're not going to get the best output. It comes down to human touch at every stage.

Interviewer: The last point on the innovation process is inclusivity, how do you maintain inclusivity through the innovation process that you go through?

Ritchie: It's a very co creative environment, so inclusivity for us is making sure our stakeholders are constantly involved within the process. I think there is an organisation part to this, you are going back and forth at key stages and keeping an agile mentality that helps you do that. Where you can Skype people at any part of the day. Your clients have to be willing to accept that before, the traditional model, you would give them the final product and you would judge us for it. But today it's changed to actually what we will do is iterate with and co create the final product together. There is a big shift in mindset around that.

Interviewer: So I think you have already answered the next one, that you do co-create, you do work alongside learners to co-ideate, co-design and co-develop solutions do you?

Ritchie: Yes we do, absolutely.

Interviewer: How do you do that, how do you work alongside them in that sense?

Ritchie: It's part of the process at every stage, making sure you have consulted the stakeholders or the end users all the way through the process.

Interviewer: How do you commercialise your solutions, so once you have created this package, how do you actually take it to market and commercialise what you do?

Ritchie: In our case it's very simple because we are a b to b business. We only build when we get a commission from our clients. Effectively we are building products and our clients are taking it to market, so from our perspective it's all around working with our clients to develop their products, and basically we hand that over to them, and they give us a chunk of money for it. As simple as that, but when we get into a b to c kind of world, that would be very different and will be a more complex answer. Right now we are only b to b.

Interviewer: Theme 4, can you think of any examples of when you have used or seen jugaad innovation used within EdTech ?

Ritchie: I think all of these examples we have talked about have. The borrowing concept, using third party solutions, the processes around how do we use the right type of people. For example we will use younger people, we will use working mums for example, being more cost effective. We will use freelance staff as a way to maximise our cash flow, it's all those principles, I think jugaad is at the heart of the business really, the entire business model revolves around it.

Interviewer: The final question, what do you think are the key limitations of using jugaad innovation and Education Technology to solve the learning crisis and enhance the quality of education for learners in developing countries?

Ritchie: I think there is one major limitation with it. Are we creating an incremental product or are we creating radical changes? Can jugaad truly deliver the disruptive change? It's probably the biggest question to be asked. By making incremental tweaks and changes to things, you might do it cost effectively. But can you disrupt a business model around it? I think I will go back to the old MOOC movements for example. So MOOCS had the ability to offer courses free, but are they working? Jugaads are good in practice, but are MOOCS really working in today's world. There are many examples of many people saying they are not. Can jugaad truly deliver disruptive change?

Interviewer: Thanks, that it that, that's everything we need to talk about.

Appendices 6 - Neville Mehta Full Interview Transcript.

Interviewer: To begin, I would like to start by asking for your informed consent to partake in, and audio record this interview? I will be using the recording to write a full transcript of today's discussion, which will be used for educational purposes only, forming a constituent part of my final-year dissertation research [Neville agrees].

You also have the right to confidentiality and anonymity. You also have the right not to answer any question if you don't want to, and the interview will be stopped if you so wished. I will happily provide you with a summary of the research findings. This will be around mid May 2018.

The Research aim is 'to investigate how combining jugaad innovation with EdTech, can help solve the 'learning crisis' in developing countries'.

In terms of progress to date, I have completed the literature review and I'm now in the final stages of collecting the primary research.

Interviewer: So I think to start with if it is alright with yourself, could you give me some background information on yourself, who you are, what you do and how long you have been doing it for?

Interviewer: How would you define a quality education? What do you think is important to deliver a quality education?

Neville: I think that question is too broad a question to be given a proper answer because what does quality mean? Every country requires a different thing, and countries such as the US, the UK, the more developed countries, they require an end product which is a little more different than what someone like us would require. The question also is that when education in India has such big quantities involved. You must imagine that when you did your schooling, the chances are there were about 25 kids in the class or 30 kids in the class. In India you will find that may be 1 or 2 % of the schools, or may be way less than that will have that kind of quantity. The rest will have 70-80 children in a class, so you are talking about how does a teacher educate 80 children in half an hour for a subject? Which is where the difficulty really comes up. Also education in India, I can't talk about Africa, I don't know, is very stepped wise education and very mugging education. So again we come back to the same thing. The other big problem in countries like India is that education is not being taught in the mother language of the person who is being educated. So you first have to leap that barrier before you can reach any other barrier. If you come up with a programme and put it out in English, the chances are 80% of the people won't understand what you are talking about. So again then you come back to the other problem, if you come out with a programme for a part of India, their mother tongue is different from another part of India, so you will end up having 14 different mother tongues. So your question is, who are you really aiming at? The other problem is that people assume that everybody has a mobile phone or computer which is actually not exactly the truth of the matter. In quantity we may have more phones than you have, but in percentage terms to the population of the country, we have much less phones available or computers for that matter. It's just the quantities are so large of people here that even if 5, 6 or 7 % of people have phones here, they will end up having more phones than in the UK. So it's a case of how do you balance the two, and again it's a difficult question to answer. About 5 days ago I was literally with all the principles of my school and we were discussing exactly the same topic, as to what kind of education should we be giving our kids? In the UK you have an O level, we also have something similar, but again, you have one O level that covers the country, while we have I don't know how many there is. Every state will have one type of O level, then there is a common O

level that comes from the centre. Say the passing is O level, all the children that have passed the O level in the UK, have passed the same examination. While in India the children passing the O level might have passed 25 different types of examinations. Then you get into this little higher level, where it compresses a bit then it goes into one higher level if you want to get into engineering colleges, law or medical college or architecture. Again, there is a specialised exam for that, if you want to get into one of those specialisations. Which doesn't happen in your case, you go from O level to A level, from A level to university and then branch out wherever you feel like. Standardisation of education in India has been talked about, but it has not actually happened. So therefore again, take your programme, which is geared up for a type of education, but that doesn't mean that everybody who is being educated is using your type of education, because of the different types of finalisations that are taking place. So come back to your word quality, what is the quality that is really required? It's a very difficult topic and difficult thing to actually generalise and say this is the kind of child we want to come out of the O level.

Interviewer: That's a comprehensive answer so thank you for that. Could you give a bit of background on what you do, I believe you run a school?

Neville: Actually I trained as a chartered accountant and then I semi-retired and my family had a school. About 10-12 years ago I started taking an interest in it. I then got into the education world and have been running this school for about 12 years. It starts from nursery and goes up to A level, and slowly over the years we have been finding that things are changing. The question is that, what is changing is also becoming very debatable. I will give you an example, just now there was at the A level a physics paper that was given to the kids. Something like one third of the paper came out from nowhere, it wasn't even in the topics, and I think 5% of the questions were wrong. So it happens everywhere in the world, it's not unusual that a question set in a paper may be wrong.

Interviewer: How many children are at your school?

Neville: I've got around 2900 children.

Interviewer: Wow that's a lot.

Neville: It's not a lot of children, my school is one of the smaller ones. There are schools with 7000 children, there is an organisation that is running 27000 children.

Interviewer: The next question is how do you measure learner outcomes? Is it primarily through testing, through exams or other means?

Neville: What exactly do you mean by that?

Interviewer: So how much someone has learnt, how do you measure that, through an exam?

Neville: Well everything is finally measured by an exam, I think you have to go back a bit in history on this also. Three years ago if you wanted to go from your O level and enter your A level, it was very much based on the school or college who selected you and chose you and said ok, we will take you in and teach you. Now it's all become computer based, so basically you feed your mark into the computer and take your selection, these are the colleges I'd like to go to. Depending on where your mark is, you are allocated a college. So if you look at that, you have to say that it's now purely number based and is it good or bad? I don't know, it's just started, so it's very difficult to make a judgement as to whether this will work in the long run, or whether it's going to be a case where it's another thing they have come up with that will fail. But at the moment that is the way people are going from their O levels to their A levels.

Interviewer: What low cost education technologies do you use at your school? Do you use computers, mobile phones, tablets?

Neville: Again, my school might be a little, again not the norm, because every class in my school is wired for projectors, wired for computer teaching, every teacher has an iPad or laptop. What we actually find the problem is, that computer teaching or the way Ritchie is trying to do it, is very time consuming and the time given to a teacher to teach during a period is limited to between 35-40 minutes. So the set up is ready, you just have to plug in your computer and all that. We find that the other problem again is that, because of the issue of mother tongue and non mother tongue teaching, it requires a lot of explanations on concepts to be actually taught to them in their mother tongue. Because if it's taught in English, they have no idea what the hell you are talking about, so they have to grasp it in their mother tongue and then translate it to English. So again you are trying to put something like this forward, which we have been trying to do for quite a few years, is what normally schools do, is that they teach a subject in their classrooms and then they take them to a computer lab or something like that and say look, this is a mountain and this is a volcano, if you can imagine, pictures are shown at a later stage. What we are trying to do in our school is simultaneous. I won't say it works brilliantly, it works to a certain extent, but it doesn't work absolutely fantastically. The other issue also that comes up in education here is that, a child that finishes O level has to actually sit for 10 papers and there is no selection procedure involved. Everybody has to do maths, everybody has to do science, everybody has to do geography, history, English or another language or whatever it is. The question I keep asking is, the girl, what is the reason for her to know high level maths or statistics? Because after all, at the O level stage, to my mind, the course and the syllabus is way higher than what you guys are doing. You people catch up more on the A level and university stage, while here it's crammed at the bottom and then university crams it even more.

Interviewer: Is your school catering for lower income people, or is it a private school?

Neville: I think you need to define a lower income people, if you mean the middle class of the UK, the answer would be about yes. But lower income people in India would mean in reality, lower income could not afford a private school. The other thing you have to remember a lot, is that, I am not sure of figures, but I would say 90% of your kids come from public schools, private schools 10% maybe, and that I think happens in America and UK, France. While in India, it's urban and rural. In the rural areas everyone is coming out from a government school, because there are no private schools there. In urban, everyone is trying to come out from a private school, but again, there is a lot of money being spent by the government on their schools, but whether they are performing or not is another story.

Interviewer: The way you do things at your school. What do you do to keep things frugal, what do you do to keep costs low?

Neville: See to run a school requires one main basic fact, a teacher. If you say to me that I want to run my school at a lower cost, the only way you can do that is by not paying the teacher, but the reality is that every child requires a teacher, and the cost of teachers is going up. None of our schools are air conditioned, so you cannot cut the cost by not putting air conditioning into the class, but everyone needs a fan, lights, teachers. What's the meaning of frugal? Everyone is running bare bottom, but the cost of the teachers is approximately 65-70% of the cost of running the school. So the reality is, that unless you cut the teachers cost, you either put more children in the classes, the cost of the child per teacher comes down. If you put less children, the cost of the teacher goes up. The salary is again it's standardised, you have to pay a living wage, and it's very difficult to say what is frugal. So if you say the boss cannot come in a Mercedes car, they are not doing that anyway, they are coming by bikes so it's difficult to talk about. There is a

certain element of cost and infrastructure that has to be there, you have to have a classroom, a building, land a playing field. If you don't have that, what kind of school are you running? There are certain absolute basics that have to be there.

Interviewer: How do you maintain flexibility in your school, in terms of a mindset, what do you do that means you can change what you are doing quite quickly, it's quite a broad question?

Neville: Firstly we are regulated as to what we have to teach by the government. The syllabus is given to us and not pre-determined by us. We are told this is what you have to teach in class 1, class 2, class 3, class 4, right up to the O Level stage. It is predefined by the government. Again we come back to the same problem, that one ward predefines one thing, another ward predefines another thing. If you take a topic like statistics for instance, there are lots of topics in statistics. One ward might say you will only touch these 5 topics, another ward will say you will only touch these 5 topics, so the question is, as to what we can teach is very inflexible in India. It is very much predetermined by the government right up to the higher levels. The only thing that you can do is, you can talk to the kids and advise them and give them a few other little things like clubs on the side, for them to be able to be a little more flexible. But flexibility as far as the syllabus is concerned is out. The only other thing that can happen, is you can rationalise the syllabus a bit and you realise that certain things are not necessary and taking time and energy away, so we knock those things out. But you finally end up having to follow what the government want, because the end result is set by the government. It's your government who sets your O Level paper, they also have a syllabus that has to be finalised and ended, and the same thing goes on here. It's very difficult to really play around with how much flexibility a school can have anywhere in the world. Finally you have to do what they want, because you are not the ones giving the degree.

Interviewer: The final thing around this point is around inclusivity, so how does your school include, I suppose it's not the lower income learners you are catering for?

Neville: I don't understand why everybody keeps saying a low income learner, a low income learner is as clever as a high income learner, in fact some of them are way cleverer. It's only a question of how does a low income person send a child to a school, or which school can he afford to send the child to? In UK it's a question of what's the closest school and you send them there, he can be a plumber, he can be anybody, he will end up at that school and be taught, because he is not going to pay a penny for it. Here if you go to a government school you are not going to pay a penny, but if you go to a private school you are going to have to pay for the cost of running it. So therefore I don't think it's a good thing to try and differentiate between a low income learner and a high income learner, because they are learning the same thing. It's not that they are learning anything different, it's just a question of where they go and learn.

Interviewer: What do you do at your school to be inclusive to lots of different people?

Neville: Again we come back to the same thing, it's people. We have a fee structure that doesn't make us any profit, we just break even and anybody who can afford it, can join the school. We have a lottery system, whoever wants to join the school, we put them in a hat and say here you are, twenty of these kids can come and twenty of these kids can come and goodbye to the rest. That is not differentiating anything, it is just a way of us saying we are putting our hands up and not asking the parent who they are. Everyone has an equal chance, but the defining part of the whole thing is the fee.

Interviewer: A trade off exists between low cost and high quality?

Neville: It should not, it should not.

Interviewer: It does exist, a low cost learning solution, might not necessarily be high quality, so for example, do you think that education technology such as mobile phones and computers that are a low cost way of learning, can improve the quality of education for people in India?

Neville: Very honestly why do you say that a computer and telephone is low cost education? A teacher is as low cost as anybody else. Are you saying self learning or being taught?

Interviewer: Self learning, just using education technology, so ignoring the teacher, do you think that computers and mobile phones that are low cost, can improve the quality of education for students in India?

Neville: Let me think about this. I don't know is the answer, because basically, the issue in India is, what you are talking about doing is already being done. It's not that it's not being done. I don't know how many different people come to my school every week, month and offer this kind of programme. We can do this on the computer, we can do this on the phone, we can do this and that. The reality is, none of those companies have been very successful in what they have tried to start with. A lot have fallen by the wayside, because finally the computer guy does the programming and creates the programme, he has to have funds from somewhere to maintain and if you then go to low cost, you say low income students, they can't afford it. So they will not be able to do it. The rich can do whatever they feel like. If you say I am giving the programme free to you, even that will be a problem because they will need the net, they will need to be able to pay their phone bill. A lot of people in India use the phone literally as a device, they don't even actually phone anybody, they wait for calls to come in because they are free.

Interviewer: But do you think using mobile phones and computers can improve the quality of education or not?

Neville: Ritchie and me have had too many arguments on this one. I personally feel it is a benefit only up to a certain extent. But if you say that can they replace a teacher, the answer is categorically no.

Interviewer: Why do you think that is?

Neville: Because children like to be taught, they like to sit in front of the teacher, like to be told off by the teacher, like to be guided by the teacher. Saying, look, this is what you have to do and they also like to be helped by the teacher while they are learning. So the teacher in my mind cannot be replaced. You can help the teacher to speed up things, you can help the teacher to be able to save time by flashing your screen with different things, but as far as teaching goes at the end of the day, I personally feel that you cannot replace them. They are the key element that has to be there. Every child is not of the same calibre in the classroom, so therefore the teacher has to notice which child is slower, which is faster, which requires help, which a computer or phone cannot do. The problem is, if you give a slow learner a phone, the first thing he will do and look at it and think I don't know what this is and put it away. Give a classroom of 50 children a phone and say go home and start learning from it, I bet you 10-20% will do it, the rest will quietly put it away and forget about it and come the next day and say yes we have done it, but have done nothing.

Interviewer: So you don't think they are very effective, education technologies?

Neville: I think in the higher standards where you are a much more mature student, and you are having to learn to do things for yourself. Yes, then I would say, here it is quite beneficial, but in the lower standards, up to O Level the teacher is not replaceable yet, even up to A level. But yes if you are doing a law degree, if

you are doing accountancy and the student is much more mature, yes you could get away without the teacher. But again, that also has to be put in brackets, there has got to be someone they can turn to for help.

Interviewer: At your school you use computers don't you?

Neville: Yes.

Interviewer: And how effective are they, do you have any evidence that you can think of, or statistics about increases in test scores from using these computers?

Neville: That is impossible to determine, because basically computers are used by the kids more for fun, they are all computer savvy and know more about the mobile phone than I do. Study wise it's still down to teaching and classroom teaching. Again you must remember one thing, people seem to forget, if you have a classroom of 100 people you are always going to get the ratio that 10% are going to be good, about 60-70% will be middle to bottom, and the last 10% will be bad, give them anything you like, that issue will always turn up from somewhere. You can do exam after exam and for some reason, that ratio just sits. The kids if they are really interested they will do it, it's the kids that are not interested that find it difficult to learn. They are the ones that are not going to bother. That is the bulk of the kids.

Interviewer: At your school when you go about creating new ways of doing things, you are changing what you have done traditionally in some way to meet a new regulation or meet a new demand, when you need to make a change at your school, what is the process you go through to make that change?

Neville: What kind of change are you talking about, do you mean subject change, teaching method change, infrastructure change, which kind of change are you really talking about?

Interviewer: Say you wanted to implement a new computer or a new infrastructure change, a new technology in the classroom, what's the process you would go through?

Neville: In my school, basically I just sit down with my principles and say, are you ready to take this on? I want this to go in and are you ready for it? If they say yes put it in, if they say no, we say ok forget it. Every school is basically self run, so therefore the same thing would apply to most schools. Syllabus changes we cannot make, that is made by the government so that is completely one sided. Teaching change, method of teaching change, how to teach, that also develops a little bit as time goes on. Certain teachers are better, certain teachers are worse, nothing you can do about that, you will always get that problem. From what I can understand is you are trying to bring in computer or app based learning, that is what you are trying to figure out. The only advice I can give you on that one is basically do it for the more mature students, yes you will be successful, but don't try and do it for the youngsters, it doesn't work. I mean a youngster can learn A,B C, that part of it is fine, but if you are going to teach geography, maths or a language, it's very difficult and they just don't get it.

Interviewer: Because they are too young?

Neville: They are too young to pick it up, they need to be self motivated, they need a teacher to teach them, they can't motivate themselves. A child from 3 to 5, from what experience we have, a child doesn't have a learning span of more than 15 minutes. More than 15-20 minutes and that child is bored. You have to take him and go and play a game for an hour then come back and study for another 15 minutes. Ok it gets better as it goes up, but even as high as 9th and 10th standard, their span of concentration is limited to about 2 or 3 hours per day, so those three hours are critical hours. The span of learning of children is very short, that's

what you talk about, hey here is a computer and learn for 2 hours, they would be gone from the computer in 10 minutes.

Interviewer: The innovation process I suppose doesn't really apply to your school so much, but I would be interested to know if you had any thoughts on it around what we have just talked about. What do you do to keep things frugal when you need to make a change, so what do you do to keep things low cost, whether it's an infrastructure change, or a teacher change?

Neville: I keep coming back to you on the same point, what is low cost? If you have to put a computer in, you have to put a computer in, there can't be a high cost computer and a low cost computer.

Interviewer: The way you are approaching it, is it low cost, or can you can think of anything?

Neville: This is why you guys need to come into a country like ours, about what it high and what is low cost. The main cost of a school is salaries and infrastructure. Infrastructure has to be paid, in the UK it is the government. Every school is given a budget to spend, say go and spend £100,000 this year on infrastructure. That £100,000 is never recoverable, and the same thing applies in schools. Basically schools have to be funded in such a way that they have a source of income that's going to allow them to do infrastructure changes. Fees are actually covering the normal day to day running of the school. Obviously you could say that if you want to make a change which is drastically expensive, then obviously you will have to think twice and say where is the money coming from? Then based on your own infrastructure, your own finances, your own individual entity, you can then work out whether you can afford to do it or not. Low cost, if you are saying you are going to give your app free, that is low cost yes, but how do you earn, where is your money coming from? Therefore, you cannot do it free to anybody, you have to have a charge for something.

Interviewer: Around the same point, what do you do to maintain flexibility when you do need to make a change, how are you flexible in the way that you can make changes?

Neville: This is really meant from school to school or university to university, it depends on their management structure. In my management structure it's me as the principle, that's it. If we decide to do it, we do it. The next question is have we got the money do it, but flexibility has to be there, there is no question about it, today in life if you're not flexible, you're dead.

Interviewer: How is your school flexible, what do you do that is flexible?

Neville: Keep looking at things that are going on, changes, how to improve education, get more training to the teachers, the answers still come that all that flexibility is limited to the syllabus that we are given. We cannot actually say we are not teaching physics, forget it, we have to teach it.

Interviewer: Do you think that is a problem?

Neville: Of course it is a problem, because certain kids don't need to go to such high level physics, they are not even interested in it. We teach statistics in the 9th and 10th standard and some of the girls look at the thing as if you are mad, what the hell are you talking about. There is no particular reasons for them, they may want to become a housewife, or be interested in art, or in something else, they are forced into doing this. So flexibility is two fold, you don't have flexibility of the syllabus. Even today, if you are to have an app for us in India, you are going to have to take the syllabus and break it up, that's it. You cannot give

anything else or put something else into it because basically it's not part of the curriculum that the kids have to study.

Interviewer: Sure.

Neville: It's not a question of a university saying ok I can change my degree, I can change it to the subjects I want. I don't think there is anywhere in the world where the syllabus is not set by the government or the education board of the country. Flexibility can only be in infrastructure, method of teaching, I don't see how much flexibility you can put in.

Interviewer: Thank you for that. The last thing we have been talking about around that is making changes, how are you inclusive, so when you need to make changes at your school. I know you said you talked to the principals, but do you also talk to the learners, the students, as well in making those decisions, or is it more the top level of management who make those decisions?

Neville: I assume to a certain extent that certain feedback does come from the student via the teachers, from them to the principles. If that doesn't happen then the principles are not doing their job.

Interviewer: So it's almost an automatic thing?

Neville: I would hope, let's be very honest, I would hope that this procedure from the bottom coming up is being followed all the time, because otherwise why would the principal want to make a change. It's only because the feedback is coming from the bottom that this is required or that is required, a change needs to be made. But the other problem that one faces is that a teacher who has taught for ten years, finds it very difficult for her to change their method, they are very set in their ways. The kids are growing very fast now, it's something which unless you are right in the middle of a school and watching, you don't realise how fast they are growing. For them, talking on a mobile phone in a class would mean nothing, they would think it was just part and parcel of life. I've got a mobile phone, I will take it. And if they don't have a phone in their hand, what you don't have a phone, you've got to have a phone!

Interviewer: Excellent, last few questions now. Can you think of any examples where you might have used jugaad innovation in your school? The idea around frugality, flexibility, and inclusivity, can you think of any examples where you have used that approach in any way?

Neville: I will give you a very good example now of something that is happening. Parents came to me about 2 weeks ago and said, "we want the uniform changed". I said "why do you want the uniform changed?" "Because your uniform is only black and white". I said "ok, let's have a think about it." So we looked around and said what new uniform can you get? And we realised that there were other things available, a little more costly and so when we were discussing it, I said to them, "look, I don't mind changing the uniform. I don't care what colour the children come in, but the reality is, you as parents must remember that whatever colour you bring in, the sun in India will fade your clothes in six months". It doesn't happen so much abroad, because you don't have the kind of sun we have. I am a golfer, so I know that every six months my shorts need to be changed because they are faded. So I said, "because of that, I suggest you stick to black and white because it's cheaper and doesn't fade. So why do you want to change it?" So things like that we are always discussing. Trying to make things so it does not hurt the parent's pocket as much. You can do certain cost cutting, but at the end of the day, you still come back to if your main cost of 70% is salaries, exactly where are you cutting?

Interviewer: Can you think of any examples of where you have had to cut costs, apart from the salaries and how you went about doing that?

Neville: No, I can't think of anything, because it's salaries, it's electricity bill, it's telephone bill, it's the travelling, the sports day, unless I cut our sports day which is not going to happen. So the reality is the only thing that certain other schools, when they talk about high fees, sometimes I don't understand how high fees are justified. There are certain fees that are being charged in Bombay today, that are such a ridiculous figure, that I can't believe that they require that kind of money to run that school. I don't think if you run a decent school, and you run and honest school, you don't have that much flexibility to cut costs. Because anyway you are running it at low cost.

Interviewer: Excellent. Can you think of any examples where you have used jugaad innovation with Education Technology together?

Neville: All my classrooms have got projectors, they are all computerised, every teacher has a laptop and that in it's own way is being used. More than that, we do buy programmes from outside, but they are very specifically related programmes. For languages we don't use programmes, because nobody has come up with a good enough one. But for maths we use it, for physics we use it, for chemistry we use it, for geography we use it. So programmes are being used and we don't charge the kids for it, we buy it ourselves and do it. The reality is again, come back to the same issue that in your mind if you take away low cost and low education. There are no such things that exist, education is the same, it's just a question of how much you are paying for it.

Interviewer: OK, last question. What do you think are the limitations, the drawbacks of using this jugaad innovation approach?

Neville: I don't think personally there are any drawbacks. I just feel that it has to be in conjunction with the teacher, if you can make it in conjunction with the teacher, it will work. If it is not in conjunction with the teacher in the lower standards, it will not work. In the higher standards it will work, in professional courses it will work, for university degrees yes, but it will not work in the bulk of 0-8, 0-9, it's not to going to work there. It will work very much in the higher. I have two friends whose kids are doing law and they do work very much on their own, and if they had a programme for that, yes they would use it, but they are much more mature and know how to work on their own. The big problem is how do you make an 8 year old child work on his own, without his friends?

Interviewer: What do you think are the limitations of using Education Technologies in classrooms, what are the major drawbacks of that?

Neville: It has got to be in conjunction with the teacher. The teacher has to use it as a tool to speed up what she needs to write on the board, but has got to be taught by the teacher. It cannot be a programme that says ok here I start and go bang, bang, bang. Because the levels of children in a classroom are too diverse and it only takes one child to get bored and that ends the classroom.

Interviewer: Excellent. Do you have anything else you want to add?

Neville: From what I understand you are trying to create something for low cost, computer based education. Ten years ago, I was all for it, I was one of the first schools to give teachers computers. I found that all these things have a limitation and you cannot cross that limitation. Even in teaching it's limited to A level, it works up to that point and after that it doesn't work. It has to be in conjunction with a teacher. Can

you imagine a child sitting in a class for one hour and just listening to what's coming off the computer, the classroom would be havoc.

Interviewer: When you say, this whole thing around being in conjunction with the teacher, can you expand?

Neville: A tool for the teacher, if you are teaching something like a mountain, what you have is she presses a button and a mountain comes on the screen. This is what a mountain looks like.

Interviewer: Do you think outside of schools, education technologies could be effective, so when the students go home and they have a phone or a computer, and they learn something at home by themselves outside the classroom?

Neville: But you do realise that a lot of this is already available to them, just go on YouTube and you get whatever you like on it. And kids are very smart on it, about 3-4 months ago we had a discussion on computers, and I asked them, how many people used Google, so everybody put their hands up. So I said what do you use it for? They replied to check what the teacher said! It's not that they don't know about it, and they know where to go and get it. It's just a question of the ones that want to do it anyway can do it. I don't think per se that what you are trying to do is anything really new. It's just a question of my own personal thought in this game after many years of watching it happen. If you want to be successful you have to be very simple. You cannot make it complicated in any fashion. Whatever subject you are teaching, it has to be as simple and as easy to pick up on the screen, as you can possibly make it. The minute that you get complicated and have too many things flashing around the screen, nobody is going to look at it, especially on a mobile app, because it's just too small.

Interviewer: I am doing my final dissertation. My research question is how to combine jugaad innovation with education technology to solve the learning crisis in developing countries.

Neville: I'd like to go back to the first statement you made, that countries like us don't give an education, the answer to that question is in my mind, the basic reason why they don't give an education is the syllabuses are too large, that's number one. If you want to go into your theory, you have to cut down the syllabus. Today it's very simple, if a teacher tried to teach the syllabus that was set for the 10 standard, that's O level, it would take them 1.5 times the number of hours that they have available.

Interviewer: So the problem is really stemming from the syllabus then in traditional schools like yours?

Neville: Yes, that's number one, number two, they are teaching in a non mother tongue language.

Interviewer: What do you mean by that, so they are not teaching in Hindi?

Neville: That's right, my school is supposed to be an English medium school, but I promise you if you come at break time to any Indian school in this state, you will not hear a word of English spoken.

Interviewer: Why is that?

Neville: Because the kids when they go home, they have been in class for 5 hours, when they go home they are talking back in their own mother tongue. The problem is, India is churning out graduates who are totally non-graduates.

Interviewer: So they are people who shouldn't be going to university?

Neville: No they should be going to university, but the university should be teaching them differently.

Interviewer: How should they be teaching them?

Neville: Much less than what they are doing, they are churning out, let's take a bachelor of commerce, this used to be a reasonable degree when I did it 40 years ago. It was considered to be quite a high degree. Today, my driver wouldn't want to have it. It has become that. Engineers for instance, we churn out engineers, but in reality, they have no standard to be churned out. All this boils down from the bottom level, that over teaching the kids totally. You are expecting kids to sit for 10 papers to pass their final exams, you can't expect them to do that. Give them four or five subjects that they like, they want, let them specialise in that, and they will be fine. Let them go back to their mother tongue, I keep telling everybody I want to change my school back to Marathi. Everybody works in Marathi. The question that you have to ask yourself is the other way, how is it Marathi medium people get better marks than English medium people? Kids are not different it's just that they understand the subject more. They can write better, they can reply to the question better, faster than a guy who is actually wasting 10-15% of his time at the exam hall, translating the question to his mother tongue, getting the answer and translating it back to English. In the meantime, god knows what you have lost in the middle. I don't think that education per se is wrong, it's just the whole set up has gone wrong. If people just sat back and said, India has so many graduates coming out but the reality is only 10% are worth it, the rest have just mucked the whole subject up. But this is changing, the new exams that are coming, are becoming more thinking exams. It has stunned all the kids this year, all of them have come from the papers, where did these questions come from? Because they are so used to getting set, standard questions, that any change in the standard in the way of using concepts changed, they all got stunned. Things are changing, you have got to look at the other side also, as to why it's happening. I don't agree with anyone who tells me that computer teaching is the godsend for teaching. Yes it is very useful to pick up knowledge, if I don't have the knowledge on a certain topic. I love to go to the computer and read it up. If I have a problem with law, I can go on the computer and read up, I don't have to go through books. So that is fine, used as an encyclopaedia it's fine, but to teach off it at school level is just not there, in my mind. What happened to all these companies that came five years ago selling these products? They have all gone, they went bust because nobody took it.

Interviewer: Why did they go bust, because the quality wasn't there?

Neville: One, the quality wasn't there, number two they thought they could charge someone 100 rupees a month and parents would be happy to pay. The parents were saying that the teachers should teach, and the teachers could not teach because basically it was taking just so much time If it's going to take you 1.5 times the time you've got to finish the syllabus, you cannot have a computer rushing through the thing. It's a combination of a lot of things that are coming into play.

Interviewer: Thank you very much and I appreciate your time.

Appendices 7 - Slate2Learn Case Study Jugaad Learning Solutions (Innovation Process Outcomes)

Theme – jugaad learning solutions

Sub-themes	Quotes
Frugality	'The tablets we use in our centres are about £30'. 'The apps download everything from an offline server so it's low infrastructure'.
Flexibility	'We are flexible to different environments, we don't take electricity or internet for granted'. 'We are flexible in that we still offer the old operating model with the new'.
Inclusivity	'We try and subsidise as much as possible by giving grant money'. 'We don't pay the teachers, we wanted the teachers to get paid through their activities, so they wouldn't pay for the hardware'.

Appendices 8 - Semi-structured Interviews Jugaad Learning Solutions (Innovation Process Outcomes)

Theme – jugaad learning solutions	
Sub-themes	**Quotes**
Frugality	'Connect2Teach should reduce your costs of discovering the right expert by about 60%, and should increase your learning outcomes by at least 80%'. 'Use free EdTech tools that already exist, things as simple as YouTube and Google Docs'. 'At the heart of the jugaad approach is user centric designs, lean start up and agile principles'.
Flexibility	'The Connect2Teach online network can source learning experts from anywhere in the world, at any time'. 'Understand the assets you can reuse, whether that's existing content, or existing infrastructure'. 'Jugaad can work in a US/UK context and a developing country context'. 'Flexibility comes from being a learning organisation, having the ability to understand what we know and what we don't know'.
Inclusivity	'Connect2Teach have democratised access to the best experts'. 'Spend time with people on the ground, getting into different schools, understanding their requirements'. 'We started researching two years before launching Connect2Teach'.

Appendices 9 - Education Quality in Developing Countries

Theme – education quality in developing countries	
Sub-themes	**Quotes**
Top of the pyramid view	'Getting the highest possible grades'.
	'Raise my income levels in the future'.
	'Traditionally education quality has always been marked by results'.
Bottom of the pyramid view	'Bring a higher level of personal understanding, a higher level of skills and a higher level of knowledge in children'.
	'Teach people so that no matter what you do in life you are able to pick up the skills and knowledge required to do it'.
	'Truly training our kids to tackle the challenges of the modern world'.

Appendices 10 - Developing EdTech Solutions

Theme – developing EdTech solutions	
Sub-themes	**Quotes**
Focus on the learner and content	'What are you truly trying to get the learner to understand? Be learner centric'.
	'Create learning outcomes that match exactly what you want the learner to achieve'.
	'Design content that matches those learner outcomes'.
	'What's the learning journey, is that a complete distance learning journey or a blended learning journey?'.
	'How do you produce that content in a compelling way which brings the content to life and leads to a learning journey?'.
	'As part of that, think about what technology are we going to be using?'.

Appendices 11 - Issues with India's Education System

Theme – issues with India's education system	
Sub-themes	**Quotes**
Student numbers	'100 million people will enter the workforce over the next 10 years'. 'How does a teacher educate 80 children in half an hour for a subject?'. 'You are dealing with an elephant system, its massive, huge numbers, a lot of people, a lot of levels, hierarchy, it's super difficult'.
Accountability	'Schools are still struggling with the teachers being there in the classroom'. 'Teachers don't show up; there is no accountability'.
Education quality	'70 percent of the population get a sub-standard education'. 'You have a lot of poorly qualified teachers'. 'You go into grade 4 level class, you will have some children at grade 2, and some children who could be in grade 5'. 'Year 5 level students cannot read a year 2 level text so they are under performing'.
Education approach	'Education is not being taught in the mother language of the person who is being educated'. 'Standardisation of education in India has been talked about, but it has not actually happened'. 'The syllabuses are too large, that's number one, you have to cut down the syllabus'. 'It's going to take you 1.5 times the time you've got to finish the syllabus'.

Resources	'Electricity is not something that's always going to be easily available'.
	'The predominant method of training will be through a book'.
	'There is no adequate technology to enable that teacher to teach adequately'.
	'The ability to have internet connection will be minimal, and in those types of context the predominant type of training will be through a book, and I would say largely the students are not being engaged in that process'.

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TEACHERS' ATTITUDES TOWARD THE INCLUSION OF PUPILS WITH DISABILITIES IN THE REGULAR CLASSROOM

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ABSTRACT

The term inclusion arose with the reauthorization of No Child Left Behind, and as a result of the discussion take place over the last several decades regarding the most appropriate methods for educating children with disabilities. It means that school systems must ensure pupils with disabilities receive instruction in general education classrooms.

General education teachers have differing views about the inclusion of pupils with disabilities in mainstream classrooms. However, the type and severity of the children's disabilities affect teachers' willingness to accommodate certain pupils and their confidence that they will effectively manage their classroom. It has been reported that teachers have expressed concerns about having pupils with disability and emotional behavioral disorder in the general education setting, because of the children's lack of social skills, behavioral outbursts, modifications made to the curriculum, and lack of training and supports. Many instructors do not believe they are able to teach these populations effectively while simultaneously teaching a large group of typically developing pupils. Teachers' attitudes toward the students with special needs dramatically affect the success and effectiveness of their instruction.

Implementing the inclusion model in Kurdistan, Iraq has been challenging for many school systems as the systems try to find ways to meet the needs of their diverse children populations. So, the purpose of this quantitative casual-comparative study is to identify basic school teachers'

attitudes toward inclusion, and the differences in the attitudes toward inclusion according to the variables of certification field, degree level, years of experience, and gender.

The sample consist (146) male and female teachers selected randomly from eight basic schools districts located in Duhok city, completed a survey contained of four demographic/background and 25 Likert-type questions. Fore analyzing data SPSS was used to compare the mean scores by independent sample t-test in addition to ANOVA

The researcher found that the teachers' attitudes toward inclusion is negative. and no significant differences in teachers' attitude toward inclusion in regards to certification field, age, and years of experience. However, the study find a significant differences in teachers' attitude toward inclusion according to gender variable. The female attitudes was more positive the male attitudes.

Keywords:Attitudes, Inclusion, Pupils, Disability, Regular Classroom

A HEART CITY: CELEBRATING THE PULSATING LIFESTYLES OF THE WALLED CITY OF DELHI

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ABSTRACT

The walled city of Delhi, baptized as Shahjahanabad, now addressed as Purani Dilli/ Old Delhi, doesn't boast of being a 'smart city' rather it jubilates being the 'heart city'. The connotation, 'heart city' stands true in essence as, every kucha[1], functions as an arterial vein, carrier of interweaved cultural flow. Its livability is found in its measurable existence based on human analogy, accessorized by, streets as arteries, fort as head, Jama Masjid as heart, mohallas[2] as organs, Chandni Chowk as its spine and the wall as its skin (Dettmann, 1969). Old Delhi is about cohesive socio- cultural structures, with unique spatial blends, allowing for composite expressions at neighborhood levels. An amalgam of above mentioned elements continue to make the walled city a living space.

Immensely opulent in cultural heritage and composite in religious diversity, Old Delhi with its assorted religious establishments, mansions, katras[3], maze of lanes and bye lanes continues to be a living city, in its own kind. The paper is conceived with a view, to underscore the prominence and sustenance of having a heart city in times, when the spotlight pitches towards smart cities. The paper attempts to reflect on the cultural livability which has been a strengthening source for

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[1] Kucha,-residential localities usually inhabited by people having the same occupation.

[2] Mohallas- neighborhoods

[3] Katra- traditional mixed residential and commercial formations

the emergence of the socio- cultural connections and interdependence in the walled city with an accentuation on composite existence, despite being surrounded by plagued social environs. The paper is divided into four sections. Section 1 briefly puts forward the prologue. Section 2 delves into the cityscape of Old Delhi, talking about the physio-social spaces within this analysis. Section 3 approaches the idea of cultural livability and section 4 draws a conclusive portrait of the analysis.

Keywords: *cultural livability, cityscape, socio- cultural milieu, heart city, Old Delhi*

Prologue

Delhi the capital city of India and one of the prominent urban centers in South Asia, is a young off- shoot of an older settlement. Of these older settlements, Shahjahanabad is the most recognized and splendid example (Fonseca, 1971). Delhi was almost extinguished from the time of sixth Delhi of Humayun to the seventh Delhi of Shahjahan, the great Mughal emperor, who laid the foundation of the city during the seventeenth century. Shahjahan's Delhi is enclaved within a more cosmopolitan Delhi of today. In common parlance it is known as Old Delhi or the walled city of Delhi. The city in its yester years contained the houses of the princes and courtiers, who were associated with the emperor's court and each establishment was set within a walled compound and comprised of mansions, mosques and temples, and workshops of these tradesmen. The city by and large has retained its pattern of existence, its traditions and original character, though with some unavoidable alterations of time. The city was developed following a Mughal style, of organic street pattern. It was outlined with signature characteristics such as different activities and trades, clusters of houses based on closeness and common interests and social ties which it still depicts today. The lanes and the streets were designed for an easy movement of pedestrians and animal driven vehicles, which today have been taken over by two- wheelers, electronic and manual rickshaws and a blown up population, the least to mention. Albeit a medieval city, Shahjahanabad, is vibrant and full of life, a busy commercial hub but also a diminishing residential area, where old lifestyles, traditions, cuisines till date abide and are palpable and should be appreciated.

Walled urban cities depict a classic form of world heritage site advisable to be termed as gem towns. Though there is no prescribed definition of a gem town, but meanings can be drawn from its nomenclature itself. To us all, a gem is always correlated with synonyms like treasure, masterpiece, and cream of the crop. Such associations can be marked out for towns that have been like jewels in the landscape around and continue to be masterpieces of culture and heritage. The walled city of Delhi befits this criterion of being a gem town, thus metamorphosing into a heart city. Shahjahanabad, survives and

sustains itself as the heart of the city of Delhi, in lieu becoming the heart city, which the author in the current section has attempted to sketch. The walled city of Delhi is indeed the heart city, as it is geographically and constitutionally situated in the center and the central district of the city of Delhi respectively, and pumps out life to the rest of the city.

Now what differentiates a heart city from a smart city is a question which needs transparency in the purpose of this paper. As per the Smart City mission of the government of India launched in 2015, there is no clear definition of the phrase, yet the conceptualization of a smart city varies from city to city and from country to country. It carries different meanings to different people, depending on the levels of development and their willingness to change. In India, the wish list of putting forward a definition of smart city consists of infrastructure, services and promotion of a clean and sustainable environment with application of smart solutions. Whereas, when terming the heart city, it is inevitable to exclude the soul, character and the feeling which spurs from cultural exchanges, social lifestyles, the traditions, the festivals, the cuisines. Smart cities promise to be technologically apt, many a times losing out on sustainability of culture couture, whereas, the heart city prefers being benevolent in bolstering its socio- cultural vigor with transient rays of technological inclusion. Some key features of a smart city are housing and inclusiveness, creation of walkable localities, promotion of mixed land use, preserving and developing open spaces, making governance citizen friendly and providing identity to the city. In reply to this, the heart city carries with it, cultural co-existence, social interdependence, carrying forward of traditions through technological assistance, composite land use favoring a commercial and residential usage, and sustaining the soulful image of the city, manifested through a shared moral unity. Juxtaposition(ing) the walled city of Delhi, within the lines of a heart city, an organized mess, congestion, ancient architectural reservoir, composite culture, syncretic religious lifestyles, a wide array of dishes to savor from and a lot more, holds to its character. Despite some of the shortcomings, Shahjahanabad continues to prevail as the heart and soul of the city of Delhi. A gem town is equivalent to the heart city, can be

simultaneously brought into usage. It is an ensemble of heritage value and cohesive socio- cultural synthesis, and the walled city of Delhi, justifies this to its maximum.

The paper crafted is on the theme of livability and how here in the walled city of Delhi, culture plays a pivotal role in flourishing the city lifestyles and knits the livelihoods and the populace together. A careful search on the web brings to light that, livability is comprehended with the sum of the agents which adds up to a community's quality of life. This includes the built environment, economic prosperity, social and cultural stability and equality, cultural and recreational possibilities. The concept of livability has several interpretations. The paper elucidates on the cultural livability of the walled city of Delhi. By, cultural livability of the walled city, the author means to communicate the idea of livability of a place, which is described by a combination of social and cultural attributes and which emanates life into the city. For a city which is over three hundred and fifty years old and has kept itself alive amidst and within a bigger city is an exemplary example to study the quotient of livability based on culture. The walled city of Delhi is an epitome of syncretic culture, which acts as a catalyst for making it a livable space and this livable space, is shaped by its social life, customs and the traditions and narratives which have been recorded and preserved and continue to amaze us. The author's approach to livability is not confined to the physical accompaniments of land, infrastructure, resources, etc. but is at liberty to delve into the non- physical requirements of a city which makes a city a livable space. Thus, in the light of this backdrop, the paper will move on to dossier the cityscape of Shahjahanabad and peel off the physio- socio layers of the city.

De-layering the Cityscape of Shahjahanabad

Delhi is many of the places which has seen and witnessed both glory and decay throughout its checkered past. The current habitation has seen the appearance of ten cities of Delhi through its existence. But none of the cities has been so evocatively Mughal, in its nature. To many people, Shahjahanabad will be a difficult and a turn off encounter at first. But a perpetual connection with the space will undeniably ignite the feeling

specified as *topophilia*, referring to the affective bond between people and place as promoted by Tuan. As (Tuan, 1974), mentioned topophilia, may not be the greatest of human emotions but it stirs the feelings and emotional range for a place. This includes visual pleasure, the delightful physical contact, the fondness of known places and faces. For the people of Old Delhi, the love and affection for their walled city has not fizzled out, as they continue to stew in to mixed cultures and traditions.

The city is the largest and the busiest city of medieval times, hence confusing. Shahjahanabad is a gem with facets, some dim, some bright. The heart of the city of Delhi can be very rightly and easily positioned in Old Delhi, which is old and has been beating since three hundred and fifty years and counting. Despite its many branched arteries have shrunk with age, its veins shoulder for space, the liveliness is unimpaired. In documenting the cityscape of the walled city this section of the paper, pulsates with all of its varying heartbeats and will break down into smaller components for an insightful impression.

The image of Old Delhi varies from the ancient days' forts and settlements of the emperor's era to the exclusive retail and wholesale markets of modern times. Extensively rich in grandeur and cultural heritage, Shahjahanabad with its palatial buildings, mosques and temples, market places, haveli's (mansions) and labyrinth of lanes and bye lanes had been a city of beauty and glory (Dutta and Bandyopadhyay, 2012). The walled city is a part of the metropolitan Delhi, yet not. In public consciousness, Old Delhi is synonymized with chaotic traffic movement, intense commerce on the go, maze of dark lanes and great mesh of billboards and wires hanging. But as you run your eyes over and above, you can locate samples and the remains of the crafting skills of the yester years, and this will convince you to de-layer the city. Therefore for an easy perusal, three distinct layers of Shahjahanabad, have been marked out (Garella, 2006). The Mughal, the Colonial and the post- Colonial Shahjahanabad are the three temporal distinctions considered by Garella. The walled city was laid out on the right bank of the river Yamuna, with a wall to delimit the city boundary from the rest of the neighboring cities.

The fabric of the city incorporated the wide streets (though now narrowed extensively) radiating from the fort, the Jama Masjid, the bazars and the gates which linked the city with other cities and towns punctured the wall. These gates were named on the basis the direction they pointed to. The Kashmere Gate directed towards Kashmir, Ajmeri Gate towards Ajmer, and Lahori Gate to Lahore, so on and so forth.

Various scholars have investigated and chroniclers documented the dimensional relationships of the city with its localities of prominence, katras, kuchas, mohallas, lanes, mosques, temples, shrines, and host of other elements relevant to the culture. Various locality names like Ballimaran, Khari Baoli, Kucha Chelan, Katra Neel, Dariba Kalan, Malliwara, survive in the aboriginal, imprinting the linkages, impressions of work settings, social groupings and the specialties of that area.

It is interesting to note that, the city of Shahjahanabad, though was an Indo- Islamic city, the laying down of its palaces, garden spaces, and architectural style of the buildings were of Islamic weight, were spread out on principles derived from Hindu concept of Vastu Shastra (Garella, 2006). Multiple factors played a decisive role in the ordering and shaping of the city. Commanding the local topography and morphological features, the city of Shahjahanabad reflected the prevailing socio- cultural, political and economic design. Chandni Chowk the main thoroughfare of Shahjahanabad was built as a grand axial pathway connecting the fort and the Fatehpuri Masjid. This setting seems not just physical but implied a symbolic relation with the ruler (Almighty) and the ruled (emperor). A general consensus emerges out from the scholarly platforms about some typical features of an Islamic city and bringing to use the human analogy proposed by Dettmann, 1969, fructifies the following ingredients of the walled city.

(a) *Main mosque/ Heart:* It occupied the center of the city, and was surrounded by the markets. The Jama Masjid fits in this place of the plan.

(b) *Main Market Street/ Spine*: These were located outside the main mosque and provided for the economic activities. The cardinal street of Chandni Chowk and

the present day adjoining market spaces of Chawri bazar, Nai Sarak, etc. were adopted on this ground.

(c) *Citadel/ Head:* The palace of the emperor was surrounded by walls and comprised of sub- structures within its main structure. It had its own mosque, guards, offices and some residences. It was located on an elevated part of the city and near to the walls. The Red Fort coordinated this feature of an Islamic city.

(d) *Residential quarters/ Organs*: As described by Eikelman (1981), residential quarters were clusters of households based on closeness, personal cords, and joint interests and responsibilities. They were usually dense and each quarter had its own worship place. They were ethnically organized. The kucha, katra and the mohalla neighborhood accommodated this pattern of an Islamic city.

(e) *Street network/ Arteries*: Bridging the residential blocks and the central areas was a network of streets and lanes and alleys. This winding network of streets has worked as the arteries of the walled city in context of Shahjahanabad.

(f) *Wall/ Skin*: A well- constructed wall surrounded the city with many gates. The city wall of Old Delhi was also tailored on such plans. It acted as a boundary of sovereignty, power and independent bearing.
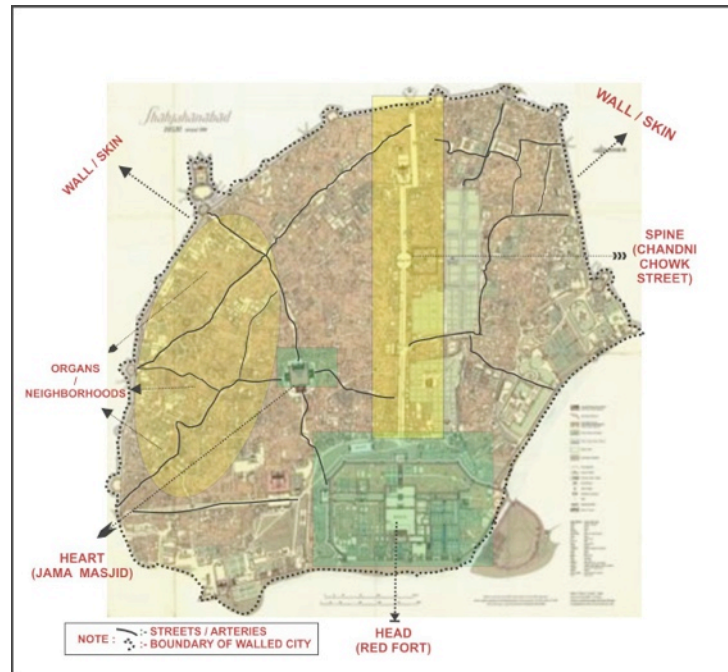
Picture 2.1 Human Analogy Camouflaging the Walled City

Source: https://goo.gl/images/CyeqWt, accessed on 12. 01. 2018 & re-done by Author

Chandni Chowk better acknowledged as the 'moon-lit square' in older times has evolved steadily as an imperative market area in the walled city of Shahjahanabad and it maintains its character till date. The fort and the Jama Masjid consolidate the head and the heart of the city.   The penetrating public realm of Shahjahanabad is fed by a complex network of lanes and bye lanes which join both urban blocks- physically and communities- socially.

Now, streets in the walled city exist in two categories, namely the katras and the kuchas. Katras which are linear in nature and branch out of the main street are specialized market streets. They are of unique characteristics. These are traditional mixed residential and commercial urban formations within the core of the city. People in katras live on the upper floors, whereas business activities are carried out on the ground floor. Rory Fonseca defines katra as 'a market with a residential quarters and storage facilities enclosed by walls and gate as its entrance (Fonseca, 1971). Some prominent katras within the walled city are- 'Katra Neel, a locality famous for indigo manufacturers and

tradesmen. Katra Pyaarelal, was named after a well- known businessman of the late nineteenth and twentieth century who later went on to become a municipal counselor. The word '*mallah'*, in Urdu refers to boatmen and therefore, Katra Mallah was a residential locality of the boatmen of the walled city. Whereas kuchas are the cul-de-sac streets which emerge out of the katras. The various katras contain kuchas, the gated cul- de-sacs, where communities related to specific trades and professions and crafts stayed. Even today most of the kuchas are market places. The kuchas in Old Delhi are particularly designated to the names of influential people of the times. To mention a few, Kucha Lalman, Kucha Fateh-Ul-Nisa, Kucha Chehlan are some of the many kuchas located within the walls.

The mohallas are another feature, in the landscape of the walled city along with the kuchas and katras. They have narrow lanes, labyrinthine alleys and houses have small courtyards and are considered a bigger unit than the former two. Among these kuchas, katras and mohallas, Old Delhi homes a number of architectural sites of historic and cultural essence and religious undertones.   Some important sites which can be located within the walled city can be traced through a north- south divide of Shahjahanabad. In the northern sphere of the city, are the St. James' Church (the oldest church in the city of Delhi), St. Mary's Church, remains of Kashmere Gate, Dara Shikoh's library, the Lahori gate. In the southern part of the city, the key highlights are the Kalan Masjid, Ajmeri Gate, Holy Trinity Church, Razia Sultan's grave, Turkman Gate, Havelis of Kucha Pati Ram, Anglo Arabic School. With these divisions, the center of the walled city is adorned with the harmonious street of Chandni Chowk, where the sacred spaces or the worship places of all major religions are located and co-exist amicably. Blanketing not only these, the built heritage of the walled city comprises of the grand Jama Masjid, the glorious Red Fort and many beautiful Jain temples of the two sects, numerous Hindu temples devoted to a multitude of gods, the Gurudwaras, the churches, the madarssas (Islamic schools), the haveli's of the Mughal and the post- Mughal era, still survive against their slaughter at the hands of the modernity.

A presence of these religious and architectural establishments directs us to ponder over how the cityscape of the walled city is well connected and remarkably congenial, despite being so varied in socio- cultural frameworks. It is almost impossible to read the cultural landscape of any place, without talking about its built morphology. To understand the cultural landscape of Shahjahanabad, an insightful discussion has been versed in the paragraphs above. Having discussed the spatial and the built structure of the walled city, it is now time to fix our eyes on the social and cultural milieu, in which this physical heritage manifests itself. Shahjahanabad is a classic example of a highly mature city through its stages of evolution in culture, society, polity and economy. It is inclusive of the different traditions, customs, lifestyles, festivals, the language, crafts, food and music. The localities, the quaint names associated with the city, the immense cultural variety can be still located in the festive air, the festivities, the processions and fairs. This cultural livability needs recognition, reservation and conservation in a substantial manner. More than the structures and the buildings, it is this living culture, a way of life that the walled city still personifies.

Drawing examples from traditions and customs like '*phool walon ki sair*' (Flower Seller's Parade) which was initiated by the Mughals in the nineteenth century has stood the test of time. The motto of this procession is to bring the two communities together. The participants from Hindu and Muslim community embrace the fellow community members earnestly during this journey. The festival has been known for promoting peace and unity among the Muslims and the Hindus. *Kabootarbazi* (pigeon flying) and *patangbazi* (kite flying) are another set of uniting traditions, which transcend the boundaries of religion and differences. For the people of Old Delhi, celebrating the Independence Day of the country holds much more vigor than celebrating Eid or Diwali. In the *Ramlila* (a Hindu festive procession) celebrations, the material arrangements are initiated by the Muslim friends of the Hindu community. Both the communities celebrate Ramlila and Dussera together with great zeal and gusto. There are myriad sights within the walled city, where endless glimpses of syncretic cultures can be captured.   For

instance, the Surajwali masjid sports a sun emblem rather than the traditional crescent, hence the name. This cements again as an example of a composite culture.

Buildings can be revamped and replicated but this culture cannot. The pace of life, the good neighborliness, the accommodation of each other's lifestyle, values, and customs still endures. The crafts and the cuisines, the literature and the Urdu language, people of walled city cherish and as a consequence have cultivated them. Shahjahanabad as recorded by Garella (2006), showcased a mature culture during the medieval times and the early colonial period, continues to showcase both cultural continuity and transforming the socio- cultural etiquettes, though with certain plunges with time. But nevertheless, a glance at the ethereal culture of Old Delhi uncovers that it is the result of fusion of cultures which build up over many decades thus resulting in the epithet, *Dilliwale* (people of Delhi).

Thus, the character of the walled city is one that of amalgamation of cultures, people, traditions, which resonates within the society in the fashion of intangible heritage. This syncretic cultural landscape of the walled city is an offspring of the multiple streams of socio- cultural impulses. Shahjahanabad stands unique as a culmination of plentiful architectural marvels and conglomeration of cultures and the following segment will approach the livability of the walled city through the lens of culture and establish the design of cultural livability.

Celebrating Cultural Livability

Even though its remnants exist in parts, the mighty old wall of the walled city is mostly lost due to demolition, resulting from the redevelopment plans, which never bore fruits of development. But the 'real' populace residing within this walled territory has not changed much with interests to their basic value systems, practices, traditions, patterns of behavior in relation to the spaces they utilize. The term, 'real', credits to the families and generations of the original inhabitants of Shahjahanabad. In the preceding paragraphs, it has been noted that how the physical structures lay the foundation of the social structures and provide for the blossoming of the many cultures together and respecting one

another's traditions. It is has been acclaimed that how Shahjahanabad has had traditions of communal harmony and congeniality and how the walled city has been a reservoir of poetry, music, and literature. Old Delhi has acted as a sanctuary of traditional ties and manners and etiquettes. The walled city has been through the junctures of love, power, and prestige. It has been nursed, desired, loved, conquered and ravished and neglected (Jagmohan, 1975). It has beheld manifold of eras of transformation in its physical appearance and all these imprints of good old days now stand interlaced in the physical and the social texture of the city. Let us look at the space of the walled city from the lens of cultural livability and how this unique culture of Old Delhi knits its demographic and the social fabric.

As quoted by Lewis Mumford, 'a city's best economy is the care and culture of its people', and taking this statement as the premise for the understanding of cultural livability, will make the concept of cultural livability more justifiable and coherent. Till now, we have traced the cityscape, the physical and the spatial organization of the walled city but how with time, these physical structures have planted the seed of synthesis and congruence is still to be unearthed. What makes the culture of the walled city stand out from the rest of the city of Delhi, so to say. To quickly enlist the qualities which Old Delhi possess are of exhibition of pivotal interchange and exchange of human values, over decades and within a cultural space, with developments to conserve the architecture, monuments and the socio- cultural linen of the place, secondly, it bears testimony to a cultural tradition which is still breathing. Alongside these, Old Delhi stands out as an epitome of living traditions, with beliefs and ideas transferred down from generation to generation, with linguistic and artistic marvels, and customs coming down from elders. Despite the fact, that Old Delhi failed to make its mark in the United Nations Educational, Scientific and Cultural Organization's (UNESCO) list of heritage cities due to the lacuna in the planning bodies, it nevertheless continues to reverberate, through its noisy streets and loud commercial environments. It is then, when the echoing sounds of cultural mix and social ties within the city can be heard and seen, one can comprehend what makes this physically dying city, a culturally living city.

At this point, the author reiterates that, Shahjahanabad through its degenerating conditions and battered physical health, still lives and its livability is found and kept alive in its socio- cultural strengths and unification. To envision this idea of cultural livability, the paper looks into the divisions mentioned as (a) composite culture, (b) living traditions, (c) neighborhood relations, (d) festivals, (e) food.

Composite Culture

Shahjahanabad is the smallest parliamentary constituency of India, which entails the vestige of years gone by. The roots of the culture and the spirit of what is named as the *'Ganga- Jamuna Tehzeeb'*, is symbolic of a unified Hindu- Muslim bond. This Hindu-Muslim synergy became a way of life which has withstood the alterations of partition and the following communal assaults. This syncretic bonding between the two communities is perceptible and keeps flowing through the veins crossing each community based locality. The spatial organization of neighborhoods is such that the Hindu localities are blended off with neighboring Muslims areas, meaning, Hindu areas and Muslim areas border each other in a way which makes it for a perfect fusion of the two communities. To quote a few examples, Sita Ram Bazar, a Hindu locality is joined by Churiwalan, a Muslim locality and Malliwara, also a Hindu locality is adjacent to Muslim dominated area of Jama Masjid. Not only the arrangement of localities over the cityscape of Shahjahanabad, but the appearance of this syncretic culture is also showcased by the worship spaces. The Central Baptist Church, opposite to Gurudwara Sis Ganj Sahib, usually goes unnoticed on the bustling street of Chandni Chowk is the first Urdu church in the city and also in the country, that is, the prayers are offered in Urdu language not neglecting Hindi and English. During the festive seasons, the morning *azaan*, sounds of bells from the temples and the Christmas carols are intertwined. The essence of being in Old Delhi is simply that all barriers are washed away and people become homogeneous despite being heterogeneous in outlook.

Living Traditions

The traditions and the customs in the walled city gives an impression of being hale and hearty, as the medicinal touch of preservation and inculcation is time to time delivered. While Old Delhi has remained famous for its exquisite indulgences, such as poetry, music, there were other part time and recreational activities and events which made their entry into the cultural milieu of the city. These are the traditions of *kabootarbaazi* (pigeon flying) and *patangbaazi* (kite flying). The tradition of pigeon keeping is as old as the city itself. These days the pigeon flying competitions are held at regular intervals in the neighborhoods. And kite flying as an activity of recreation and merriment, pulls a greater crowd because it is not limited to just a community but welcomes outsiders as well. Through older times, kite flying had been associated with the Independence Day celebrations. Apart from kite and pigeon flying, the most exciting and well known sport of the city is *Kushti* (wrestling) which can be still found in Old Delhi. Few traditional gymnasiums known as *akharas* can be located within the walled city and they continue to survive. The wrestling is differently called in both the localities of Hindus and of Muslims. It is called *'dangal'* in a Hindu area and '*kushti'* in a Muslim locality. In The legacy of living traditions does not cease here. The still surviving and living traditions of Shahjahanabad are *naqqashi* (calligraphy), jewelry, embroidery, and wood carving, and ivory and sandal wood work, metal work products. Many Jain temples of the Mughal times stand in glory with their beautiful facades and decorative interiors. And also the flowering of the Urdu language during the Mughal period has been kept alive till date. The city maintains its literary traditions of Urdu and hosts small gatherings for the language preservation on micro scales. Also the printing of texts in Urdu is a way of keeping it alive. These traditions are alive and render not only outsiders a sight and a moment to remember and cherish, as the communities play host and the guest at the same time.

Neighborhood Relations

As put forward earlier, the walled city of Delhi is a mixture complex in nature depicting Mughal, Colonial and post- Colonial architecture. This overlap has emanated in a rich

cultural and social texture and had added to the diverse personality characteristics of the city. The meaning of the city is made relevant with its societal base, which generates the quality of the fabric.   The population of the walled city is community based, which enables the development of relationships on micro levels within localities. The families have their work places at a stone's throw and the rooftops of the houses serve as public realm, within the private spheres. These are connected to each other and create networks of interactions and intermingling, paving way for sense of bonding among the localities. Reflecting upon the new constructions, the houses in the city of Delhi, it is interesting to note that, in spite of ignorant mindsets towards spatial by-laws, there are few regulations which go on. These silent yet implemented codes generate the energy and the vigor that the walled city lives with. These codes express the soul of the family inhabiting the house. The serpentine lanes welcome to witness the bonds that the families have among themselves. The houses in the walled city are tightly packed and composite in their character of building. This compactness can be correlated with some of the families still living together for generations.

Festivals

Bollywood film director Rakesh Omprakash Mehra's directorial venture Dilli- 6, brought forth a song with the following lyrics, *'yeh Dilli hai mere yaar, bas ishq mohabbat pyaar. Yeh sheher nahi mehfil hai'* (This is Delhi, my friend, all you can find here is love. This not just a city but a gathering of entertainment and fun). These lyrics define the festive nature of the walled city. Old Delhi since ages of its conception has been a home to different religions and hence, one can find the celebrations of festivals of all faiths. From Eid to Diwali to Christmas and from Guruparv to Jain festival, all are celebrated with much respect and zest. The most uniting festival within the walled city is that of freedom, that is, the Independence Day. All residing communities, majorly of Hindus and Muslims come together as one to celebrate this occasion of national importance and unity. Another festival of the city is the *Ramlila ki Sawari* (procession), which has been an integral part of the city since the past one hundred seventy years. It is fascinating to note that, the

some of the characters in these processional plays are enacted by people of different faith. For instance, a Muslim would play a character from the story of Ramayana or the arrangements are carried by the Hindu community during the times *Ramzan* (holy month in Islam). These acts of inter- mingling of communities afford the truth that there are no religious boundaries within communities residing in Old Delhi.

Food

Food is an intrinsic part of the cultural space which assigns Old Delhi its identity. Food is an identity marker of the walled city. This culture of food, itself is a product of numerous decades of development, and commix is a pivotal asset of it. With the coming of merchants, artists and nobility and the migration of population during partition have enriched the city with their distinct ethnic and religious and culinary styles, therefore giving birth to a fresh and a typical culture of the place. There are specified gastronomy skills and culinary arts present in the walled city. Old Delhi shares an intimate relationship with food, which was initiated way back during the Mughal period. In Old Delhi, traditions are served exclusively garnished with the culinary secrets, which have trickled down generations. The *breads, street food, rice preparations* and the *meat dishes* are some common and well known foods, which are the identity conveyor of Shahjahanabad. The base of every meal is the bread also known as 'roti/ chapatti'. Apart from roti, there is variety of *paranthas* (thicker breads cooked with oil on a circular griddle, which makes them crisp) which has rendered a street with the title of 'Paranthe wali gali' or the street of the paranthas. Other exotic breads found within the walled city are the '*sheermal, roomali roti, tandoori roti'.* If breads are not in the menu, the rice preparations come to aid. Rice is prepared in many ways in Old Delhi, accompanied with meat or vegetables. The most beautiful rice dish is that of a *'Biryani',* rice cooked with mutton or chicken, with rare spices for hours in a pot over simmering flame. The real show stoppers are the meat dishes which abound the city. The most noted preparation is *'kebabs'*. These minced meat preparations marinated for long hours and then are skewered and roasted on hot coal. There are dishes like the *nahari, qorma, stew* and a

new addition to the list is the *butter chicken*, which has become widely recognized and popular in the city.

Once when the stomach is satiated and there is not enough talent to savor any other preparation there arrives the dessert. *Kheer, firni, jalebi* are some delectable items to choose from. And lastly, for a digestive experience, *paan*, which is the leaf of a betel plant, is consumed along with some digestion stimulating ingredients. It is considered as a sign of prosperity by both men and women alike. Old Delhi continues with its age old culinary traditions.

Conclusive Portrait

Knowledge of such lively geographic environment could only be gathered by delving into the city's life and tracing its community life. A remarkable attribute of a great city is that while it is graced with power and honor, it also controls the beauty and the diversity within the community cosmos. Like Rome was not only a city of its emperor Caesar but also of ordinary people. We have seen through the journey of the current paper that the walled city of Delhi beat and breathes. It not only it breathes for self but also for other parts of the city of Delhi. It lays forward the spinal support for many places and spaces around. Among many historic cities, Delhi has retained its head high among many such places. If we dig deep into Delhi's soil, Shahjahanabad emerges out as the seventh city of Delhi. Every time a new city was born, the previous one was unquestionably marked as the old. This is how Old Delhi came into existence. Shahjahanabad is the core of the city of Delhi and the youngest among the claimed seven cities. Historical texts reveal that the city was rich and full grandeur. The streets being wide and the mansions and palaces were resplendent. A city such great was also a city of great cultural richness. Old Delhi was the confluence center of socio- cultural liveliness. It has preserved this trait even though being betwixt between the eras of smart cities, the walled city persists with its age old syncretic nature and the cultural milieu it possesses. Though the city faced turbulent times during the partition period, when a sizeable proportion of population was relocated. The city from then on, has worked effortlessly to maintain its synthesis nature and has

nurtured the living traditions to put together a city living and surviving. The living traditions found in this city, are the hallmarks of its cultural livability.

A space where a mosque, a Hindu temple, a Jain temple, a church and a Sikh temple (gurudwara), stand side- by- side, it is in itself a witness of a living city. These architectural assets of the walled city are live testimonies of cultural harmony and congruity. The paper traversed through a four membrane discourse, touching upon the evolution of the walled city, how it became and continues to be a heart city. The initiative paragraphs of the paper talked about the underlying difference between a smart city and a heart city. It laid emphasis on how the walled city accords itself within the purview of a heart city and how livability can be studied through lens of culture. The first layer set the stage for the introductory briefing. The following segment dealt with the de-layering of the cityscape of the walled city. It showcased the urban morphology and the vivid spatial structures. Bearing cognizance to these premises, the section focused on the leverage these spatial structure have on the life and culture of the walled city, which prepared a chief ingredient for the analysis of cultural livability, which forms the content of the third division of the paper. In the third slice of the paper, the author evokes the idea of cultural livability. As echoed in the previous discussions, the quotient of livability is not confined to the physical and tangible resources but is also observed through the immaterial aspects. The paper in this section, has laid the spotlight on the syncretic culture of the walled city and how does the culture of a place makes its city life come alive. The living traditions of the city such as the Hindu- Muslim composite culture, the celebration of festivals together, old customs of kite flying and pigeon flying and the ambrosial dishes passed down from generations with many more, all sum up to the indomitable spirit of cultural livability. And lastly, the final piece has precisely drawn on the overarching schemata of the paper, yet again proving the presence of cultural conglomeration and social ties makes a city livable.

The city of Old Delhi, in common usage *'purani Dilli'* calls for a quest of its cultural livability and the present attempt is a way forward in the direction proposed. This paper is

an invitation to look into cities with heritage value and significance and build upon a strong and healthy narration of their existent nature not only physical or the built environment but also the socio- cultural climate. The bustling worship spaces, the jarring market spaces, and the aroma of the eateries, the surviving art forms of calligraphy, deed writing, Urdu recitations and much more than the eyes can behold have survived a hundred years. Shahjahanabad is ready to greet you with its lanes as arms, and give you the warmth emanating from its realms of culture and traditions.

Note: The present paper is from an ongoing Ph.D. programme and is majorly based on the review of literature and author's observation and interaction with the participants.

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Bio Note-

Olivia Biswas is currently pursuing her doctoral studies from the University of Delhi, India. She is interested in unfolding socio- cultural transactions, occurring at various levels of the society. She is a recipient of Best Young Scholar, 2017. She is actively involved in her parish activities, which to a great extent have helped her shape her research interests in academics and social initiatives. When not writing, she spends her time in observing the happenings around her, looking out for new research themes and questions and developing frames to accommodate the not so 'geographical' ideas and notions.

SPORTS IN EGYPTIAN POLITICAL PARTIES PLATFORMS "ANALYTICAL STUDY"

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1.   Background

Political parties' platforms and their ideological and organizational view are laws, legislations and solutions affecting community, its individuals and the state political and social system in general when any party takes parliamentary authority and assume power, including its great effect on the public order and the community social status, accordingly the importance of looking into parties views and platforms emerged as one of the most important current civil communities organizations and their thoughts and attitudes related to different community activities.

Physical activity is one of the most important human activities contributing in building character, rectifying its behaviors and amending its trends of all ages, sports in modern ages in neither luxury nor recreation but rather a very important life aspect, regular sound sports practice for all community's groups may create a healthy climate supporting human, social and political principles and rights aimed and agreed upon by such parties' human rights and principles, social justice and citizenship.

2.   Method

From here it was the researcher's take to pinpoint these parties through their platforms and views of what can be offered to community, through pinpointing the relationship of parties' trends, platforms and views to sports as a main factor of the researcher's work.

This study depends wholly on scientific analytical reading of the Egyptian political parties' platforms to extract and analyze these parties view to sports practice in community and what may be offered by every party via its program to develop sports and potentials, means and activities that can be availed to support sports.

3.   Expected Results

Through concentrated readings and permanent research in Egyptian political parties platforms and specifically what can be availed thereof due to disability to reach necessary information and data due to lack of printed materials of most of political parties platforms due to lack of fund – the research submitted to these parties websites and Egyptian information authority to obtain any available Egyptian parties platforms.

Especially great parties whose influence and of which some are expected to assume power. The researcher believes that there is an absence and intended negligence in most of if not all political parties platforms of sports importance as a human activity profitable community in these parties platforms and most of these platforms dealing with sports as a secondary and recreational activity through their view to juniors upbringing and youth cases and not as a main activity deserving concern and concentration and discussion of all community's groups.

Key Words:

Political party definition: "some citizens believe in common political and ideological goals and organize themselves to assume power and achieve their programs"

Political party platform definition "an official statement or declaration of a political party's belief, principles, strategy and view for managing the state home and foreign affairs in case of assuming power"

Sports definition "an advanced form of human movement and developed stage of games and is more organized and supreme skill, aiming at creating good citizen, more coherent and advanced community and improving the life quality"

INTERNATIONAL LAW AND ARBITRATION IN TERRITORIAL DISPUTE RESOLUTION : THE CASE OF ERITREA-ETHIOPIA

SEGHED HAGOS

ABSTRACT

In this article, the challenges new opportunities in enforcing international law and arbitration in resolving territorial dispute between sovereign states is researched. The border dispute between Eritrea and Ethiopia, as two sovereign states, will be used as a case study to detail the challenges and propose solutions to enforce international law and arbitration in resolving territorial disputes. In this study, the role of the guarantors, stakeholder nations and the United Nations (UN) as well as lack of enforcement mechanisms that consequently failed to implement the verdict for seventeen years is discussed in detail. Furthermore, the paper presents practical enforcement mechanisms and procedures learned from other regional and international bodies such as Intergovernmental Authority on Development (IGAD) and World Trade Organization (WTO). The paper presents a thorough study on these mechanisms that helped to address the case and furthermore proposes a solution based on this model to overcome the general challenges in resolving any territorial dispute using only international law and arbitration.

Keywords: : Arbitration, International Law, Dispute Resolution, United Nations (UN), World Trade Organization (WTO), Intergovernmental Authority on Development (IGAD).

BARRIERS AND POSSIBILITIES TO TEACHING UNIVERSAL DESIGN IN HIGHER EDUCATION IN NORWAY

ULF RYDNINGEN AND PHUOC TAN LE

ABSTRACT

Implementation of universal design (UD) e.g. within the design of high-rise dwellings, school buildings, public offices available to the public, and public transportation, is currently required by law in Norway. In the planning and design of the Built Environment, traditionally the architects, civil engineers, urban planners, and landscape architects play an important role. The knowledge they possess influences strongly how the built environment is designed, built, maintained and used. In order to achieve good usability and accessibility, it is also required by law to involve representatives for the disabled persons' organizations into the local planning processes. However, other important professions do not have the same tradition of being involved in the planning processes of the built environment. In particular, this applies to the health professions, which can contribute with their knowledge background about of how to improve peoples' ability to perform tasks in their daily living and working environments. Their views often come too late into planning processes, and changes will therefore either not be possible or will be too expensive to implement. Universal design is an interdisciplinary theme, which should be current knowledge for many different professions. Here we have looked at how universal design is taught in different professional education programs in Norway, and investigated some university professors' attitude towards teaching their students about UD.

Introduction

In Norway, an overall goal is to develop an equal society, and to ensure equal opportunities and rights for community participation for all. Universal design (UD) is a strategy for achieving this goal in all areas of society. Universal design refers to broad-spectrum ideas meant to produce buildings, products and environments that are inherently accessible and usable to people with disabilities as well as older people and people without disabilities. The term 'universal design' was coined by the architect Ronald Mace to describe the concept of designing all products and the built environment to be aesthetic and usable to the greatest extent possible by everyone, regardless of their age, ability, or status in life. (The Center for Universal Design, 2008). There is a growing interest in universal design, and there are many higher education areas in which universal design is having a strong focus, but there are also many others in which it has not yet been adopted to any great extent. The term Universal Design is used in many fields for example when it comes to design of buildings and outdoor areas, when planning of information and communication technology so that the tools can benefit all. In higher education UD is important in planning of study programs in view of the diversity of student masses, and in new methods of teaching and learning that provide increased student quality for all. Research and knowledge development on universal design takes place within several subject areas, like ICT, Architecture, Civil Engineering, Product Design, Planning, Public Health, and Occupational Therapy. Previous research in teaching universal design has among others been on 'strategies for teaching inclusive design' (Dong, 2010), on 'inter-professional collaboration and education' (Hitch, Larkin, Watchorn, & Ang, 2012; Karen P & Bush, 2010; Rydningen, Norenberg, & Lid, 2016). Then, the need for new knowledge production, and to decide what knowledge is essential to learn is also studied (Budge, 2009; Heitmann, 2005; Imrie, 2000; Turner & Turner, 2011).

Required competencies on universal design

Today, universal design has won a political and legal approach nationally, internationally and is included in both Norwegian legislation, the UN Convention on the Rights of Persons with Disabilities (CRPD), and in several other political, legal and technical documents (Lid, 2013).

Some essential competencies of practice for health and social care education is described in national regulations for health and social care education:

> *The candidate has knowledge of inclusion, gender equality and non-discrimination, regardless of sex, ethnicity, religion and philosophy of life, disability, sexual orientation, gender identity, gender expression and age, so that the candidate helps ensure equal services for all groups in society.*

There are no written detailed demands to competencies on universal design for the occupational therapy, the social educators or other health professionals in the national regulations for higher education. Neither is there national regulations demanding civil engineers, planners or architects to learn about universal design in their professional training. Then, what is taught about universal design is assumed to be random and linked to the fact that some teachers have particular interest in this topic. However, so far the scope and attitude to the teaching of UD in Norwegian university courses has not been investigated. We will look at how universal design is taught about, in the education of different professions in Norway, and investigate university professors' attitude towards the UD. Our research questions is therefore: 1) what do students learn about universal

design during their education? and 2) What is the main barriers to teaching universal design in Norwegian higher education?

Knowledge development

Indirectly, there is a requirement for various professional skills, as a result of adopted national legislation and international obligations. The 2009 enactments of 'the Discrimination and Equality Act' and 'the Building and Planning Act' in Norway, put demands on knowledge and understanding about UD, and is therefore something that various occupational professionals need to know about in their professional practice. Article 4 in Convention on the Rights of Persons with Disabilities (CRPD) emphasizes that implementation of universal design require new knowledge, to have an understanding of both the necessary measures, rights and awareness about problems that people with disabilities experiences. Lid (2013) have proposed an interpretation of UD that distinguishes between three levels - a macro level, then a meso-level and last an individual level.

Table 1 UD understood in three levels (Lid, 2013)

Knowledge level	Base Knowledge
Macro	Ethical concept, concept of human, human rights, UN-convention (CRPD), Local Master planning
Meso	Technical standards, design of services for elderly and disabled, implementation of plans and regulations. Knowledge of other professions knowledge base and cooperation.
Micro	Individual experiences. Knowledge of how architectural barriers occur and who experiences them

The research design and methodology

In this study, an online-questionnaire have been distributed to a sample of Norwegian university teachers, in order to reveal their attitudes to, and knowledge about UD. The respondents are also asked to answer which UD themes they teach (if they are teaching about UD), and the most important barriers to teaching about UD.

Respondents is grouped as 'Architects' if their educational background is within Architecture, Landscape Architecture, Town and Regional Planning studies or Design. The category 'Health Sciences' includes university educators of Nurses, Occupational Therapists, Physiotherapists, Social Educators. Social sciences includes political scientists, sociologists, or human/social geographers. 'Civil Engineering' also contains architectural engineers.

These educational groups are chosen because candidates from these educational programs most frequently ends up as Town Planners, or executive officers for planning permits or to advisory committees for representation of disabled people in the municipalities.

A qualitative content analysis of the national standards for the educational programs for the above mentioned educational groups is completed.

Results

UD courses / themes taught at university

Table 2 UD themes taught at university, reported by respondents. Legends used: 0 None, + a few (0-32% of respondents,) ++ some (33%-66%), many (67%+)

Theme	Architecture	Health Sciences	Social Sciences	Civil Engineering
Wheelchair turning circle	+++	+	+	++
Allergenic plants and trees	+	+	+	+
Visual impairment	+++	+++	+	++
Hearing impairment	+++	++	+	++
Cognitive impairment	+	++	+	++
Planning and Building Act	+++	++	++	+++
Technical regulations to the Planning and Building Act	++	+	+	+++
Zoning plans and regulatory provisions	++	+	++	++
Ramp design	+++	+	+	++
Colors and contrasts in buildings	++	++	+	++
Tactile surface paving/guiding lines	+++	+	+	++
The Usability Pyramid	+	+	+	+
The seven principles of universal design	++	+	+	++
The Universal Design Definition(s)	++	++	+++	++
UN Convention on the Rights of Persons with Disabilities (CRPD)	+	+	++	+
Other professionals' knowledge-base in UD	+	+	+	+
The Social Model of Disability	+	++	+	+
The Medical Model of Disability	+	+	+	+
The Relational Model of Disability	0	+	++	+
Gap-model of Disability	+	+	+	+
Using GIS-Analyses and/or Building Information Modeling (BIM)	+	+	+	+
UD strategies in general municipal plans	++	0	++	++

The results in Table 3 shows that Social Scientists seem to have little specialized education on UD themes, in their knowledge base from universities. Civil Engineers and Architects seem to have been taught some about the different groups of disabled, and about the relevant laws and regulations and UD measures. The Health Sciences category consists of several health professional groups, which

Table 3 Have you ever taught in classes with disabled students. Legends used: 0 None, + a few (0-32%,) ++ some (33%-66%), many (67%+)

Theme	Architecture	Health Sciences	Social Sciences	Civil Engineering
Students suffering from temporary reduced mobility	+++	+++	+++	+++
Mobility & Physical Disabled students (wheelchair users)	+	++	+	+
Students suffering from visual impairment or blindness	+	+	+	+
Students suffering from hearing loss or deafness	+	++	+	+
Students suffering from dyslexia	++	+++	+++	++
Students suffering from impaired self-reflection ability (Asperger)	+	+	+	+

Table 4 tells us that the educators within the health programs seem to have gained more experience with disabled students, than within other higher educational programs that is relevant for this study. This may probably remind these teachers about the importance of the UD, in their daily life.

Table 4 Experienced barriers to teaching about UD. Agreement to the assertion from the sample: 0 None, + a few (0-32%,) ++ some (33%-66%), many (67%+)

Theme	Architecture	Health Sciences	Social Sciences	Civil Engineering
There is no time-gap for teaching about UD in my courses	+	+	+	+
I lack competence/skills to teach UU	+	++	+	+
I do not know about suitable teaching materials for the UD	0	++	+	+
The Department Chair does not want us to teach UD	0	0	+	0
The Department cannot afford to hire people to teach about UD	+	0	+	+
Other subjects must be deleted if UD is to be included	+	+	+	++
UD is something students can learn when they get employed	0	0	0	0
UD should not be basic competence for our profession	0	+	++	+
UD is primarily the architect's responsibility	+	+	+	+

Surprisingly there are a large share of the respondents from the health sciences reporting they are lacking the competence to teach about UD. This may be explained by some diversity in how relevant UD seems to be as a knowledge base within health professions. While UD is regarded as a basic competence within the occupational therapist and the social educators study programs, the theme is rarely regarded as this among the educators for the nursing program, or the physiotherapist program. Still, a few respondents in each of the education categories above, claims that the main responsible for UD should be the architect profession. An argument for not implementing UD, is that if so then other themes must then be deleted from the educational programs.

Scheduled time for teaching UD and Curricula content

There is no significant differences between the respondent groups in teaching hours. The most frequent (median) level of teacher led education about UD is 4-8 hours, and 71 percent of respondents have answered they are using 8 hours or less to teach their students about UD. This means that many of the themes that are important in order to obtain a comprehensive competence in the field of the UD, are given little instructional time.

Universal Design is rarely mentioned specifically in the curricula for most of the educational programs studied. This may be a result of strict content requirements for professional knowledge in the framework plans for education, which provides little flexibility for new knowledge.

Concluding remarks

In view of the prerequisites laid down in laws and regulations of relevance for UD, there is a need to make some changes in the higher education curricula and knowledge base. One of the important issues then is that university lecturers acquire this knowledge and understanding, in order to teach effectively and collaboratively in this new domain.

Table 5 Knowledge levels varies between educational programs

Knowledge level	Base Knowledge	Concepts	Professions
Macro	Ethical concept, concept of human, human rights, UN-convention (CRPD), Local Master planning	Visions "where", change strategies "how"	Master Planners, Social Geographers, Public Health Professionals
Meso	Technical standards, design of services for elderly and disabled, implementation of plans and regulations. Knowledge of other professions knowledge base and cooperation.	Measures "how and what", Causes "why", Effects "Cost Benefit"	Architects, Landscape Architects, Civil Engineers, Town Planners
Micro	Individual experiences. Knowledge of how barriers occur and who experiences them	Causes "why", Effects "for whom", Measures "how"	Nurses, Social Educators, Physiotherapists, Occupational Therapists

There is a big difference between the overall level, which is mostly about ethics, values, strategies and understanding of rights, and the more concrete and technical intermediate level where UD may be understood as a threshold concept in accordance with standards, regulations and guidelines. For the micro level, it is often about degrees of perceived usability and accessibility. Our study (table 2) confirms that the different education programs focus on different levels. While social scientists and public health professionals are most focusing about the concepts at the top, architects, planners and civil engineers are operating at meso level, and at the micro level, we find most of the health professions knowledge base. However, there is a need

for interdisciplinary knowledge development something that requires awareness of each other's knowledge base (Lid, 2013).

There are some barriers to teaching UD in higher education, most frequently mentioned is the educators lack of knowledge, a lack of relevant teaching materials and an attitude that UD should not be the core competence for the educational programs.

It may seem that there is little compliance with the requirements for the implementation of UD in the community, and the national requirements for higher education learning content.

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