

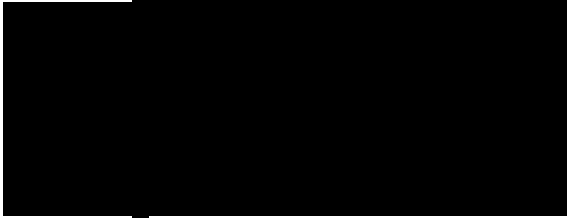
Theorising Evidence-Informed Learning  
Technology Enterprises:  
A Participatory Design-Based Research  
Approach

Anissa Moeini

Institute of Education, University College London  
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### **Author's Declaration**

I, Anissa Moeini, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.



**Date of Submission: October 9, 2020**

## Abstract

The goal of this doctoral work was to build a bridge between academia and small and medium-sized enterprises (SMEs) in the educational technology (edtech) sector by bringing the rigour of academic research methods to start-up and scale-up environments so that they can conceptualise and realise products that are built with evidence from the learning sciences. The overall research question, **What theoretical framework supports edtech enterprises to build evidence-informed products and services?** is answered through a design-based research methodology with six Cycles of research, grouped into three Phases, each with goals that evolve in an iterative way. A design-based research approach was chosen after a highly exploratory Phase surveying London's edtech ecosystem prior to Cycle 1. Part 1 (Cycles 1 and 2) focused on developing the construct in question (a practical framework for building research-minded edtech enterprises) through a participatory design process with key Participants. Part 2 (Cycles 3 and 4) focused on evaluating the new construct with Participants. Part 3 (Cycles 5 and 6) validated the framework developed in Parts 1 and 2 with edtech enterprises both from the EDUCATE programme and also the greater global ecosystem. The theoretical contribution of this study is the ELTE construct and its 7 Sub-Constructs, including Learning Culture, Leadership Vision, Sense of Purpose, Teamwork, Research Know-How and Action Orientation; the ELTE Survey outlining all facets each Sub-Construct in the framework; and the ELTE Sub-Construct Hierarchy Model, introducing Sub-Construct dependencies. Methodological contributions of this study include the ELTE Action Model, an effective boundary object for researchers when approaching edtech enterprises to understand how the ELTE framework has uniquely manifested within the structures of their organisations, and ELTE Hallmark Questions, an introductory tools for researchers to give context to enterprises regarding the ELTE model prior to a workshop, line of inquiry, or discussion regarding the model's particular manifestation enterprise context. The contributions of this study represent an intellectual advancement in our understanding of evidence-informed design and development within the edtech sector, and it provides a tool of practical use to edtech SMEs that want to become Evidence-informed Learning Technology Enterprises.

## Impact Statement

The ELTE (Evidence-informed Learning Technology Enterprise) framework developed through this study has both academic and non-academic impact. The ELTE framework is designed to better connect academic research and edtech enterprises. It offers academics a context and structure within which an academic can explore

- the way their research and/or approach may be appropriated by the edtech to secure valuable impact;
- the possibilities for a collaboration with an edtech enterprise that might provide a 'test rig' for the further evaluation of academic research;
- highly relevant case studies for students engaged in master's-level study of educational technology or entrepreneurship.

The ELTE framework can also guide edtech enterprises to cultivate within their organisations the necessary capacities to build products that are grounded in sound evidence. The ELTE framework is useful not only for edtech enterprises to elevate their product output to better meet the needs of their users. It is also useful for

- accelerator, incubator and other such programmes that aim to build capacity in edtech enterprises to build better products;
- the investor community that wishes to assess whether an edtech enterprise is worth backing;
- policy makers to make evidence-led decisions as they aim to set policies that do not stifle the entrepreneur community whilst protecting users from false claims;
- most importantly, the market for learners to elevate the quality of the products available so that claims are backed by evidence and do not take advantage of users' vulnerability.

The ELTE framework, with its components and accompanying processes, serves to enable academia to work productively alongside the edtech SME community. The key components of the framework include the ELTE Action Model, the ELTE Hallmark Questions and the ELTE Hierarchy Model, which aid in the process. These ELTE constructs have instigated a line of research that can be built upon beyond education, in the fields of management, leadership, entrepreneurship and organisational psychology, for example. The Sub-



Constructs of the ELTE framework touch many academic communities and offer multiple opportunities for future collaboration.

Edtech entrepreneurship is exploding given the global need for digital learning solutions, particularly resulting from the 2020 COVID-19 pandemic, which the ELTE constructs are timely to support. ELTE is a novel framework and has the potential to be of service in the development of numerous learning tools globally. Dissemination will include journal articles, blogs, videos, module development for edtech accelerators, mainstream magazine articles and news stories and bespoke consulting for edtech enterprises and master's programmes in edtech entrepreneurship.

## **Dedication**

We are the sum of the greatest influences in our lives, and these four amazing people I have been lucky enough to know have shaped me; I dedicate this work to them.

To my grandma, legendary kindergarten teacher, my greatest teacher and my inspiration in education, who taught countless students and was loved by them all.

To my father, the amazing entrepreneur, who taught me entrepreneurship, visionary leadership and that the meaning of real success as an entrepreneur is to look for the needs in your community and be of service to your fellow man. I will always be in awe of all that you have accomplished and continue to accomplish in your life.

To my mom, who taught me about friendship, love, selflessness, empathy, beauty, kindness and faith, my best and favourite friend and example.

To my brother, who taught me to be brave and to blaze my own trail – you are my example of independence and authenticity. Thank you for always believing in me.

I love you four more than I could ever say.

*Regard man as a mine rich in gems of inestimable value. Education can, alone, cause it to reveal its treasures, and enable mankind to benefit therefrom.*

– Bahá'u'lláh

*The primary, the most urgent requirement is the promotion of education. It is inconceivable that any nation should achieve prosperity and success unless this paramount, this fundamental concern is carried forward. The principal reason for the decline and fall of peoples is ignorance. Today the mass of the people are unformed even as to ordinary affairs, how much less do they grasp the core of the important problems and complex needs of the time.*

*Observe carefully how education and the arts of civilization bring honour, prosperity, independence and freedom to a government and its people*

– 'Abdu'l-Bahá

*A mechanism of world inter-communication will be devised, embracing the whole planet, freed from national hindrances and restrictions, and functioning with marvellous swiftness and perfect regularity.*

– Shoghí Effendí, 1938

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## **Foreword: From Gold Line to Golden Triangle**

The role of education in helping my family create a new life after escaping the revolution in Iran has nurtured my commitment to educational equity. Providing access to high-quality education for all is one of the greatest opportunities of well-designed educational technology. My parents' persecution in Iran included exclusion from the educational system, and I was raised with the knowledge that my education is a privilege and that it is a human right to which everyone should have access – a passion and belief that fuel my love for education today.

I believe that everything I have done has led me on a clear trajectory to contribute to the education community. I received an undergraduate degree from the number one ranked international business degree programme in Canada, iBBA (International Bachelors of Business Administration) from the Schulich School of Business, York University, Toronto. I then proceeded to complete my graduate work in the top comparative education programme in the United States, earning a MA in International Education Development with a specialisation in Instructional Technology and Design from Teacher's College, Columbia University, New York, where I was able to explore the best educational systems in the world and how technology can be used as a tool to improve performance.

I then spent 7 years in the private sector, working in my family's global telecom and media technology company GL |Group of Gold Line as the vice president of business development. I have experience building companies from the ground up, both in designing technology solutions and negotiating with various stakeholders when developing those solutions. I always wanted to apply this knowledge to education and feel that my experience has given me unique expertise to be able to do so. I have worked with companies of all sizes, from mentoring start-ups to signing contracts with global conglomerates and government organisations and believe that this exposure has aided me immensely in understanding the context of emerging tech companies in my research.

Perhaps the most important lesson that I learned in the family business was from my dad, who always said that a successful entrepreneur is one who sees the needs in the community and rises to serve them to make people's lives better. I always wanted to build educational technologies; however, my experience building media and telecommunications products prompted me to ask

a daunting question: How do I know my products work? With media and telecommunications technologies, my customers told me when our products did not work – in fact, we had 24/7 customer service in more than nine languages ready to answer calls and send reports to developers. However, with a vulnerable customer like a learner who does not understand their own abilities, how would I get that kind of feedback? I knew that for schools, the buyer of the technology would not necessarily be the teacher, and the facilitator would not be the customer – and outside of schools, parents and adult learners would have trouble knowing how to give feedback as well. I started to research how I could determine that my products worked, and I was led to Professor Rose Luckin's research on the golden triangle of evidence-based edtech development. I found my answer in this triangle, which was bringing educational technology entrepreneurs together with developers and customers to co-design products. I applied for a PhD, and the next thing I knew, I had gone from a Gold Line to a Golden Triangle and was in the world of research.

My main research goal has always been to uncover how to know if emerging technologies work and to share that knowledge with my fellow educational technology entrepreneurs so that they can go on to create technologies that will better the world. It is my hope that this study has fulfilled the goal it set out to accomplish – so that I can honour those not as fortunate as I to have escaped a life of educational exclusion.

## **Acknowledgements**

My incredible supervisors – words cannot express my appreciation. You allowed me to pursue my dream and guided me from a place of wisdom, sensitivity and patience to learn more than I ever hoped over this amazing experience.

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To my dear friends and unofficial advisers, Shademan, Sarah and Nava joon, thank you for sharing your wisdom from the moment I embarked on this journey and throughout. Your support was invaluable.

To my sister Hoda, thank you for being there from day zero of this journey and beyond, for the advice, the love and the Sloane tea on tap – I would not have done this without you.

And to my friends who helped me get through the final months of thesis writing, which coincided with Corona lockdowns – thanks to my dear Assieh, Abbas and Nilu joons for checking in on me constantly and for steadfast love and support, to my CDC family for giving me so much to look forward to every week, and to the greatest tennis partner and Spiritual Gangster Rish for playing every morning without fail, I am so grateful (and our seven month streak leading up to my viva will forever be one of my happiest memories). I love you all very much.

To my family and friends who have supported me along the way and who send me love, words of encouragement and prayers: I love you all and am deeply grateful.

## Chapter 1: Background and Research Issue

### 1.1 Introduction

Educational technology (edtech) is an increasingly important aspect of education. The last industrial revolution ushered in a dramatic rise in access to the Internet, powering the potential for digital tools for an increasingly connected global marketplace and inspiring a rise in visionary entrepreneurs to envision digital tools that have the potential to transform learning. More than 1,200 edtech companies exist today in the United Kingdom alone (Clark-Wilson et al., forthcoming), coming from a wide range of backgrounds, from education and academia to the learners themselves. In many cases, however, intention and vision are not matched by the ability to produce products that are educationally sound, causing entrepreneurs to make claims about the potential of their learning technologies that are not backed by empirical evidence, thus compromising their ethics. Honing learnings and associated research methods from the field of the learning sciences would enable the validation that is required to make said claims regarding the efficacy and impact of products – enabling the truly ‘formidable task of conducting studies as a part of the dynamic emerging edtech enterprise’ (Clark-Wilson et al., forthcoming).

Meta-level investigations, such as Cox et al. (2003), confirm that impact evaluations for emerging edtech companies are challenging for the research community, let alone the entrepreneurs themselves, because change is the very essence of start-ups. Traditionally, stakeholders in the edtech ecosystem (including policy makers, investors and beneficiaries of various kinds) use impact evaluations to standardise and scale (Cukurova, Luckin, & Clark-Wilson, 2018) – however, the dynamic nature of start-ups presents a challenge to assessment for these purposes. In a follow-up report reviewing edtech start-ups in the United Kingdom, only 39 out of 150 innovations were in use in their original forms 3 years after deployment (Luckin et al., 2012) due to the rapid nature of change. Indeed, the research task ahead of visionary entrepreneurs in the edtech industry is immense and would need to be matched with a complementary research methodology and robust research methods that are compatible with the pace and unique context of edtech start-ups in this age.

Kurshan (2013) aptly noted,

Marrying research to practice . . . instead of simply bombarding the marketplace with product after product to see what sticks, innovators must

lean on the extensive experience of classroom practitioners and research executed by reputable non-partisan institutes, and more importantly, research-oriented graduate schools of education. Innovators at all levels (of the education ecosystem) from corporate and professional development experts to kindergarten and special education teachers to museum educators must demand that every proposed intervention, product or service have a theory of action behind it. That is: *Why do we believe what is happening – based on what we know through empirical study – is happening?* And more significantly, what does this suggest for how a given intervention should be structured?

Kurshan captured the need for an elevated edtech ecosystem where products are built with robust evidence and released with knowledge of their efficacy. In a paper published after the first year of the EDUCATE programme, a research accelerator situated in the Institute of Education, University College London, designed to support edtech start-ups to develop internal research capacity, researchers Cukurova, Luckin, and Clark-Wilson (2018) stated that this requires a reconceptualisation of research where

an evidence-informed decision-making process for the design and use of EdTech, rather than only considering evidence as the outcome of an evaluation. Even when evidence from impact evaluations is considered, a pragmatic and collaborative approach to evaluate the subsequent impact of emerging technologies is needed to accommodate the innovative and dynamic nature of EdTech. Hence, an important first step towards evidence-informed and impactful EdTech is to create opportunities to arrive at such shared understandings of the roles and nature of research evidence as both products and processes, for the EdTech ecosystem, which also includes potential investors. (p. 4)

Led by Rose Luckin, Professor of Learner-Centred Design, researchers at EDUCATE attempted to create the opportunity to develop this capacity in edtech enterprises and believe that the problem of the lack of evidence lies in the fact that products and services are being created without the collaborative participation of the three key stakeholders, namely developers, academic researchers and practitioners, thus resulting in less than optimal products and services for learners (Luckin, 2015). We must first learn how to engage these various stakeholders in conversation, because they have varying goals, speak different languages and operate in different silos. The value of educational technology as a tool to create a positive impact in formal learning environments has been demonstrated (Luckin et al., 2012); we must go further by learning how to engage in a co-designing process to unleash the potential of educational technology (Luckin, 2015). In other words,

those that develop edtech (edtech enterprises), those that research edtech (academia) and those that use edtech (users – teachers/learners/parents)



operate in silos, and information regarding how to demonstrate impact, on what to demonstrate the impact, and for whom, is not accessible enough to create truly impactful educational technologies. Compounding the issue is that no theories exist to inform how to bring these three particular communities closer together. (Clark-Wilson et al., forthcoming)

In response to the lack of theoretical underpinnings guiding the area, Professor Luckin put forth the *Golden Triangle of Evidence-Informed EdTech* (Figure 1; Luckin, 2015).

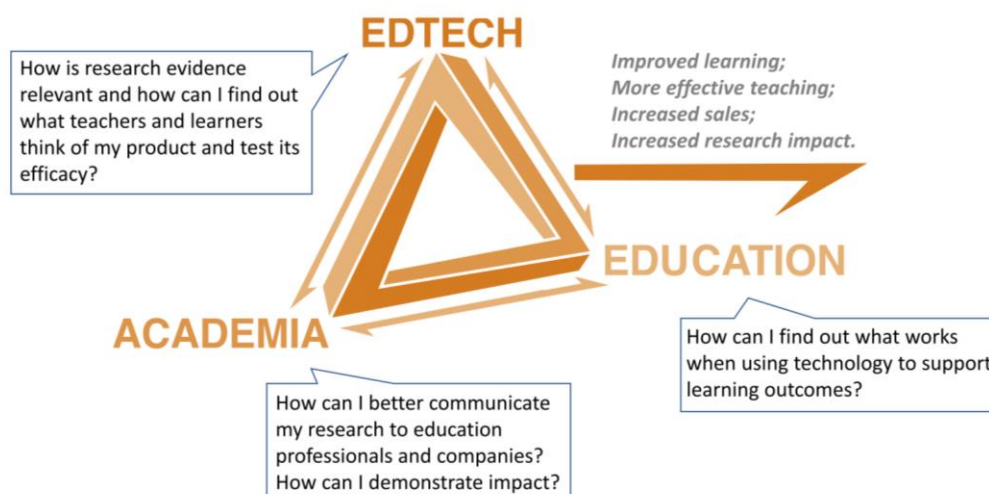


Figure 1. The Golden Triangle of Evidence-Informed EdTech.

In the introduction to a *Research for All* special feature on the EDUCATE programme, this construct is explained as follows:

The *Golden Triangle of Evidence-Informed EdTech* implies that the more tightly connected the three communities are, the better the quality of evidence to support the ultimate common goal, which is to produce the best, most evidence-informed, impactful edtechs that are underpinned by sustainable business models. Luckin devised the EDUCATE programme to address this gap for the edtech SME community. (Clark-Wilson et al., forthcoming; see Figure 1)

The EDUCATE programme, hosted at the UCL Knowledge Lab at the Institute of Education, University College London, is the brainchild of Professor Rose Luckin, and it was created out of a desire to bring the aforementioned three major stakeholders in the educational technology ecosystem closer together to build more robust evidence-informed learning technologies. Cukurova, Luckin, and Clark-Wilson (2018) eloquently summarised the problem at the heart of the EDUCATE programme: ‘The lack of access to, understanding of, and engagement with research evidence among most EdTech developers and educators’ (p. 4). EDUCATE is the only project of its kind, offering 262 small- to

medium-sized London-based educational technology enterprises (SME – defined here as having fewer than 250 employees and less than £5 million annual turnover) the opportunity to collaborate with academia to learn how to move forward in building their products informed by research evidence. According to Cukurova, Luckin, and Clark-Wilson (2018), 'EDUCATE (<https://educate.london>) is a unique programme that is bringing together entrepreneurs and innovators, with academics and educators, with the aim to deliver evidence-informed education technology products and services' (p. 3). The programme culminates in the opportunity for enterprises to receive EdWards, which are marks of research awareness (EdWard Level 1) and the ability to apply research plans to their enterprises (EdWard Level 2) awarded to all enterprises that achieve these milestones in their journey to build evidence-driven learning technologies.

At the heart of this thesis research was the question, Does the edtech work? And if so, when, where, how, why and for whom? To answer these questions, it is important for the developer of the educational technology to be committed to finding the evidence to answer these questions and for them to be open to learning the correct way to conduct research. The research at the heart of this study coined the desired orientation of the entrepreneur as a *research mindset*. The aim of this thesis was to investigate EDUCATE's research-minded entrepreneurs to uncover how a *research mindset* can be cultivated in educational technology enterprises and their teams.

The overarching research question of this study was, **What theoretical framework supports edtech enterprises to build evidence-informed products and services?** The four main objectives were as follows:

- 1. Explore the features of a research-minded entrepreneur within the context of edtech.**
- 2. Explore if and how a research mindset is distributed across individuals within an organisation.**
- 3. Assess whether EDUCATE's definition of the EdWard Level 2 is appropriate.**
- 4. Offer guidelines on how to develop an understanding of research and evidence in edtech enterprises.**

Ultimately, the aim of this study was to understand how to support entrepreneurs to build an understanding of what research is and how it is conducted, to demystify research and to 'establish it into the DNA' of educational technology

entrepreneurs through a framework that can be used as a concrete and practical tool, complete with guidelines about how best to develop a *research mindset* in edtech entrepreneurs. Born out of Luckin's background in the learning sciences, the EDUCATE programme continues in the practical tradition of the field that, from its roots, involved multiple disciplines and a rich investigation of learning in real-world contexts (Kolodner, 1991; Sommerhoff, Szameitat, Vogel, Loderer, & Fischer, 2018) and represents the general desire of many researchers in the field to add to both theory and practice (Sommerhoff et al., 2018; Stokes, 2011), avoiding the *applied versus pure* research dichotomy of other educational disciplines (Hoadley & Van Haneghan, 2011; Sommerhoff et al., 2018).

This study focused on edtech entrepreneurs who have been through the EDUCATE programme successfully (where success is defined as receiving the highest mark of research mindedness, the EdWard Level 2). I followed a design-based research methodology with three Parts (also referred in the text as Phases). Part 1 (Cycles 1 and 2) focused on developing the construct in question (a practical framework for building research-minded edtech enterprises) through a participatory design process with key EDUCATE team members: EDUCATE Research Mentors. Part 2 (Cycles 3 and 4) focused on evaluating the new construct with EDUCATE Research and Business Mentors. Part 3 (Cycles 5 and 6) validated the framework developed in Parts 1 and 2 with edtech enterprises both from the EDUCATE programme and also the greater global ecosystem.

For the purposes of this study, the term *edtech* refers only to products that are for learning and not to those that are designed to help the education sector in general. This is because I am interested in the most vulnerable users in the sector. Learners do not often understand their own abilities, and they are rarely able to identify whether a product is working properly or whether they are using the product effectively. Professor Luckin asked in an EDUCATE welcome brochure,

But why is a research mindset so powerful in EdTech enterprises? Because much like medicine, where patients don't understand their own healing process, and are dependent on evidence-informed solutions for healing, learners do not understand their own learning process and have no way of knowing if those tools are optimized for their learning. We have a vulnerable customer in the sense that learners – no matter their age – do not have an understanding of how learning occurs, or how the tools designed for them to learn engage with their abilities and disabilities. When you develop a research mindset, you develop a learning culture in your company, a vision for how evidence can help you build robust technology, and how practical research methods can be implemented in

your business model, whether just at the beginning or 10 years in. Your products will have increased impact, and you will have the confidence in knowing that the tools work well and solve the big problems in education that you aim to address. (Luckin, 2018, p. 3)

The learning technology customer is vulnerable and therefore dependent on the incorporation of sound research at the stage of product development. This vulnerability amongst learners was the inspiration behind pursuing my research question, because I believe that edtech founders should have a *research mindset* if they are to build ethical products for learners. However, research and industry do not yet know what an SME that produces evidence-driven learning technologies looks like. This study aimed to bring clarity to edtech SMEs in this regard and to develop a framework that can be used to set up and build capacity in emerging edtech enterprises to build evidence-informed products and services.

## **1.2 Assumptions**

Education is a market where the customer can be vulnerable; as such, this study was written in the belief that, regardless of whether it leads to more or less financial success for their companies, edtech entrepreneurs should have an understanding about what evidence is and how to support claims regarding the efficacy of their products. This study was built on the belief that a *research mindset* is a necessity in edtech entrepreneurs to ensure that educational technology products and services support learner needs effectively. Research evidence is needed to support developer claims, because most learners are not in a position to provide full feedback, which puts them at a potential disadvantage, unable to understand whether the products are working. This study also assumed that it is possible for edtech entrepreneurs to develop a *research mindset*, and it explored and proposed guidelines and principles for developing such a mindset.

## **1.3 Context for the Study: The EDUCATE Programme**

### **1.3.1 Summary**

The EDUCATE programme (June 2017–December 2019) was launched by Rose Luckin, Professor of Learner-Centred Design at the UCL Knowledge Lab situated in the Institute of Education, University College London. EDUCATE received 3 years of funding from the European Regional Development Fund (ERDF). The ERDF funding was matched by the members of the EDUCATE

consortium: University College London, the National Endowment for Science Technology and the Arts (NESTA), the F6S Network and the British Educational Suppliers Organisation (BESA). The EDUCATE programme worked with 252 companies between 2017 and 2019. All these participant companies were London based and formed 12 cohorts with between one and three members of each company completing a training and mentoring programme over a 6-month period. Participants were encouraged to learn about the nature of evidence, how to collect data about their products and services and how to analyse and interpret these data to evidence any changes in learners' or teachers' behaviour that resulted from their product or service. The heart of the programme was the development of a theory of change by each company and an associated logic model. Companies designed research questions and study proposals that they were encouraged to apply to their businesses.

Participants in the EDUCATE programme self-selected through an application available from the EDUCATE public website.<sup>1</sup> Participants were selected through two rounds of interviews, which were conducted with, and screened by, the various consortium partners. The programme was free for the emerging edtech companies provided they had fewer than 250 employees or £50 million in turnover and were based in London. There were 262 places on the 2017–2019 EDUCATE programme, which ran through 6-month cohorts, in a blended or fully in-person experience at the UCL Knowledge Lab in central London. Cohorts began every 3 months during this period.

Once accepted, EDUCATE provided the entrepreneur with the ability to design robust research which aims to

1. reveal the value of the product or service;
2. help the business communicate the effectiveness of their product;
3. influence any design revisions.

The EDUCATE Research Training Programme was designed for edtech companies, which also benefit from one-on-one mentoring with a researcher who helps each edtech company apply the knowledge they have gained through the training programme to their unique context. In addition to the research training sessions (called the EDUCATE Research Training Programme), EDUCATE offers a series of workshops and opportunities provided by the programme's

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<sup>1</sup> Educate.london, last accessed November 2019. Website defunct as of December 2019 when programme ended.

official and unofficial partners in the ecosystem. EDUCATE also offers business support and mentorship to complement research training.

The EDUCATE programme culminates in an opportunity to be awarded an award called an EdWard, which is explained in detail in Section 1.3.4.

### **1.3.2 Research Training Programme**

At the heart of the EDUCATE research accelerator is a comprehensive Research Training Programme providing Master's-level research methods training for emerging edtech enterprises. The aim of the programme is to deliver research know-how to enterprises so that they develop the capacity to answer the question, Does it work, and if so, in what context? (i.e. where, why, how and when). The EDUCATE Research Training Programme consists of four two-hour classes, spread over an eight-week period, delivered by EDUCATE Research Mentors to EDUCATE enterprises. The off week is reserved for one-to-one time for companies with their assigned EDUCATE Research Mentor, described in the next section. The programme is designed to give participating companies enough Research Mastery to review appropriate literature in the learning sciences; design research plans that fit within their enterprise goals, resources and timelines; and ultimately develop capacity to demonstrate product efficacy and impact. In short, the EDUCATE programme is a research accelerator with the overall goal to develop a research mindset in enterprises.

### **1.3.3 EDUCATE Research and Business Mentors**

The heart of the programme is the research training and mentorship that enable entrepreneurs to understand sound research methods and apply them to their products.

The core competency to be gained by entrepreneurs through the EDUCATE programme is research know-how, and the key EDUCATE team members supporting the journey to research know-how in the edtech context are the EDUCATE Research Mentors. EDUCATE's team of 14 Research Mentors are the front line of developing research know-how in enterprises. Research Mentors are assigned to enterprises based on their background and experience.

EDUCATE also has Business Mentors to reconcile business trade-offs that arise as a result of research activities and to gain general business support. Business Mentors are provided as an added support for members but are not

central to the success of the programme. Programme success is defined by receiving the EdWard.

#### **1.3.4 EdWards: Marks of Research Mindedness**

The EdWard is the EDUCATE programme's mark of success, where Level 1 is awarded to programme participants who are able to demonstrate their Research Mastery in the design of an approved research proposal complete with logic model and theory of change (see Section 2.2 for more about the logic model), and EdWard Level 2 is awarded to companies that follow through with their research plan. EDUCATE Research Mentors review EdWard applicants to determine whether they qualify for the EdWard Level 1 and/or 2. Figure 2 is the official logo and description of the EdWard.



#### **EdWard Level 1 Evidence Aware**

The Evidence Aware EdWard is presented to companies that have successfully completed the EDUCATE programme and demonstrated a clear understanding of how to apply research methods within the company's context.



#### **EdWard Level 2 Evidence Applied**

Companies receiving the Evidence Applied EdWard have successfully completed the EDUCATE programme and applied their understanding of research methods to improve their product's development or quality of delivery.

Figure 2. EdWard official logo.

For the purposes of this study, EdWarded companies were seen as the most successful participants in the EDUCATE programme, and EdWard Level 2s were considered exemplary model companies with the greatest research mindset (see Appendix A for full EdWard criteria).

#### **1.3.5 Future Plans**

The scope of this study was constrained to the EDUCATE 1.0 programme, the first cohort of which started their training in June 2017, with the last cohort

finished at the end of 2019. EDUCATE then spun off into EDUCATE Ventures, a company offering research acceleration for enterprises, primarily through a further round of ERDF funding for EDUCATE 2.0 starting in January 2021 (including plans to franchise the programme to other countries). EDUCATE Ventures also offers AI readiness services and is developing an EDUCATE for Schools programme. The rapid growth of EDUCATE is evidence of the need the programme addresses in building research capacity key stakeholders in the edtech ecosystem to elevate the quality of products and services for our learners.



## 1.4 Key Terms

Following are working definitions of key terms used in this study:

*Accelerator programme (aka start-up or seed accelerator).* A fixed-term, cohort-based programme designed to expedite emerging company growth.

*Beneficiary.* The learner – not always the sole user of the educational technology but the one it is designed to teach.

*Collaborative design.* A design process including major stakeholders in the development of prototypes and products, often used when no one group can develop the product effectively on its own.

*Context.* Circumstances surrounding an individual or event.

*Ecosystem.* Any system or network of interconnecting and interacting parts.

*Educational technology (edtech).* Digital technology used to facilitate learning directly (aka learning technologies) or indirectly by supporting some aspect of the education sector. (This study focused solely on edtech that is designed to directly support learning [learning technologies] and not on tools aimed for the education sector in general.)

*Emerging technologies.* New technologies that are currently developing or will be developed over the coming years. The term is generally used to describe a new technology, but it may also refer to the continuing development of an existing technology.

*Entrepreneur.* Founder and/or owner of a business corporation.

*Evidence.* The available body of facts or information indicating whether a belief or proposition is true or valid.

*Evidence-informed design.* The use of data and evidence to inform the design of a product or service, often involving rapid, iterative design cycles.

*Evidence-informed practice.* The conscientious, explicit and judicious use of current best evidence in making decisions in practice (Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996).

*Impact evaluation.* An assessment of how the intervention being evaluated affects outcomes and whether these effects are intended or unintended.

*Innovation.* A new (iteration of a) product, method or idea.

*Learning.* The acquisition of knowledge or skills.

*Learning technologies.* Digital tools used to support the learning process.

*Pragmatism.* An approach that evaluates theories or beliefs in terms of the success of their practical application.

*Rapid-cycle research.* A process by which practical problems are identified and addressed using analysis methods that are incremental and contextually informed (Johnson, Ewigman, Gustafson, Provost, & Roper, 2015).

*Research mindset.* Established set of attitudes held towards research.

*Users.* Beneficiaries and facilitators of edtech products.

## **1.5 Outline of the Thesis**

This study has seven chapters. Following is an outline of each chapter and its goals, for ease of navigation of this study.

### **Chapter 1: *Introduction***

Goal: Introducing the context, goals and assumptions of the study

### **Chapter 2: *Understanding the UK EdTech Ecosystem to Inform Research Design***

Goal: UK edtech ecosystem context check and literature review

### **Chapter 3: *Design-Based Research Methodology***

Goal: Justification of the design-based research (DBR) approach and outline of the six DBR Cycles

### **Chapter 4: *Part 1 – Development Phase (Design-Based Research Cycles 1 and 2)***

Cycle 1 Goal: Develop new construct – keeping hypothesis in mind; literature review – methodology to develop construct and conceptualisations of mindset

Cycle 2 Goal: Validate with same participants as C1 (most expert participants)

Result: Construct refined and needs further validation with other Research Mentors

**Chapter 5: *Part 2 – Evaluation Phase (Design-Based Research Cycles 3 and 4)***

Cycle 3 Goal: Validate with a new group of research experts

Cycle 4 Goal: Validate with Business Mentors

**Chapter 6: *Part 3 – Validation Phase (Design-Based Research Cycles 5 and 6)***

Cycle 5 Goal: Validate with model edtech SMEs

Cycle 6 Goal: Validate with greater edtech ecosystem

**Chapter 7: *Conclusion and Further Research***

Goal: Presentation of contributions of this study, including the ELTE framework, six Sub-Constructs of the ELTE, the ELTE Action Model, methodological insights and further research

## **Chapter 2: Understanding the UK EdTech Ecosystem to Inform Research Design**

### **2.1 Introduction**

This study began with the goal of gaining an understanding of the UK edtech ecosystem and, more specifically, the goings-on in London, where the EDUCATE project is situated, in order to inform a research design strategy for this exploratory study. This chapter covers this exploration in two parts.

The first part of this chapter covers the initial aim of the exploration, which was to assess the needs of the sector and elucidate how the EDUCATE project is situated to meet those needs. This Phase took a grounded approach (Glaser & Strauss, 1967) to scanning the ecosystem and used semi-structured interviews to begin to shed light on how founders of edtech companies view the contribution of the EDUCATE research programme to their organisations.

A review of literature concerning the purpose of the EDUCATE programme and materials underpinning this study follows in order to stimulate the exploration (Strauss & Corbin, 1994) in topics that emerged as significant to the goals of this study in the ecosystem check.

Ultimately, the goal of the edtech ecosystem check was to choose an appropriate research design in order to meet the goals of this study. This chapter is designed to inform the next chapter (Chapter 3, 'Design-Based Research Methodology'), where the choice of a DBR approach is justified for this study.

### **2.2 Literature Review**

This section reviews the current literature on evidencing emerging technologies in education. A discussion of educational technology evaluation in general is followed by a discussion on emerging educational technology evaluation and relevant frameworks.

#### **2.2.1 Evaluating EdTech**

Though the focus of this study was helping edtech entrepreneurs evaluate educational technologies, I began by looking at the history of evaluation from the perspective of users of educational technologies in the first instance to understand the complexity of the market the edtech entrepreneur is meaning to serve. Zhao, Yan, and Lei (2008) made clear that the edtech ecosystem is multifaceted, complex and highly context driven, making evaluation very difficult.

Major concerns with evaluation are that stakeholders have differing values, goals and priorities; every environment has a very different context; and technology is expected to produce various outcomes which lack precise measures.

In 1996 the U.S. Department of Education summarised all of the purposes of evaluation (see also Zhao et al., 2008):

- Provide information to funding agencies so that they can determine whether to continue the funding or invest in similar programmes in the future.
- Provide information to school leaders so that they can decide whether to continue the implementation and engage in similar ones in the future.
- Provide information to teachers and school staff so that they can decide whether or how they might support and participate in the programme.
- Provide information to programme staff so that they can take action to improve the programme.
- Provide information for future evaluation efforts.
- Provide information to the general public.

A review of literature presented by Zhao et al. (2008) concluded that most evaluations ask the same question – ‘Does it work?’ – without sufficiently looking at contextual considerations that result in a larger variety of outcomes within rather than between treatment groups (Kulik, 2003; Pearson, Ferdig, Blomeyer, & Moran, 2005; Waxman, Lin, & Michko, 2003; Zhao, 2005). The correct question takes the implementation process and the context into account: ‘Does it work? If so, how, where, for whom, for how long and why?’ Zhao et al. (2008) concluded that studies show that ‘appropriate technology uses are associated with conditions for technology uses’ (p. 637; see e.g. Dexter, Anderson, & Ronnkvist, 2002; Mann, 1999; Noeth & Volkov, 2004; Penuel, 2006; Zhao, Pugh, Sheldon, & Byers, 2002). Evaluations must not underestimate the importance of these conditions and the role of contextual considerations in the efficacy and impact of technology implementations.

Moreover, the speed of technology development requires practical evaluation processes that can keep pace. Randomised control trials not only fall short in contextual factors but also fall short in the pace that is needed to continually evaluate with the rapid evolution of technology (Van Valen, 1973; Zhao et al., 2008). Innovative methodologies must keep context and pace in mind.

### 2.2.2 Logic Model for Technology Evaluation

To be truly useful for future users and to science, evaluations should focus on the implementation process and contextual factors as much as the outcomes and impacts of the intervention (Zhao et al., 2008). The process is non-linear, dynamic and complex (Mandinach, 2005; Molas-Gallart & Davies, 2006; Zhao et al., 2002; Zhao et al., 2008) and requires appropriate methods to handle the complexity (Heinecke, Blasi, & Skerker, 2000; McNabb, Hawkes, & Rouk, 1999; Melmed, 1995). Zhao et al. (2008) proposed that a classical logic model framework (see Figure 3) is an appropriate tool to handle this complexity. Zhao (2005) borrowed from the definition of the W. K. Kellogg Foundation (2004), stating that a logic model is ‘a systematic and visual way to present and share your understanding of the relationships among the resources you have to operate your program, the activities you plan, and the changes or results you hope to achieve’ (p. 1).

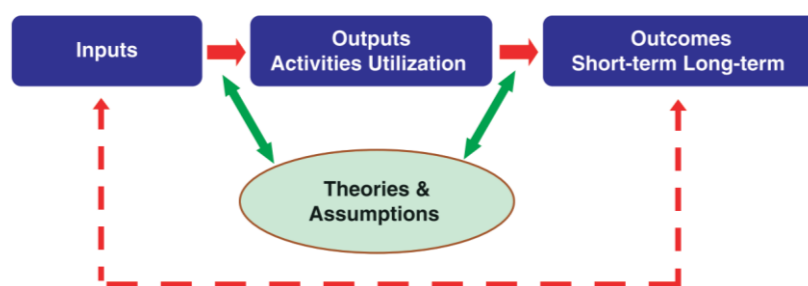


Figure 3. Logic model as presented by Zhao et al. (2008).

Zhao et al. (2008) explained that the three components of the logic model are *inputs*, which are the resources available for the program, such as human and organisational resources, that provide the context for the program; *outputs*, which are what drive implementation of the program including, for example, activities and products along with the way those activities and products are used by the intended beneficiaries; and *outcomes*, which could also be described as impacts and can be short term or long term and apply to individuals as well as organisations. The inputs, outputs and outcomes are connected by assumptions and theories.

The logic model (as seen in Figure 4) process is linear. However, successive logic models are developed in a cyclical process of plan, validate, review, revise, whereby the outcomes in one process of evaluation become a

part of the inputs in the next. The logic model framework allows for evaluating the process of investigation of how the project is implemented as well as evaluating programme outcomes and impacts. Such a framework allows for relevant information with practical strategies on how to move forward with the implementation and under what conditions the technology best works to achieve user goals.

Resources	Activities	Outputs	Short- & Long-Term Outcomes	Impact
<i>In order to accomplish our set of activities we will need the following:</i>	<i>In order to address our problem or asset we will conduct the following activities:</i>	<i>We expect that once completed or underway these activities will produce the following evidence of service delivery:</i>	<i>We expect that if completed or ongoing these activities will lead to the following changes in 1-3 then 4-6 years:</i>	<i>We expect that if completed these activities will lead to the following changes in 7-10 years:</i>

Figure 4. Logic model as seen in W. K. Kellogg Foundation (2004, p. 17).

Zhao et al.'s (2008) chapter in the *International Handbook of Information Technology in Primary and Secondary Education* was pivotal for understanding where the evaluation of emerging technology has fallen short and finding a way forward. The logic model presented in Figure 4 offers a solution to the dynamic and highly contextually charged nature of evaluating emerging educational technology. This approach and its various parts are outlined in the next section.

### **2.2.3 Practical Approaches to Evaluating Emerging EdTech with the EDUCATE Programme**

The EDUCATE research team concurred with Zhao et al.'s (2008) proposal to employ the logic model (or *theory of change*, as it is referred to in the EDUCATE research programme) as an adequate boundary object to afford the rich conversations that are necessary between cohort members and Research Mentors, subject matter experts and the business team. The successful completion of a logic model is also a key component of receiving an EdWard Level 1. Companies show their research awareness by filling out a cohesive logic

model that is approved by their Research Mentors – an achievement that often entails a 3- to 6-month conversation and negotiation between the two parties, in addition to a research proposal based on the logic model data. Figure 5 illustrates a case study of an EDUCATE cohort member and their approved logic model.

**Case Study 1:** LYRICAL KOMBAT is developing an EdTech product that is being designed to encourage and reward young people to re-imagine hip hop lyrics and poetry through the format of text battles. In so doing, it aims to connect a hip hop generation to the work of Shakespeare and beyond. This vision is captured in the logic model in Figure 3, which was developed and refined during the company’s engagement within the EDUCATE programme.

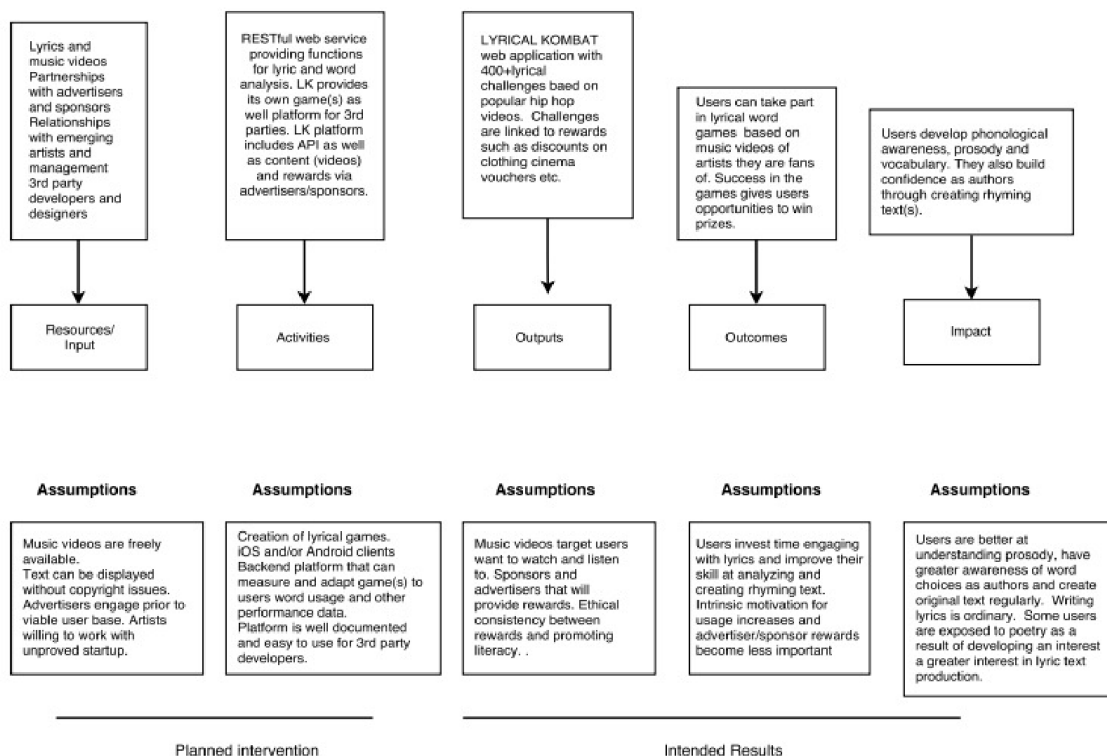


Figure 5. EDUCATE cohort member approved logic model as seen in Cukurova, Luckin, and Clark-Wilson (2018, p. 8).

EDUCATE’s pragmatic approach to evaluation asks cohort members to write proposals based on research methodologies that are appropriate to their stage of innovation. The first order of business through the EDUCATE experience is identifying their theory of change (or logic model); second is identifying the most appropriate methods to use to yield evidence based on the stage of innovation (Cukurova & Luckin, 2018). A conversation about how research methodologies are chosen for proposals follows.



## 2.2.4 Evidencing Emerging EdTech Based on Stage of Innovation

According to EDUCATE partner NESTA (2016), different stages of innovation require different types of evidence. NESTA created the innovation spiral (Figure 6) as a framework to categorise the stages of innovation of emerging technologies and identify the evidence type that would be most appropriate at a given stage. Instead of identifying causal research as the gold standard, the innovation spiral argues that such positivist evaluations of emerging technologies are most valuable at the final stage, as they require more time, more funding and a stable product with less change. The scope of this study covered emerging educational technologies; the companies' own evaluations of their stages of innovation were rarely at Stage 7 (Cukurova & Luckin, 2018). NESTA (2016) argued that various research approaches should be leveraged for successful evidence-informed decision-making depending on stage (Cukurova & Luckin, 2018; NESTA, 2016). Figure 6 shows the various stages of the innovation spiral. Stages are in the shape of a spiral as emerging technology companies are dynamic and can move back and forth between stages depending on myriad pivots (NESTA, 2016).

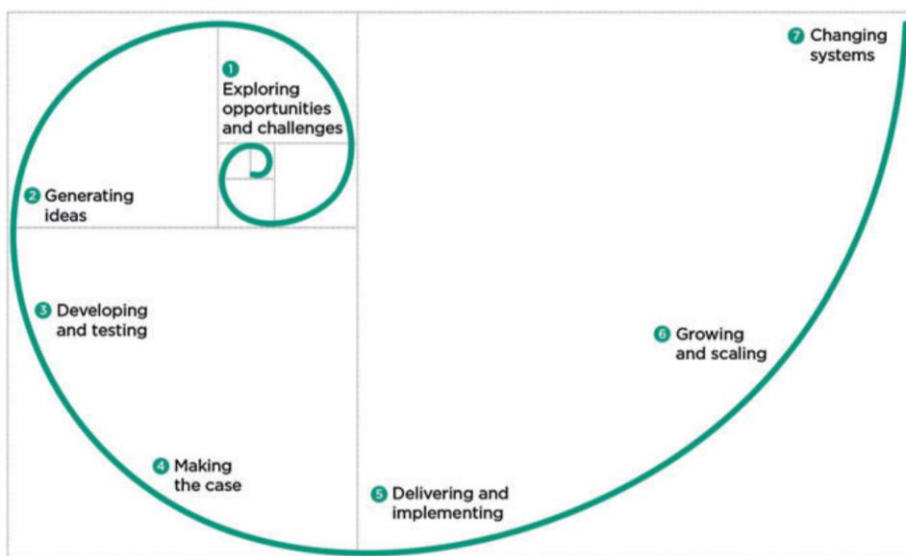


Figure 6. Innovation spiral as presented in NESTA (2016).

Cukurova and Luckin (2018) warned against encouraging educational technology stakeholders towards large-scale evaluations without considering the valuable and timely indicators of impact that other methods can yield. Research quality considerations include data accuracy (validity), precision, completeness and consistency and appropriateness considerations (O'Leary, 2004). The

EDUCATE Research Training Programme emphasises that evidence quality is not related to evidence type (Cukurova, Luckin, Clark-Wilson, Moore et al., 2018) and that different types of evidence have different advantages and disadvantages (Marshall & Cox, 2008). Interestingly, for example, O’Leary (2004) pointed out that rapid-cycle research designs have advantages over other research methods in the realm of data quality, as rapid-cycle methods, where data are reviewed early, often deal with data quality issues early, making it easier to solve current problems and prevent other problems from recurring. This information is covered in the EDUCATE Research Training Programme, and participants have the opportunity to consult their mentor regarding research quality at every level.

### **2.2.5 Towards a Golden Triangle of Evidence**

The logo of the EDUCATE programme is a golden triangle (Figure 7, also introduced in Figure 1, Section 1.1), which represents the three major stakeholders of educational technology, namely edtech companies (developers of the technology), users (teachers, learners, parents) and researchers. The research underpinning this triangle was presented in a follow-up study to a research project in 2012 called *Decoding Learning* (Luckin et al., 2012). The purpose of this study was to look at the impact of digital technology in the classroom by critically investigating research evidence with the goal of optimising edtech affordances for learning. The research report highlighted the significant disconnect between the main stakeholders in edtech, namely industry, research and users (Luckin, 2015). The follow-up report presented the golden triangle as the solution to the issue. The golden triangle recognises that researchers and practitioners are frequently isolated from the technology developers whose products they use or study. It taps into the increasing consumerisation of educational technology and the increasing evidence that well-designed technology can be effective for teaching and/or learning. The golden triangle concept suggests a different design philosophy that is described as ‘collaborative evidence-based product design’ (Luckin, 2015), where researchers, educators and developers all work together in an evidence-informed way.

# The Golden Triangle

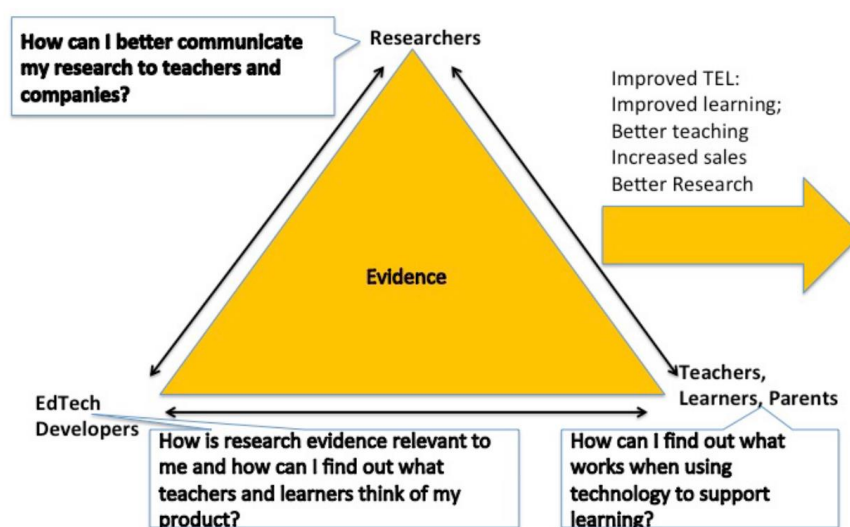


Figure 7. The golden triangle of collaborative evidence-based product design as seen in Luckin et al. (2012).

The collaborative evidence-based product design model (golden triangle) hypothesised that it is not until these three major stakeholders collaborate and co-design that edtech products can be built with a strong evidence base to be impactful for users. The EDUCATE programme was born out of a desire to bring the major stakeholders of edtech together in this golden triangle of evidence – essentially, to test how this can be applied in practice. The subsequent discussion section highlights what was found as a result of observations of the golden triangle. Please note that though I reviewed participatory and learner-centred design literature (e.g., Basballe, Halskov, & Hansen, 2016; Good & Robertson, 2006; Hendriks, Dreessen, & Schoffelen, 2016; Ostergaard, Karasti, & Simonsen, 2016; Simonsen & Jensen, 2016; Simonsen & Robertson, 2014), I justify in Section 3.3 why this has not been included in this study due to a lack of relevance to my specific research question.

## 2.3 Methods

I chose to pursue a two-pronged approach to exploring the EDUCATE programme and the London edtech ecosystem in which it is situated. On one hand, I conducted semi-structured interviews (see Appendix B for full interview questions), and on the other, I took a grounded approach to exploring the edtech ecosystem (see Appendix C for a full list of activities and events in which I

participated). The grounded approach allowed me to incorporate experiences from a week-long visit to Silicon Valley, where I was able to visit key individuals in the ecosystem and get ideas for alternative ways of approaching this study's research design.

I grouped ecosystem activities reported in Appendix C into four categories, based on the major stakeholders presented in the golden triangle – edtech entrepreneurs, users and researchers – and added a government category. An activity that fell into different categories was counted twice. Recurring event types, such as EDUCATE bi-monthly research team meetings, were only counted once. Table 1 depicts ecosystem activities visited in this Cycle in the United Kingdom (mostly London), whereas Table 2 depicts ecosystem activities visited in this Phase in the rest of the world (excluding the United Kingdom).

Table 1. Ecosystem Activities Visited in the United Kingdom (Mostly London)

Activity type	No. attended
Entrepreneur	25
Research	31
User	10
Government	10

Table 2. Ecosystem Activities Visited in the Rest of the World (Excluding the United Kingdom)

Activity type	No. attended
Entrepreneur	15
Research	10
User	2
Government	3

I kept a research journal during this time. To support meta-tagging, I used digital note-taking in Microsoft OneNote. OneNote was instrumental to my synthesis and analysis of notes and aided me in delineating six major issues in the ecosystem and the contribution, if any, that EDUCATE makes to those issues. The six issues are presented and discussed in Section 2.4.

In light of the complexity inherent in most educational contexts, evaluations of IT tools in education usually demand multiple or mixed methods (Mark & Shotland, 1987; Mertens, 2005); it was a highly exploratory round, but I followed Greene and Caracelli's (1997) advice and tried to ground my exploration

with conversations with edtech founders through interviews, because the authors described two of the major advantages of mixed-method evaluation as triangulation of my impressions with experiences of participants building a *research mindset* through the programme and complementarity of results.

## 2.4 Discussion

The research activities described generated the following six observations:

1. *Vulnerable users*. Similar to medicine, where patients do not understand the way a treatment should feel, educational technology founders cannot depend on users being able to provide feedback on their experience and whether the product works, as they could for a TV streaming product or a car. When the user does not understand their own learning process and their own strengths and challenges, they depend on products being tested and feedback being designed with their vulnerability in mind.
2. *Context matters*. In social science, an intervention may not work for myriad reasons. This may explain why the literature review along with many active members of the London edtech ecosystem remarked on the limited use of many existing studies. Edtech research must not only answer the question of whether edtech works; it must also answer in what context a product or service does and does not work. Without this contextual information, the research is not useful.
3. *Pace of technology development*. Technology products are dynamic, and, in particular, emerging technology products pivot at a fast pace; however, research is generally slow and measured. Research must fit into the world of technology if it is to work for entrepreneurs of emerging edtech companies.
4. *Lack of regulation*. There are no laws regulating the testing of educational technologies at the moment, and over-regulation runs the risk of stifling the market. This gap in regulators' knowledge needs to be addressed not only to enable regulators to fully understand the sector but also so the market can build more useful products for users.
5. *Ontology*. Developers and users do not speak the same language; they need a common language and understanding to enable more productive co-design.

6. *Founder vision.* Founders' influence in edtech start-ups seems to be substantial – if edtech leadership does not participate in the EDUCATE programme or do not have a research background, it seems unlikely that the enterprise as a whole will maintain a research mindset long term. EDUCATE as a project addresses many of these issues.

Learnings from the programme addressed Issues 1–5; however, Issue 6 required more attention. At present, the programme curriculum is not designed for founders to fit into their day if they are able to participate themselves. From observations of participants in the EDUCATE programme, when founders do not support the programme, even if their employee gets an EdWard, the EDUCATE mark of research awareness (EdWard Level 1) or research mindedness (EdWard Level 2), and even if the founder is happy with the employee's work, they will be not be able to move forward with a cohesive vision for a research strategy for the company as a whole. It is for this reason that developing a *research mindset* in the founder of the edtech company is of the utmost importance. I focused on developing the construct of a research mindset, building a success profile of the research-minded entrepreneur and working with some of EDUCATE's most research-minded edtech entrepreneurs (meaning founders) to explore how this mindset can be developed optimally.

In reflecting with my supervisors, it became clear that EDUCATE is moving towards the golden triangle, where the three stakeholders can work together; however, they are not yet there. To collaborate towards evidence-based innovations, all three parties require a research mindset. EDUCATE is currently working on the research–edtech axis. Only when the knowledge is there can these three stakeholders truly collaboratively design stronger products for their learners, and only then can a participatory design methodology through the golden triangle of evidence truly be tested.

It became clear to me that EDUCATE is in the business of building research mindedness; a meaningful contribution I could make with my study was to pursue the research–edtech axis further due to my past experience as an entrepreneur. I came to understand what the success profile of a research-minded entrepreneur in educational technology looks like and to define the construct. It is my hypothesis that edtech leaders do not need to know how to do research, but they need to know how research works to build an appropriate

vision and leave the appropriate space, resources and research support in their activities. The initial questions to answer were, What is a *research mindset* of a successful educational technology entrepreneur, and how can the construct be defined? Success is here defined by receipt of the EdWard, the most successful of the EDUCATE programme participants being EdWard Level 2 recipients.

## **2.5 A Note on Semi-structured Interviews**

Semi-structured interviews conducted in this phase served to inform me regarding CEOs' motivations for joining EDUCATE and their experiences in the programme. However, the format resulted in inadequate responses. I did not therefore analyse these interviews formally. The interviews were helpful in informing me of the EDUCATE experience from the point of view of founders and were primarily an exercise for me to begin to understand the importance of appropriate methodology in order to gain necessary information in subsequent rounds.

## **2.6 Chapter Summary**

In this chapter, I described the EDUCATE programme in detail and the London edtech ecosystem in which it is situated, and I reviewed literature on current approaches for the evaluation of edtech. I concluded that EDUCATE is in the business of building a research mindset within the edtech entrepreneur, by which I mean a knowledge of how to do research to build evidence-informed edtech. From this work, it became clear that this study should develop a construct that aids in the development of research mindedness in the context of edtech entrepreneurs. The next chapter presents the methodology that best supported this aim.

### **Chapter 3: Design-Based Research Methodology**

In an article summarising key research studies of EDUCATE edtech enterprises and their Research Mentors, Clark-Wilson et al. (forthcoming) confirmed the lack of a theoretical frame to guide the design of the programme given its unique context, although its approach has its foundations in activity theory. A DBR methodology was therefore selected to allow for the integration and constant refinement of the programme's offerings (T. Anderson & Shattuck, 2012; Brown, 1992; Clark-Wilson et al., forthcoming). The goal of each Cycle of research was to develop both theoretical and methodological knowledge. This suited the exploratory nature of the pioneering goals of the project. DBR suited the programme well, because 'the exact nature of the activity of the programme and its actors was something that the programme team played a key role to determine' (Clark-Wilson et al., forthcoming).

The field of learning sciences has a tradition of using a variety of methods as a result of the field's highly interdisciplinary origins (Collins, Joseph, & Bielaczyc, 2004; Design-Based Research Collective, 2003; Hoadley & Van Haneghan, 2011; Sommerhoff et al., 2018); however, 'DBR is suggested as a key method in the field (Cukurova & Luckin, 2018; Nathan & Sawyer, 2014; Sawyer, 2014; Sommerhoff et al., 2018) as it integrates the development of theory and the design of learning environments through an iterative, holistic approach' (Hoadley & Van Haneghan, as cited in Sommerhoff et al., 2018, p. 324).

Bakker (2018) explained eloquently that 'the design researcher sees the potential for a new technology and must imagine the environment in which the intended learning process can be researched' (p. 7). The EDUCATE programme did not have a theoretical frame to guide its design given the unique context of the project; therefore, DBR was the method of choice to meet its overarching aim of getting closer to an optimal learning design to support edtech SMEs in building research know-how into their processes (Clark-Wilson et al., forthcoming). To meet this goal, the EDUCATE programme went through a series of three DBR Cycles over the course of the programme (see Figure 8).



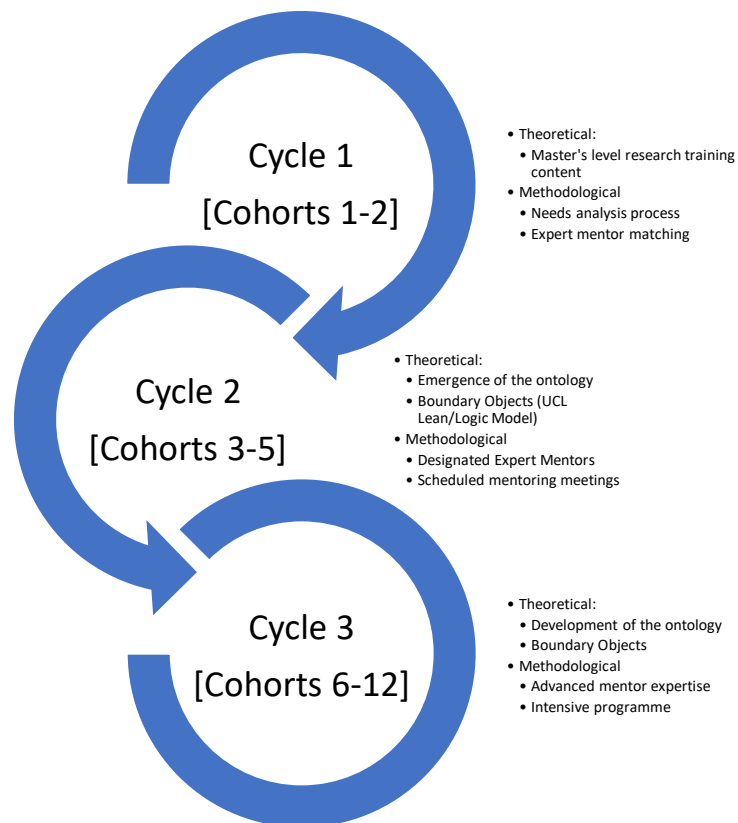


Figure 8. The EDUCATE programme design-based research Cycles as seen in Clark-Wilson et al. (forthcoming).

DBR was also deemed appropriate for EDUCATE to validate the golden triangle (see Figure 1) in an exploratory fashion and to allow for constant iteration and refinement to improve programming (T. Anderson & Shattuck, 2012; Brown, 1992). The goal of each Cycle of research was to develop both theoretical and methodological knowledge.

I chose to follow a DBR methodology that allowed for exploration in a similar iterative manner. DBR facilitates a process that focuses on what is possible (what could be or what should be) rather than on what is or what was (Bakker, 2018); the methodology therefore seemed most appropriate to handle the highly untested nature of the *research mindset* in educational technology entrepreneurs. It allowed for new thesis research goals to be developed if the EDUCATE programme itself (i.e. the context of this study) were to pivot in an unpredictable way.

Established approaches make way for Cycles and observation with interwoven design and research processes: 'the design is research based and the research is design based' (Bakker, 2018, p. 4). The addition of a theoretical basis and outcomes distinguish DBR from agile and similar methods frequently

used for technology development using iterative prototype testing and re-design Cycles (Bakker, 2018).

The forward-facing nature and the flexibility afforded by design research were appropriate for capturing the necessary data with each Phase of research, thus allowing me to get closer to understanding how best to support educational technology entrepreneurs to become research minded.

### 3.1 Research Goals

The overall aim of this research was to ascertain, **What theoretical framework supports edtech enterprises to build evidence-informed products and services?** The design-based nature of the research study required that each design Cycle has design research goals rather than explicit research questions. Here I present the goal of each research Cycle, the flow between Cycles and the trajectory towards achieving the overall research aim.

The Phase that came before Cycle 1 (as described in Chapter 2) was highly exploratory. It took place between September 2017 and March 2018; its goal was to gain an understanding of the educational technology sector in the United Kingdom (Figure 9). I wanted to understand the edtech ecosystem as a whole to assess the sector's needs and to establish if and how EDUCATE fitted into these needs. A set of preliminary interviews with edtech founders participating in EDUCATE was also used to identify their perspectives on their work, the ecosystem, research, EDUCATE and its research activities, including the following:

1. grounded research, which included attending meetings at EDUCATE and those of EDUCATE partners, the educational technology community and the greater education sector (see Appendix C for a complete list of events and activities I attended during the period autumn 2017 to winter 2019);
2. semi-structured interviews, conducted with a small sample of EDUCATE founders, to understand their experiences in educational technology development and as part of the EDUCATE programme to develop an initial hypothesis about how best to support them (see Appendix B for full interview questions).

The conclusion of this Phase produced the initial working definition of a *research mindset* in educational technology entrepreneurs (where *entrepreneur* refers to

the founder of the enterprise in question), a construct that would need to be developed Cycle 1.

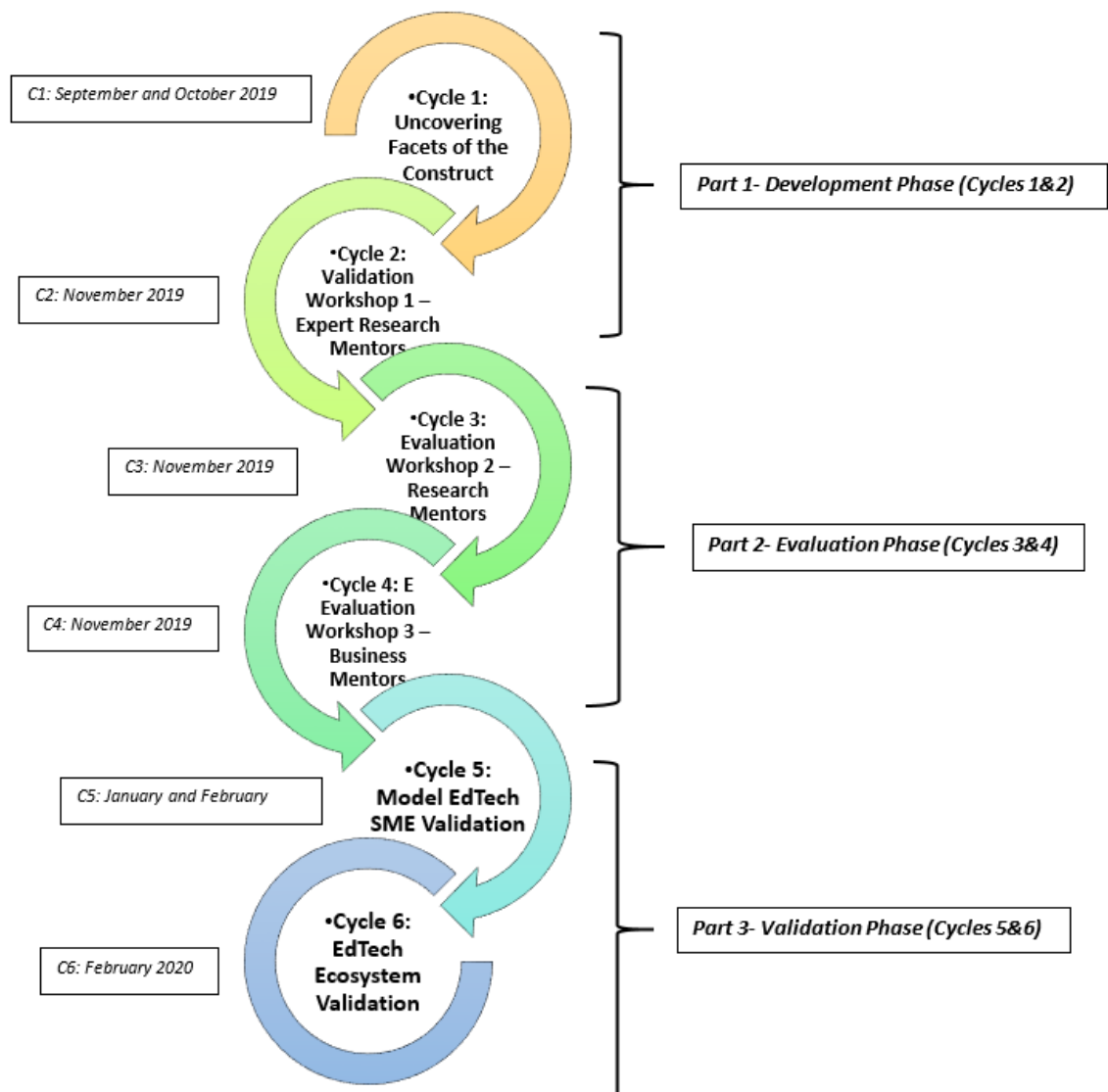


Figure 9. The DBR Cycles of this study.

The goal of Cycle 1, which took place in September and October 2019, was to develop a new construct that would serve as a framework for building a research mindset in edtech enterprises (Figure 9). This was done with a participatory design process involving key members of the EDUCATE team – the EDUCATE Research Mentors with the most experience in the programme. This Cycle’s goal was to uncover the facets of the construct in question. The result of this Cycle was the development of a new construct (called the Research-Minded Educational Technology Enterprise, or RMETE, at this stage) that required further co-design and internal validation with expert Research Mentors.

Cycle 2, still in DBR Part 1, 'Development Phase', had a goal of further developing the emerging construct with the original group of expert Research Mentors through a participatory design process. The result was a further refined construct (now called the Evidence-Led Learning Technology Enterprise, or ELLTE) ready for an Evaluation Phase with other experts in the EDUCATE programme on both research and business sides in Cycles 3 and 4.

The goal of Cycle 3 was to evaluate the construct with a new and different group of EDUCATE Research Mentors. The result was a further refinement of the construct. The goal of Cycle 4 was once again to evaluate the construct, this time with the EDUCATE business team. Results showed a stable construct that seemed to be ready for validation with emerging edtech companies. The 'Evaluation Phase' (DBR Cycles 3 and 4) evaluated the Evidence-Led Learning Technology Enterprise or ELLTE framework; evaluated the ELLTE Survey outlining the six Sub-Constructs of an ELLTE, which presented a single question that would be most powerful in the instant assessment of the research mindedness of an emerging edtech enterprise; and hypothesised three Hallmark Questions for each of the six Sub-Constructs and a hypothesis of how Sub-Constructs interact in practice through the ELLTE Action Model. The 'Evaluation Phase' concluded with the desire to validate the above-mentioned constructs with both model edtech companies and the greater edtech ecosystem in the next Phase.

The 'Validation Phase' had two DBR Cycles. Cycle 5, which took place between January and February 2020, aimed to validate the ELLTE construct with EDUCATE model companies (i.e. those with an EdWard Level 2). The result was a further refinement of the construct and a final name change to the Evidence-informed Learning Technology Enterprise (ELTE) and the ELTE Sub-Construct Hierarchy Model. Cycle 6 aimed to further validate the construct with a group of global stakeholders. This round of validation was done at the European EdTech Network conference in Oulu, Finland, in February 2020, with representatives from the greater edtech ecosystem, including educators, researchers, students, entrepreneurs, policy makers and investors. Results suggested a stable construct. This was the final Cycle of validation of this study.

### **3.2 Ethical Considerations**

Ethics approval was granted for this study by the Institute of Education, University College London. Live human subjects were interviewed in this body of work; therefore, a participant information sheet was carefully prepared, outlining the EDUCATE programme, the goal of this study and how the collected data would be used. A separate consent form was prepared for each participant's signature once the participant had read the information sheet. Both the information sheet and the consent form, along with the 'Doctoral Student Ethics Application', were approved (see Appendix D).

### **3.3 Methodological Literature Review**

My earlier text has argued that no construct exists to guide emerging edtech enterprises to build evidence-informed learning technologies. Therefore, the goal of this literature review was to aid in the DBR process with a review of methods that may be useful in the development of this construct. Prior to this review, there was no knowledge of what construct would emerge. This literature review's goal was to gain insights into methods that would optimise the data yielded from the expert community that EDUCATE propelled into the edtech ecosystem. This literature review first looked at knowledge systems and communities of practice and then moved to techniques of how to design with experts.

The literature review then scanned the current conceptualisations of the mindset construct in order to gauge how to (a) gain insights into which construct was most appropriate to build upon for the construct under development, which was looking at developing a research mindset for edtech enterprises, and (b) be aware of both individual and collective mindset constructs in the conversations with experts.

In summary, the overarching goal of this literature review was to inform the design of methods that would allow for the optimisation of learning from key expert participants in the EDUCATE programme. To do so, the three questions that needed to be answered were as follows:

1. What grounded approach is appropriate? (See Section 3.3.1.)
2. How do we design with experts? (See Sections 3.3.2 and 3.3.3.)
3. What are the current conceptualisations of mindset? (See Section 3.3.4 to 3.3.9.)

The literature review began with an exploration of the grounded approach as the underpinning theoretical frame of Phase 1.

### **3.3.1 Grounded in Programme Learnings**

As EDUCATE was the first programme of its kind, the Development Phase undoubtedly needed to ground learnings in the expert community of researchers (the Research Mentors) in the EDUCATE programme and be theory generating, as grounded theory proposes. This new knowledge about how to build research awareness and ultimately research mindedness in entrepreneurs was a unique outcome of the knowledge of this group. That being said, it was Strauss and Corbin (1987), in their further exploration of grounded theory in qualitative research, who proposed that there may be a place for literature review so as not to reinvent the wheel and to use what others have said to stimulate discussions. Although this contradicts the original design of grounded theory, I have adopted the stance of Strauss and Corbin (1987) and included a literature review that explores literature which I felt could be helpful in the development of this construct. The section that follows looks first at expert communities, then at how to design with experts and finally at the conceptualisations of mindset to explore methodological techniques that may optimise data yielded to achieve the goals of the Development Phase.

### **3.3.2 Communities with Expertise**

The unique context of the EDUCATE programme brought together a range of experts who were generating research knowledge and expertise about the programme design and its impacts (Clark-Wilson & Weatherby, forthcoming; Cukurova, Luckin, & Clark-Wilson, 2018).

The epistemological stance I took in this study was that research has shown time and again that the creation of knowledge is innately a social process among individuals (Berger & Luckman, 1966; Wittgenstein, 1953; Vygotsky, 1962, 1978) – much like the design and structure of the EDUCATE programme, which is grounded in Wenger's (1998) model that learning is a social process, occurring through interaction with a community of practice.

There is a rich history of organisational theorists discussing such emergent networks of expertise (Barnard, 1938; Follett, 1924). It is only in recent years that researchers have combined knowledge and learning with the study of these networks (Teigland, 2003), which have a multitude of natures, including

communities of practice (Wenger, 1998), scientific communities (Knorr-Cetina, 1981), invisible colleges (Crane, 1972), networks of practice (Brown & Duguid, 2000) and knowledge networks (Teigland, 2003).

Empirical studies comparing these networks are not high in number, perhaps owing to the informal nature of many interactions, making them difficult to monitor. The most robust contributions to this field are, as a result, ethnographic studies and include Teigland's (2003) study 'Knowledge Networking Structure and Performance in Networks of Practice' and Wenger's (1998) landmark book *Communities of Practice: Learning as a Social System*. These studies are often ethnographic in nature.

In her study on knowledge networking, Teigland (2003) showed that an improved understanding of these emergent networks of work-related relationships will enable firms to overcome challenges while facilitating their ability to create and sustain a competitive advantage. The EDUCATE programme is designed to facilitate formal (research and business mentoring, Research Training Programme and a host of workshops) and informal (networking events) learning offered by a group of experts in the field (the EDUCATE Research Team) to facilitate this sociocultural learning (Clark-Wilson & Weatherby, forthcoming) and build a supportive community of practice (Wenger, 1998).

In this regard, the EDUCATE programme has multiple networks of practice – the participants themselves, representing the enterprises and the mentors who supported the companies and who as a research team shared information on how to improve. Perhaps not being around long enough for it to be deemed a community, the edtech ecosystem established by the EDUCATE programme is undoubtedly a network, and the Research Mentors were in a unique position to feed the network, on one hand, and work together as a network or community, on the other. It was the aim of this Phase to ground learnings in the knowledge of this network of experts to build a construct that could act as a framework that would empower the development of evidence-informed edtech enterprises.

This study aimed, not to study the dynamics of these knowledge networks, but merely to acknowledge the unique opportunity in EDUCATE to develop a framework to understand model companies so that their success may be replicated in others, and perhaps even more systematically. This research has borrowed from the learnings of knowledge networks, however, and sees boundary objects, used by Wenger (1998) in his landmark study introducing

communities of practice, as constructs used to make social relationships visible. Boundary objects have the power to incorporate different parties into the design process and are vital to creating a language that is common within the boundaries of the conversation (Sanders, Brandt, & Binder, 2010).

The EDUCATE Research Mentors were the network with the greatest knowledge of the programme, and after having worked with 252 edtech enterprises to develop research know-how, they offered a unique co-design opportunity. Thoughtful participatory design processes are needed to extract this knowledge in the most effective way possible – the literature that follows looks at participatory design methodology that suggests how to design with experts.

### ***3.3.3 Designing with Experts***

While exploring the UK edtech ecosystem, interviews with founders of enterprises did not yield expected insights. Upon reflection, this could have been due to the lack of review of literature on participatory design and inadequate structuring of questions given the level of expertise of subjects and their ability to process the information. This resulted in the second goal of this literature review, which was to look at literature in participatory design that informs a strategy around how to design with experts, and generally with individuals of varying levels of expertise, effectively.

Central to this study was the goal of developing a new construct with the expert community – the EDUCATE Research Mentors – and choosing a methodology that would be appropriately collaborative in nature to give respondents the opportunity to contribute their expertise and experience from time spent in this unique programme. It was not the aim of this literature review to be exhaustive in scanning participatory approaches; rather, it sought to find highly referenced practical guidelines to follow in aiding the development of the construct in question through a process of making mentors a part of the design team.

Sanders supported the ‘say, do, make’ strategy, where participants who are asked to make offer the greatest depth of feedback, as they must justify what they do (the scores they give) and what they say (the justifications they give; Sanders & Stappers, 2008, 2014). Through this process, I asked EDUCATE Research Mentors to become part of the design team and to participate in the co-creation of the construct underdeveloped at a point in the EDUCATE programme



when Mentors had not yet fully defined themselves as ‘expert of their experiences’ (Sleeswijk Visser, Stappers, van der Lugt, & Sanders, 2005).

According to Sanders and Stappers (2008), as long as appropriate tools are given to participants at their level of expertise in order to express themselves, the co-design process can take place. Table 3 shows the four levels of creativity presented by Sanders and Stappers and suggests appropriate design expectations at each level.

Table 3. The Four Levels of Creativity

Level	Type	Motivated by	Purpose	Example
4	Creating	Inspiration	‘express my creativity’	Dreaming up a new dish
3	Making	Asserting my ability or skill	‘make with my own hands’	Cooking with a recipe
2	Adapting	Appropriation	‘make things my own’	Embellishing a ready-made meal
1	Doing	Productivity	‘getting something done’	Organising my herbs and spices

*Note.* From Sanders and Stappers (2008, p. 12).

Boundary objects, as mentioned in the previous section, would need to be used in a strategic manner to allow them to co-create the construct according to their level of ability. Cycle 1 began with the EDUCATE Research Mentors with the greatest expertise to be participants, and as such, methods designed needed to be along Levels 3 and 4 of Table 3. In Cycles 3 and 4, where participants with slightly less experience and content mastery were invited to take part, methods were designed along Levels 2 and 3 for validation. This model allowed participants to be given the chance to operate at Level 4 with open-ended questions; however, the design of the workshops did not depend on this level of expertise, and indeed feedback was often given appropriate to the aforementioned levels of participants. Elaboration on the methods chosen and justification of why they were appropriate to the creativity level of the audience is in Section 4.2.2.

Sanders and Stappers (2008) explained that it is the role of the researcher to appropriately engage subjects with whom co-design is occurring, depending on the subjects’ aforementioned levels of self-expression, by

- leading people who are on the ‘doing’ level of creativity;
- guiding those who are at the ‘adapting’ level;
- providing scaffolds that support and serve people’s need for creative expression at the ‘making’ level; and
- offering a clean slate for those at the ‘creating’ level. (p. 14)

Table 5 illustrates Cycles 1–4, each with methods grounded in knowledge and experience that build on the last. Chapter 3 explains that a design research methodology (Bakker, 2018) is employed in each Cycle to meet the Cycles' overall goal of developing a new construct defining a research-minded enterprise and for design ideas to build upon one another.

The goal of this Phase was ultimately to answer the question of what the construct of a research mindset entails. The section that follows explores various conceptualisations of the construct of mindset to aid in the development of research methods.

### **3.3.4 Mindset Conceptualisations**

The goal of the Development Phase was to develop a construct for a research mindset in educational technology enterprises, that is to say, an enterprise that is evidence informed in its decision-making, so that this capacity could be developed in other enterprises. Though data were grounded in learnings of the Participants in this Phase, it was hoped that a review of the conceptualisations of mindset would help with the design of methodology to encapsulate various possibilities that Participants should endeavour to consider when co-designing this new construct.

The term *mindset* is used colloquially to refer to one's worldview and has been conceptualised based on a variety of disciplinary traditions; however, there is still no singular definition (French, 2016; Han & Stieha, 2020; Legrand, Ebby-Rosin, Kurshan, & Zapf, forthcoming). A thorough review of the literature showed the 'fuzziness', as French (2016) put it, of the construct. For the purposes of this study, the literature supported having a broad understanding of the concepts to be able to prompt the expert mentors to consider various aspects of the *research mindset* it was the goal of the EDUCATE programme to achieve. It was my hypothesis at this point in my study that a research mindset was the propensity of edtech entrepreneurs to do research. This fuzziness is in part due to the difficulty of the construct as it defines the inner workings of the mind (Legrand et al., forthcoming), and in part because of a lack of rigour of academics in the definition of the construct itself historically (French, 2016), which resulted in how French suggested mindset theories may be best represented visually – with the 'permeable boundaries' of a Venn diagram (as in Figure 10).

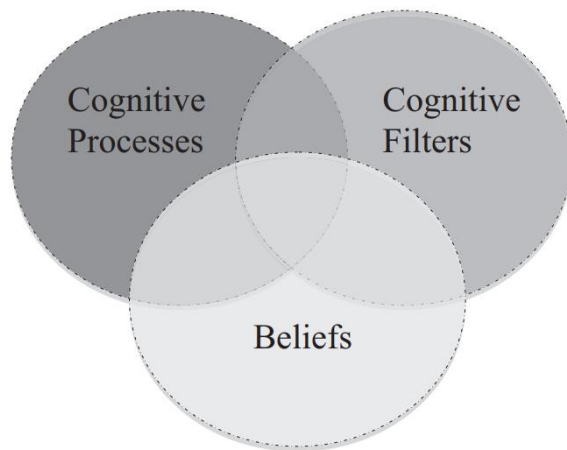


Figure 10. Representations of the fuzziness of mindset conceptualisations in scholarly research as seen in French (2016).

In a strongly worded conclusion of a systematic review of the historic uses of the construct, French (2016) conceded that ‘this fuzziness appears to stem from inadequate attention to theoretical and conceptual boundaries, which has created conceptual porousness in a relatively indistinguishable linguistic space’ (p. 10). The construct varies not only interdisciplinarily but intra-disciplinarily as well, with substantial variation in conceptualisations and operationalisation by scholars, resulting in a considerable divide. This allowed this study to develop the term *research mindset* without strict limitations on the use of the construct. The end of the literature review proposes that this term be used in Cycle 1 methods in order to meet the Development Phase’s goals.

A commonly known and highly referenced conceptualisation is Dweck’s mindset theory or ‘implicit person theory’, concerned with an individual’s belief in their own capacity and the malleability of their attributes and abilities (Dweck, 2000; Dweck & Leggett, 1988), which Dweck re-branded with terminology from the implicit person theory used in earlier studies of the growth and fixed mindsets that are more commonly known today (Dweck, 2000, 2006; Han & Stieha, 2020). Table 4 shows these interchangeable terms and associated definitions.

Table 4. Mindset and Implicit Person Theory as Seen in Han and Stieha (2020)

Mindsets	Implicit person theory	Definition
Growth mindset	Incremental theory	Belief that one’s skills, strengths, and abilities can be refined through effort and determination.
Fixed mindset	Entity theory	Belief that one’s skills, strengths, and abilities are innate and immutable, or only change slightly.

In the field of social psychology, Dweck famously presented the present evidence for a new model of individual differences in judgement (implicit theories about human attributes) and reactions (judgement structure understanding and actions; Dweck, 2006; Dweck et al., 1995). Specifically, Dweck has claimed that when people believe attributes are fixed, trait-like entities, they understand outcomes as fixed, whereas when people believe attitudes are dynamic, they tend to have a constructive, mastery-oriented response. In *A Dictionary of Education*, Wallace (2015), discussing Dweck's work, differentiated between *fixed* and *growth* mindsets and defined a fixed mindset as 'an individual's fixed beliefs about their own existing abilities, skills, or intelligence'. For people who hold this mindset, there is no possibility that working hard can improve their abilities, skills or intelligence. A fixed mindset can prevent people from developing their potential. Those who hold a *growth* mindset, by contrast, believe that ability, skills and intelligence can be developed through hard work and are more motivated and likely to succeed.

Dweck's (2013) motivation in developing this mindset construct arose from a desire to see potential met – and an exploration of our self-theories can inhibit potential:

I have always been deeply moved by outstanding achievement, especially in the face of adversity, and saddened by wasted potential. I have devoted my career to understanding both. For almost 30 years, I have done research on motivation and achievement. (p. ix)

In her conceptualisation of the term, mindset has been developed to describe outlook on an individual level. This may be a useful term if the Development Phase's findings suggest the role of enterprise leadership is central to the new construct. At the end of Phase 1, this study was aiming to explore the hypothesis that the founder, CEO or director in charge of the company needed to have a research mindset if it was to permeate the company. There is a risk that founders of educational technology companies lack a *research mindset* as defined above – they possibly feel their products work without checking them. Alternatively, entrepreneurs may be open to research but possess unrealistic expectations and misconceptions about what research is, what it can do, what questions can be asked and how much it would cost to answer those questions.

Dweck (2013) explained that she worked on the assumption that people develop beliefs or 'meaning systems' that give meaning to their interactions in the

world. People's beliefs about themselves are called their *self-theories*, and these beliefs can be very powerful, leading different people to behave very differently in what look to be identical circumstances. Psychologist Howard Gardner (2004) viewed the individual's mind as having four entities – stories, theories, concepts and skills – whereas Senge (1990) argued that mindset is a mental model organised in the mind. These theories were from the individual level – one's worldview. If data in the Development Phase had yielded that is it not at the individual mindset level, one's worldview, but indeed an enterprise-level collective mindset that is most relevant to aid in the development of this construct, these theories will prove to be less helpful to the goals of this study. This led to an exploration of the enterprise-level mindset theory.

### **3.3.5 Mindset in Business and Entrepreneurship Literature**

A popular definition of mindset in business and management literature is 'one's worldview, the place or orientation from which you experience your reality and form your perceptions of it' (D. Anderson & Anderson, 2001, p. 80). Literature in business and management has explored the construct of the entrepreneurial mindset in order to aid in the understanding of qualities and capacities that drive successful enterprises (Legrand et al., forthcoming), defined as the ways in which a person can see and view opportunity in an environment that is both unfamiliar and dynamic (Canals, 2016; Davis, Hall, & Mayer, 2016; McGrath & MacMillan, 2000) – *the inclination to discover, evaluate and exploit opportunities* (Bosman & Fernhaber, 2018).

As I have already highlighted, the definition of *mindset*, like the definition of *entrepreneur(ial)*, has a history of varying within and across disciplines. In their comprehensive literature review, Naumann (2017) concluded that much like the general conception of mindset, there is no common conceptualisation of the entrepreneurial mindset, and that scholars have most frequently contributed to the representation of specific attributes within the construct.

In an exploration combining the fields of business and psychology, this construct made way for a psychometric test called META, a validated self-report inventory of entrepreneurial tendencies and abilities (Ahmetoglu, 2014; Ahmetoglu, Chamorro-Premuzic, Klinger, & Karcisky, 2017; Ahmetoglu, Leutner, & Chamorro-Premuzic, 2011; Hamzah & Shakir, 2016). META is included as an example here as it has been found to be the single best predictor of performance

outcomes against time among all other established psychometric tests (Ahmetoglu, 2014). The test includes nine trait domains (namely curiosity, creativity, belief, opportunism, proactivity, resilience, vision, authority and stability) and three trait derailers (namely dominance, hubris and mercurial), forming a strong approach that presents the success profile of entrepreneurs (Garforth, 2015). The META traits are described in Figure 11.

Work Domains	Traits	Descriptions
<b>Ideation</b> <i>The generation of innovative business ideas</i>	<b>Curiosity</b>	<i>The strong desire to know and learn new things.</i>
	<b>Creativity</b>	<i>The ability to generate original ideas, to create and invent.</i>
	<b>Belief</b>	<i>The propensity to act on conviction rather than trying to please others.</i>
<b>Execution</b> <i>The application of innovative business ideas</i>	<b>Opportunism</b>	<i>The tendency to spot new business opportunities.</i>
	<b>Proactivity</b>	<i>The energy and willingness to get stuff done straight away.</i>
	<b>Resilience</b>	<i>The capacity to recover quickly from difficulties, and demonstrate determination and perseverance.</i>
<b>Leadership</b> <i>The ability to lead innovative people and teams</i>	<b>Vision</b>	<i>The tendency to have a meaningful mission in life and to see the bigger picture.</i>
	<b>Authority</b>	<i>The tendency to take charge of situations and command others.</i>
	<b>Stability</b>	<i>The ability to remain calm and optimistic under pressure.</i>
<b>Behavioural Derailment</b> <i>The tendency to display dysfunctional behaviours that hinder innovation.</i>	<b>Dominance</b>	<i>The tendency to be overbearing and driven by power.</i>
	<b>Hubris</b>	<i>The tendency to act with excessive pride and self-confidence.</i>
	<b>Mercurial</b>	<i>The tendency to be impulsive, unpredictable, and eccentric</i>

Figure 11. META trait descriptions and work domains as seen in Garforth (2015).

The META tool would be useful to this study in the instance that findings in the Development Phase pointed to the founder's research mindset as central and the framework was centred around them as an individual. This tool could have been used to set a baseline profile to better understand how these tendencies and abilities may inform a *research mindset* among EDUCATE founders interviewed in a subsequent Phase to go deeper into understanding the key individual. (See Figure 11 for a description of traits and work domain categorisations.) However, if Development Phase findings suggested that the

framework should be more holistic in nature, encompassing the edtech enterprise instead of the individual, then this individual difference approach would not be a helpful construct, and macro frameworks would need to be explored.

Literature review on entrepreneurial mindset proved only tangentially relevant to the goals of the Development Phase, once again confirming the disagreement of academics (this time in business and management) on the conceptualisation of the term, and was generally unhelpful in the development of the construct in question, whose goal it is to develop a helpful framework that describes what the evidence-informed edtech enterprises have in common – and their *research mindset* – as opposed to the traits and characteristics that make them enterprising.

### **3.3.6 Mindset in Educational Entrepreneurship**

Smith and Petersen (as cited in Legrand et al., forthcoming) proposed four attributes that frequently characterise the mindset of education entrepreneurs. These are reviewed in Section 7.2 so as to keep the information grounded in programme learnings (Glaser & Strauss, 1967).

### **3.3.7 Research Mindset**

Abdul-Jabbar and Kurshan's (2015) mention of edtech enterprises having a *pedagogical mindset* is much closer to the idea of the research mindset in question as it encapsulates the conception of evidence-informed product development – and the ideas of engaging with the primary stakeholders of edtech, whom they define as educational practitioners and researchers. This is similar to the hypothesis and basis of the golden triangle theory (see Section 2.2.5) introduced by Luckin as the hypothesis driving the design of the EDUCATE programme (Cukurova, Luckin, & Clark-Wilson, 2018). Though Luckin and her team referred to this idea as a research mindset, as opposed to the pedagogical mindset proposed by Abdul-Jabbar and Kurshan (2015), they introduced a similar spirit of developing research know-how in enterprises and asking them to co-create with users and researchers to build products that are evidence-informed and robust so as to elevate the ecosystem.

EDUCATE research team members are currently working on adapting the Educators' Attitudes toward Educational Research Scale (EATER), a validated tool originally developed by Ozturk (2011) that measures teachers' attitudes towards education research. However, this adaptation to assess edtech

entrepreneurs' attitudes towards education research would not be validated during the time of this study; therefore, the results of testing EDUCATE participants could not form the basis of my argument.

### **3.3.8 Inadequacy of Mindset for This Study**

From the literature review, it was clear that mindset is not an adequate construct as it looks at the attitudes of individuals and not at groups of individuals or the collective. In an enterprise, the capacities of the whole may need to be considered as a collective worldview as opposed to a focus on the individual. The EDUCATE programme was unique in its development of a research mindset in companies. It also had 252 spots, encompassing one-quarter of the United Kingdom's educational technology businesses. This unique project allowed me to take a grounded approach (Glaser & Strauss, 1967) to EDUCATE data to develop guidelines and offer research in the area.

### **3.3.9 Collective Mindsets**

If, as the literature seems to suggest, knowledge is distributed across the enterprise, and mindset is too singular a construct and would be of limited use to underpin the emerging framework. Though references to collective or organisational-level mindsets are starting to be made in empirical literature, these are not yet extensive and well developed (e.g., Dweck, Walton, & Cohen, 2014; Hanson, Bangert, & Ruff, 2016). On the other hand, literature in the area of distributed cognition is extensive, though only coming under the current name in the 1980s, when Vygotsky's (1978) *Mind in Society* was published in English. Minsky published his *Society of Mind* in 1985, and the cognition model of parallel distributed processing re-emerged at a similar time (Rumelhart, Hinton, & McClelland, 1986). Hutchins (1995) described collective mindsets in a study of naval navigators as a cognitive unit in his cornerstone book *Cognition in the Wild*.

Collective mindsets in this sense are described in such works as Hutchins' (1995) *Cognition in the Wild*, which analyses a team of naval navigators as the cognitive unit or as a computational system, or Senge's (2007) *Knowledge Entrepreneurship in Universities*. There are also parallels to the emerging field of 'collective intelligence' (e.g., Zara, 2004) and exploiting the 'wisdom of the crowds' (Surowiecki, 2005) of stakeholders. Zara (2004) noted that since collective reflection is more explicit, discursive and conversational, it is especially useful when it comes to developing information and communication technology.



Hutchins (1989) explained distributed cognition, a theory that aims to address such a situation, in contrast to mindset, as working beyond the physical boundaries of a single human body to embrace a ‘broader class of cognitive events’ that extend within and across the context within which a person is acting. Figure 12 shows the contrasts between constructs of a traditional cognitive science perspective where the unit of analysis is the individual’s mind, or distributed cognition, wherein knowledge is distributed in the mind of individuals, or artefacts and processes.

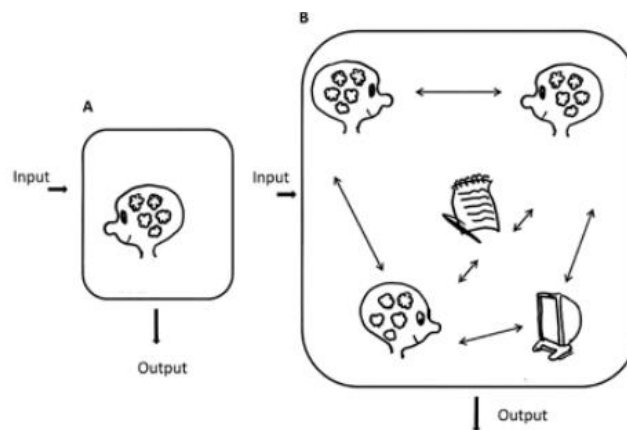


Figure 12. Constructs of mindset and distributed cognition as seen in Andreasson, Lindblom, and Thorvald (2017).

In this model, Hutchins (1995) presented the fact that in the workplace, it is not just the individual mindset but also artefacts and processes that interplay. This theory supports the inadequacy of individual mindset theory in the context of an enterprise.

The in-depth exploration of mindset within various bodies of literature revealed the inadequacy of the construct for the purpose of defining the research mindedness of an enterprise as a whole – and explored the obvious fact that an enterprise does not have a mind and is made up of individuals and artefacts. Knowledge, it is hypothesised, is distributed in companies so as not to increase cognitive load (Sweller, Ayres, & Kalyuga, 2011). They have a vision, mission and business plan and undergo activities; however, how they come to this, and the understanding and mindsets of individuals, is not identical. In fact, some knowledge is housed in artefacts.

The goal of this study was to be of use to the entrepreneurial community; therefore, what was useful for this construct was its practical application in view

of cognitive load theory (Lindblom & Thorvald, 2014; Paas & Van Merriënboer, 1994; Sweller, 1994; Sweller et al., 2011; Sweller, Van Merriënboer, & Paas, 1998), which is deemed to be a major factor in determining a successful learning intervention. Indeed, if knowledge is distributed, the EDUCATE programme can develop capacities in a more strategic way for various parties in the enterprise using the principles of cognitive load theory to optimise learning in the programme.

### **3.3.10 Conclusion on Literature**

In summary, the overarching goal of this literature review was to inform the design of methods that would allow for the optimisation of learning among participants in the EDUCATE programme. The three questions that needed to be answered to inform Phase 1 were as follows:

1. What grounded approach is appropriate? (See Section 3.3.1.)
2. How do we design with experts? (See Sections 3.3.2 and 3.3.3.)
3. What are the current conceptualisations of mindset? (See Sections 3.3.4–3.3.9.)

The EDUCATE programme is situated in a unique network of practice in the world, and this literature review started with a justification of why and what method to use to ground research (Glaser & Strauss, 1967) in knowledge generated by the EDUCATE research team, a 14-person community with knowledge that should not go untapped for the development of this construct. They are perhaps the most valuable asset of the EDUCATE programme in that they hold the knowledge at the heart of the research accelerator – how to build research-minded enterprises.

The goal of the Development Phase was to develop the construct of a research mindset in educational technology entrepreneurs – it was important to start with the construct of mindset to determine whether this construct was appropriate to explore to meet this Phase’s goals. This section looked at both individual and collective mindset constructs to assess whether either of these frameworks would be useful in developing the new construct necessitated by the hypothesis that the edtech entrepreneur’s mindset is important in the development of evidence-informed edtech products and services.

The *fuzziness* of the concept of mindset resulted in a freedom of the use of the term *mindset* for the purposes of this study to be similarly variable – and

allowed for the grounding of data in the insights and instincts derived from asking experts to co-design a meaning for a *research mindset* based on their ideas of the worldviews and perspectives of the most successful edtech enterprises in the EDUCATE programme. Questions in the initial interviews were centred around the individual participant's mindset and on the enterprise level and included a distributed cognition question to gauge whether knowledge and desire were indeed in the minds of key individuals or distributed in different ways amongst individuals, artefacts and processes in the enterprise.

The singular nature of mindset makes way for the exploration of constructs that encompass collective mindsets addressing the understanding of the mindset of the entire enterprise – allowing for the exploration of the collective or the individual mindset in the development of the construct of a research-minded education technology entrepreneur. In this regard, the theory of distributed cognition (Hutchins, 1995) was explored. A review of cognitive load theory was included to address the practical elements of what entrepreneurs need to know to run successful evidence-informed enterprises. Cycle 1 also included a question exploring the extent to which knowledge is distributed among stakeholders and artefacts (Hutchins, 1995). If research mindset is indeed found to be distributed, this will be further explored throughout the study. However, if research mindset was found to be the responsibility of the individual – perhaps the founder of the organisation – then this would be re-evaluated, taking an individual differences approach. The next Cycle's literature review further explored mindset measurements such as META for entrepreneurial mindset and the adaptation of EATR for research mindedness on an individual level. The chosen co-design methodology was observed in this section and grounded in this unique network of practice. The concept of a research mindset in this section is explored with the participatory methods presented, namely Sanders' recommendations based on her four levels of creativity framework.

### **3.4 Summary of Methods**

This chapter presented a DBR methodology that was followed in this study, and the literature review informed the methods employed to reach this study's goals. Table 5 offers a summary of methods, which will be expanded upon in the chapters that follow.

Table 5. Summary of Methods

Phase	Cycle no.	Method	Participants	Purpose	Result
Development	1: <i>Uncovering Facets of the Construct</i>	Semi-structured interviews	EDUCATE Research Mentors who worked with enterprises that were awarded EdWard Level 2s, N=5	Co-designing the first iteration of the construct in question with EDUCATE mentors who worked with most research-minded enterprises that participated in the EDUCATE programme	7 Sub-Constructs emerged as important themes. Survey created with all statements organised by Sub-Construct for further validation
Development	2: <i>Validation Workshop 1 – Expert Research Mentors</i>	Activity 1: Validation Survey	Same participants as Cycle 1	Validation of survey of new construct definition with 7 Sub-Constructs and accompanying statements resulting from Cycle 1	Items reviewed based on feedback. 1 Sub-Construct and 14 statements removed. Survey updated and prepared for Validation Workshops in Cycles 3 and 4
Development	2: <i>Validation Workshop 1 – Expert Research Mentors</i>	Activity 2: Debate Game	Same participants as Cycle 1	Participants tasked with ranking EdWard level 2 companies from most to least research minded. Activity designed to draw out further discussion, justification, discrepancies and contradiction in the construct definition survey	Items coded in NVivo Software – to uncover contradictions to what was said in survey. No contradictions were found. Insights shared in Cycle 2 Discussions
Evaluation	3: <i>Evaluation Workshop 2 – Research Mentors</i>	Activity 1: Validation Survey	The rest of the EDUCATE Research Mentor team (N = 6)	Validation of survey of new construct definition with six Sub-Constructs and accompanying statements validated once in Cycle 2	Items reviewed based on feedback. Item stabilised, all Sub-Constructs were approved and no statements removed. Survey updated and prepared to be further evaluate the construct.
Evaluation	3: <i>Evaluation Workshop 2 – Research Mentors</i>	Activity 2: Open-ended question	The rest of the EDUCATE Research Mentor team (N = 6)	Participants asked to suggest an EDUCATE enterprise they feel would score highest on the survey, give them a	Similar to Activity 2 in Cycle 2, this activity was designed to draw out further discussion,

				score from 0–5 on the scale and justify why.	elaboration, missing items or contradictions in the survey. No contradictions were found, and examples put forth contributed to Cycle 2 Discussions.
Evaluation	4: <i>Evaluation Workshop 3 – Business Mentors</i>	Activity 1: Validation Survey	Three members of the EDUCATE business mentorship team (N = 3)	Participants administered identical Activity 1 survey to Cycle 3	Items reviewed together with Cycle 3 Activity 1. Identical results.
Evaluation	4: <i>Evaluation Workshop 3 – Business Mentors</i>	Activity 2: Open-ended question	Three members of the EDUCATE business mentorship team (N = 3)	Participants administered identical activity 2 as Cycle 3	See Cycle 3 Activity 2 – identical results.
Validation	5: <i>Model EdTech SME Validation</i>	Activity 1: Validation Survey	EDUCATE – model enterprises (EdWard Level 2 recipients, N=9)	Validate the survey with model companies who inspired it. Ensure ELLTE is an accurate abstraction of their reality	Survey validated, much more stable than Evaluation Phase – minor adjustment to survey overall quite stable
Validation	5: <i>Model EdTech SME Validation</i>	Activity 2: Open-ended question	EDUCATE model enterprises (EdWard Level 2 recipients, N=9)	Gain further insights into the reality of edtech enterprises. Assess whether ELTE Action Model is a valid abstraction of edtechs reality	Insights gained from commentary towards the development of ELTE Hierarchy Model. Development of Hallmark Questions. Validation of Action Model. Survey highly stable.

Validation	6: <i>EdTech Ecosystem Validation</i>	Activity 1: Validation Survey	EETN – sample of global edtech ecosystem (N=40)	Validate survey with the greater edtech ecosystem	Survey stabilized with no changes.
Validation	6: <i>EdTech Ecosystem Validation</i>	Activity 2: Presentati on and Open- ended Q&A	EETN – sample of global edtech ecosystem (N=40)	Brief presentation of Sub-Constructs and Hallmark Questions and time for Q&A by participants	Question and answer showed overall interest and positive sentiment towards new construct.

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Table 5 aims to simplify the methods employed in each round and the reasons these methods were chosen. An elaboration of the chosen methods can be found in subsequent chapters; however, this table was designed to serve as an introduction to the methods employed for purposes of clarity.

## Chapter 4: Part 1 – Development Phase (Design-Based Research Cycles 1 and 2)

### 4.1 Introduction

The current working definition of the construct of a *research mindset in educational technology entrepreneurs* is the propensity of entrepreneurs to envision and support research in educational technology companies. Cycle 1 of the research study was concerned with developing the construct of a research mindset in educational technology entrepreneurs.

This chapter has two Cycles; both were concerned with the development of this new construct to better understand how to build enterprises that produce educational technology products and services that are built with sound evidence. In the first Cycle of research, semi-structured interviews with EDUCATE researchers who mentored the most research-minded participants were used to develop the construct, which then went through another round of development (Cycle 2) with the same participants.

Cycle 1 was the heart of the study; its goal was to develop a construct that can serve as a conceptual framework for understanding the conditions that exist in edtech SMEs so as to build research-informed edtech products. The exploration phase reported in Chapter 2 resulted in the standing theory that it is the research-minded entrepreneur (where entrepreneur = leadership) who drives evidence-led enterprises. This Cycle's goal is to further explore the concept of the *research-minded educational technology entrepreneur*, where an *entrepreneur* is defined as the founder of an edtech enterprise, to develop a new construct for assessing and understanding evidence-led edtech companies, with the goal of getting closer to developing a new construct to inform the effectiveness of the EdWard Level 2 in the EDUCATE programme and to contribute to the edtech ecosystem.

My revised hypothesis was that the entrepreneur, defined as the leadership of the enterprise, is fundamental to whether the enterprise is research minded, and understanding the mindset of successful entrepreneurs will help to define a construct to build such a mindset in other entrepreneurs.

### 4.2 Methods

The Development Phase has two Cycles. These Cycles are visualised in the context of the greater study in Figure 13. In this Phase, findings are grounded

in the knowledge of the community of practice with the greatest expertise in the EDUCATE programme, that is the EDUCATE Research Mentor team ( $N = 13$ ). I will briefly discuss each round's results to justify goal revision and the methodology for the next round of research. The discussion of overall results from the Development Phase are presented in Section 4.3.

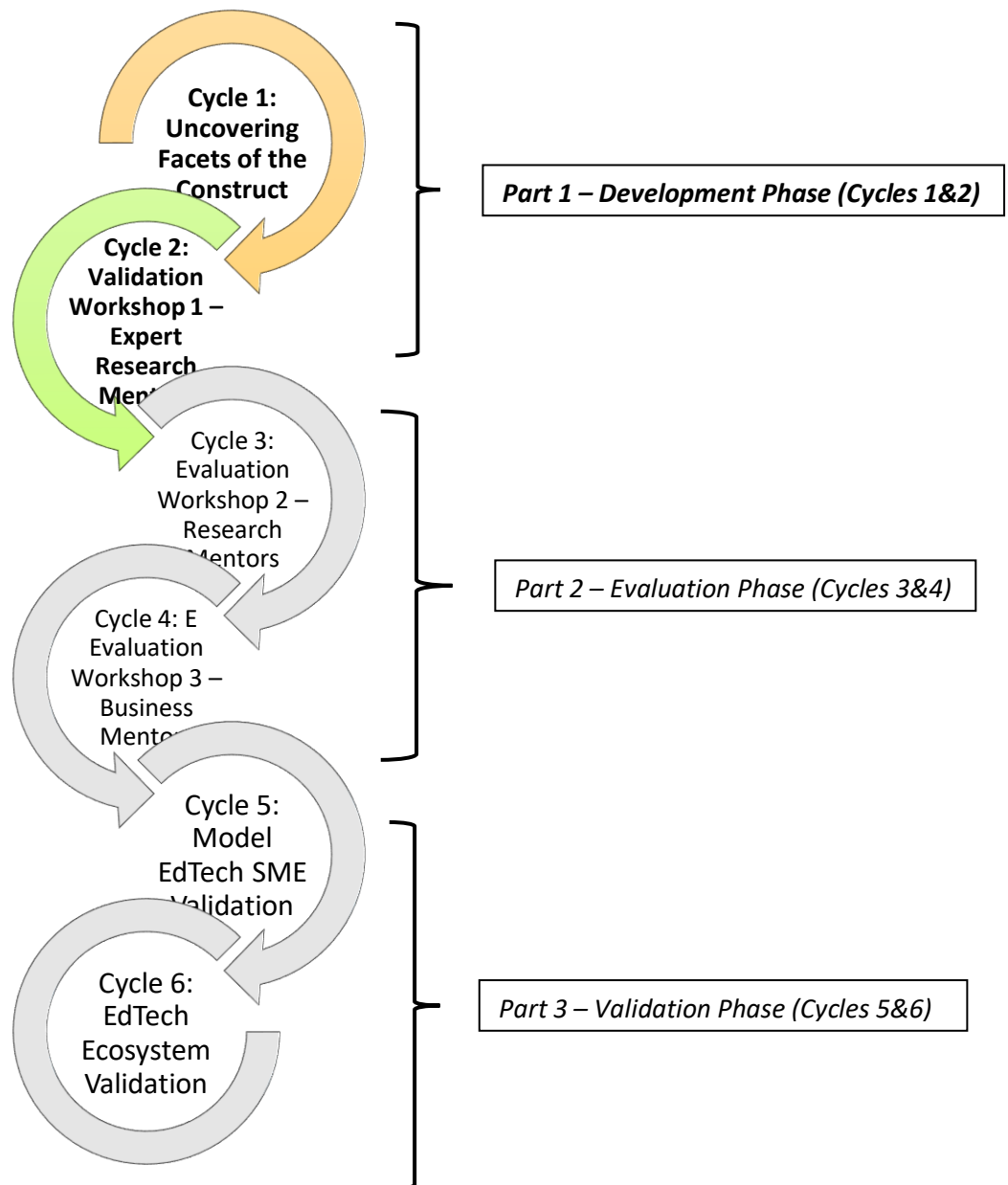


Figure 13. The two Cycles of Phase 1.



### **4.2.1 Relevant Theory**

#### *Participatory Design Methods*

Central to the development of this Cycle is the employment of participatory design principles in order to co-design a construct with expert Research Mentors in the EDUCATE programme. The methodology chosen was collaborative in nature to give respondents the opportunity to contribute their expertise and experience resulting from time spent in this unique programme.

Through this process, mentors became part of the design team to participate in the co-creation of the RMETE construct that they were working to develop without yet fully defining as ‘expert of their experiences’ (Sleeswijk Visser et al., 2005). However, according to Sanders and Stappers (2008), ‘in order for them to take on this role, they must be given appropriate tools for expressing themselves’ (p. 12).

As detailed in Sections 3.3.2 and 3.3.3, Boundary Objects were designed to facilitate the process of co-designing the construct in question. In Cycles 1 and 2, where participants had the greatest expertise, methods were designed along Levels 3 and 4 of Table 3, ‘The Four Levels of Creativity’. In Cycles 3 and 4, where participants’ level of expertise moved lower, methods were designed along Levels 2 and 3 for validation. Participants were always given the chance to operate at Level 4 with open-ended questions, however, the design of the workshops did not depend on this level of expertise, and indeed feedback was often given appropriate to the aforementioned levels of participants. Elaboration on the methods chosen and justification of why they were appropriate to the creativity level of the audience can be found in the sections that follow.

Sanders and Stappers (2008) explained that it is the role of the researcher to appropriately engage subjects with whom co-design is occurring, depending on the subjects’ aforementioned levels of self-expression, by

- leading people who are on the ‘doing’ level of creativity;
- guiding those who are at the ‘adapting’ level;
- providing scaffolds that support and serve people’s need for creative expression at the ‘making’ level; and
- offering a clean slate for those at the ‘creating’ level. (p. 14)

Table 5 (See Section 3.4) summarises the goals of Cycles 1–6, each with methods grounded in the knowledge and experience that build on the last.

Chapter 3 explains that a design research methodology (Bakker, 2018) is

employed in each Cycle to meet the Cycles' overall goal of developing a new construct defining a research-minded enterprise.

### *Distributed Cognition*

Literature review section 3.3.9 pointed to Hutchins' distributed cognition theory that presented the idea that knowledge and ideas are distributed across individuals, objects and tools (Hutchins, 1995). In his cornerstone study *Cognition in the Wild*, Hutchins made a clear distinction between the cognitive properties of an individual and those of a system – and it was my belief after seeing this study and Chapter 3's methodology literature review that that this Phase's methods must consider the fact that perhaps an enterprise should be considered a system that has a research mindset as a result of various factors, instead of focusing on the perspective of the entrepreneur alone. Therefore, distributed cognition theory was taken into account in the design of methods for Cycles 1 and 2.

### **4.2.2 Development Phase Participants (DBR Cycles 1 and 2)**

#### *Cycles 1 and 2 Participants*

The first two Cycles of this study had a sample of Participants that included the EDUCATE Research Mentor team members who mentored all companies that received an EdWard Level 2 by September 2019. As a result of this achievement, they were deemed the most expert Research Mentors. On average, they had spent more time on the programme than other EDUCATE Research Mentors.

Research Mentors participating in this study were only chosen if the companies they guided achieved an EdWard Level 2, were building learning technologies (as opposed to products for the education industry in general) and were from cohort 2 or later. Cohort 1 was a unique exploratory cohort comprising only seven companies for whom the experience was drastically different from that of cohort 2 and later – the programme was in its infancy, and the Research Training Programme looked very different. For example, Research Mentors were not assigned in the same way as they were in subsequent cohorts.

*Please note: For purposes of clarity in below discussions, Participants with a capital 'P' will refer to the EDUCATE Research and Business Mentors who took part in Cycle 2 research. When 'participants' is written with a small 'p', it refers to*

representatives of edtech enterprises who took part in the EDUCATE programme as part of the programme.

#### **4.2.3 Cycle 1: Procedure**

I interviewed the six expert mentors one per company to co-design the construct in question – a Research-Minded Educational Technology Enterprise (RMETE). Interviews were approximately 30 minutes in length and comprised four parts, each designed to draw out ideas around what makes a good research mindset using the example of model EDUCATE companies that had EdWard Level 2s. All interviews were recorded.<sup>2</sup> Interview questions are in Figure 14.

**Part 1: Research Mindset Definition**

*You mentored Company X*

*If you were to rate the Company's research mindset from 0 to 5, how would you rate them? (if they ask about criteria, ask them to say what they think 0 should represent and 5 might represent)*

*Why? Justify that rating. Talk me through your thinking.*

**Part 2: Drilling Down Further**

*Who at Company X did you engage with and to what extent? (Tell me more, what makes you think that?)*

*Does your research mindset rating apply to each and all of the participants you mentioned?*

*According to the project records, the Company had X hours, does this surprise you?*

**Part 3: Here is a copy of the research proposal.**

*Remind yourself of the proposal. Did it surprise you?*

*Rate it out of 5. Talk through your justification.*

*Did you see what they did next? That is, was there any evidence of them applying the research?*

*What form did it take?*

**Part 4: Distributed Cognition**

*Dcog Question: Who all is involved in the company on the research side? Do you know about the processes, people and artefacts that they needed to make their EdWard Level 2 happen?*

Figure 14. Cycle 1 interview questions.

#### *Cycle 1: The Role of Participatory Design*

In the previous section on participatory design (Section 3.3.3), I draw on the co-design work of Sanders and Stappers (2008) around the 'say, do, make' strategy, where participants who were asked to *make* offer the greatest depth of feedback, as they must justify what they do (the scores they give) and what they say (the justifications they give) (Sanders & Stappers, 2008, 2014). This round was conducted during the EDUCATE programme, where mentors had not yet had a moment to reflect on and publish experiences. I therefore designed

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<sup>2</sup> All interviews done in this study were audio recorded.

methods along Level 3, 'Making' – 'providing scaffolds that support and serve people's need for creative expression at the "Making" level' and fewer open-ended questions around Level 4, 'Creating' – 'offering a clean slate for those at the "creating" level' (Sanders & Stappers, 2008, p. 14).

Below are questions following this guidance. They are Level 3 and Level 4 because though Participants in this round are experts in the field, interviews took place during the span of the EDUCATE programme wherein none of the mentors had time to reflect and publish work. This was their first reflection on the subject; I therefore decided to employ items from Level 3 in order to make the interviews doable given this fact. These questions are designed to scaffold the new construct with the most expert mentors (those who had guided the EdWard Level 2 companies), as is the goal of these Cycles.

#### *Cycle 1: The Role of Distributed Cognition*

The distributed cognition (Hutchins, 1995) question posted in Part 4 was inspired by the possibility of a collective mindset at play in the construct in question. These were designed to see if Hutchins' frame applies to enterprises and whether it is not just the entrepreneur (i.e. the founder/CEO) whose mindset created a research-minded enterprise. This question allows for the gauging of the important players, processes and artefacts in developing this construct. Part 4 starts to gauge if the primary influence is in fact the main entrepreneur of the enterprise or whether vision and knowledge are distributed across the company, requiring various conditions to be in place on top of a research-minded entrepreneur for the enterprise to be informed by evidence. In the scenario where the research mindset seems to be distributed across the enterprise, the construct in question would need to be re-framed in Cycle 2 from a research mindset in an entrepreneur to an enterprise-level research mindset.

#### *The Role of Boundary Objects in the Participatory Design Process*

This was a highly creative Phase, and boundary objects were therefore used to draw out thinking. Boundary objects played an integral role in the Participant discussions as they were the agent that clarified my line of questioning to the expert group. There are four boundary objects employed in Phase 1, which are now explained.

The research proposal and research write-up were used as boundary objects (Wenger, 1998) to draw out commentary that would shape the definition

of the construct: The goal of the exercise was to extract commentary that would allow for the development of the construct in question and its components. The research mindset score of the company and research mindset score of Participants were used as tools to draw out such commentary, rather than using the number scores to tally as performance proxies. These numbers will not be disclosed, as they are irrelevant, given that each mentor was creating his or her own scale and justification and the goal of this exercise was to use these boundary objects to draw out arguments and justifications rather than to give a number score for performance.

### *Boundary Object 1*

In preparation for the interviews, information about all EdWard Level 2 companies was extracted from the EDUCATE database. All EDUCATE participant activity was divided between research and business interventions, and their participant hours were presented in Appendix E. Boundary Object 1 was employed as a methodological tool to probe Participants to elicit their reaction. Data in the table, especially research hours, were used in interviews as a proxy for engagement and as a technique for drawing out mentor opinions on research mindedness. It is important to note that data in the table were not used to rank companies in any way but were merely used as talking points to draw out commentary that would later be used for developing a construct definition of research-minded entrepreneurs.

### *Boundary Objects 2 and 3*

The second and third boundary objects were the research proposals that companies were asked to write to earn an EdWard Level 1 as well as the research write-ups of the implementation of their research, if the write-ups were available. Research write-ups were not a requirement of EdWard Level 2s, rather simply implementation of the research was required; therefore, many companies did not have write-ups available. Where they were not available, the lack of a written document reporting research findings was used as a talking point for commentary on the necessity of writing about and disseminating research in the context of enterprises. Please note that these two boundary objects are not included as appendices owing to difficulty with anonymisation.

### *Boundary Object 4*

The research mindset ratings, ranging from 0 to 5, for both the company and the individual participants were used as another important tool to elicit a definition of the construct of a research-minded entrepreneur in an edtech enterprise. Again, these ratings were not used for scoring the companies or individuals; rather, they were tools for probing justifications of what it was to have a research mindset in this context and to be used toward developing the construct definitions that were the goal of this Cycle. The justifications elicited with the scores as boundary objects were included in the survey for validation in following rounds.

In addition to grading participant and company research mindsets, researchers were asked to give general thoughts as to what a score of 0 and 5 for research mindset would mean along with any definitions in between. An example of a response using this proxy is as follows:

For me, a company that is a 5 has a strong vision at the senior leadership level, which comes from the CEO, around the role that research plays as an integral element of all they do. So you know, research isn't just academic research, it really is how do they draw on the evidence of the data that they are generally sitting on or they need to go and collect to help them to do what they do better. And if they are a 5, that is embedded in the culture of the company which means that it comes through most of the – what everybody is doing, right from the marketing and the product development to the tech people, they see how what they do fits into the scheme of things in terms of the quality of that evidence, the accuracy of it, where it is held, who has access to it. . . . And that might be back-end data, and that might be particular efforts they do to gather more research, but they are thinking it through. So, when they want a survey customer, they don't do a survey over there necessarily as a separate entity, they build it into the tech somehow, so it adds and enriches the data they are getting on a day-to-day basis.

These four boundary objects were employed as Sanders et al. (2010) suggested to provide scaffolds when co-designing with Level 3 and offer a blank slate when co-designing with Level 4 participants. Please see Section 3.3.3 for elaboration on these levels and why they were chosen for Participants.

### *Data Analysis*

After every interview, the Xmind mind mapping tool was used to summarise feedback and comments, resulting in a mind map for every company that included all of the mentor's related statements. These were subsequently then organised into categories. See Figure 15 for the mind mapping format.

Please note that mind maps are not shown in this study due to difficulties with anonymisation.

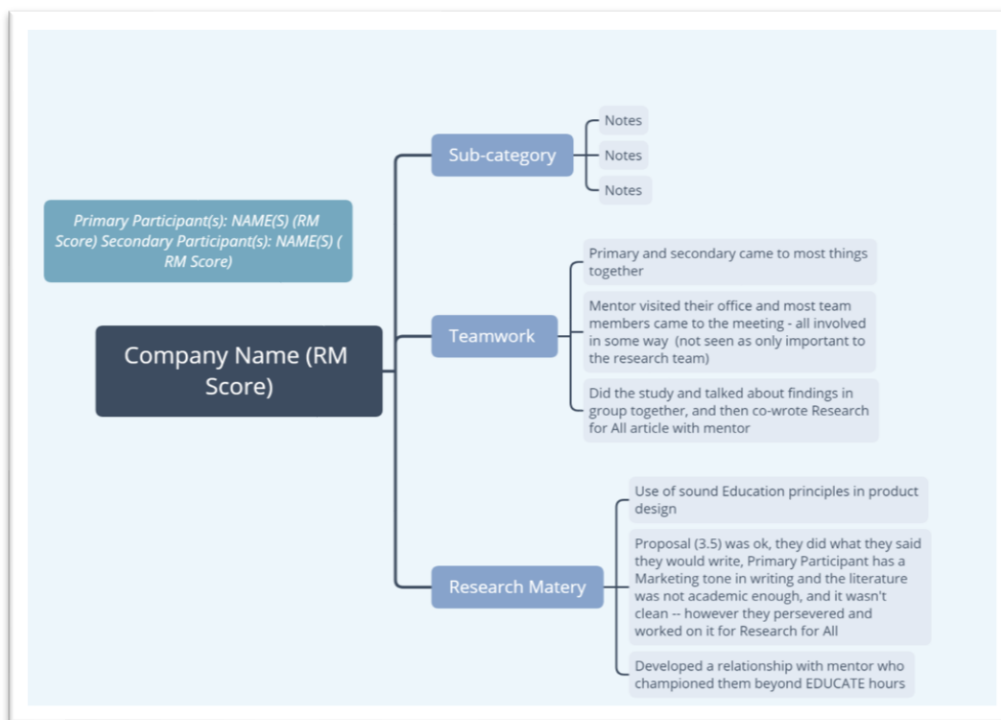


Figure 15. Sample mind map.

I listened to every interview twice to ensure that no statements were missing from the mind maps. All statements in mind maps were then consolidated into a Microsoft Word document under respective emerging sub-categories. Once consolidated, there were seven emerging sub-categories, which were the Sub-Constructs of the main construct in question. Emerging Sub-Constructs included (1) *Sense of Purpose*, (2) *Research Mastery*, (3) *Teamwork*, (4) *CEO Vision*, (5) *Learning Culture*, (6) *Action Orientation*, and (7) *Engagement*. All statements made by Participants were then compiled into a Word document, turned into phrases and put under their Sub-Construct category. Every statement was included in the Word document no matter its frequency (whether said once or unanimously). For example, the following statement can be found under Research Mastery: *A Research-Minded EdTech Enterprise must have an understanding of the affordances of research methods*. This Word document was then turned into a survey (see Appendix F), described in a subsequent section, to allow for validation by the same participants in Phase 2.

This study follows design research methodology; therefore, a limited amount of data analysis and results must be included in the methods section to justify methods utilised in the next Cycle. Full data analysis and discussions can be found in Section 4.3.

### *Cycle 1: Results*

From the consolidated mind map, research mentor feedback regarding the description of the construct of a research mindset can be categorised into seven Sub-Constructs. These seven Sub-Constructs included (1) Sense of Purpose, (2) Research Mastery, (3) Teamwork, (4) CEO Vision, (5) Learning Culture, (6) Action Orientation, and (7) Engagement. Any and all comments and definitions emerging were then listed under each core element as its descriptors in the format of a survey, whether mentioned by one or all Participants (see Appendix F). There was support for the distributed cognition (Hutchins, 1995) hypothesis as data from Cycle 1 interviews suggested that a research mindset in the entrepreneur heading the enterprise is one of seven seemingly vital sub-categories of research-minded educational technology enterprises. What Participants suggested in this round was that although CEO Vision was important, it needed to be complemented with other Sub-Constructs to operate well. (See Section 4.3 for extensive discussions on each Sub-Construct and anonymised examples of cases from companies participating in EDUCATE.) Data from Cycle 1 therefore yielded a framework beyond the research mindset of the entrepreneur; rather, it offered a framework that exists in evidence-informed enterprises on the whole – one Sub-Construct of which was indeed the CEO Vision, complemented by six other seemingly important factors that need to be in place to establish a research mindset on the enterprise level. EDUCATE participants were not always the founders, and knowledge was distributed (Hutchins, 1995) in the company; however, data suggested that the CEO Vision is an important Sub-Construct (see Section 4.3, suggesting it is the foundation of Sub-Constructs) though one of various factors that resulted in successfully evidence-minded enterprises that yielded evidence-informed educational technology products and services. These interviews showed that, in this context, distributed cognition theory (Hutchins, 1995) fits better than mindset conceptualisations at the individual level (Dweck, 2006, 2013) and that the design of the EDUCATE programme allowed for a glimpse into the design and



implementation of the research by the executing team, not just the vision of the entrepreneur. One of the results of this Cycle of research was that the construct name was altered to reflect more accurately what was being defined from a research mindset of the edtech entrepreneur to a Research-Minded Educational Technology Enterprise (RMETE) – where Minded and Mindset are used interchangeably.

No further conclusions were drawn at this stage, and the Word document was turned into a survey to validate findings in subsequent Cycles. In the next Cycle, the same sample of Research Mentors was invited to validate these statements and further develop the construct.

### *Cycle 1: Goal Amendments in Preparation for Cycle 2*

The goal of this Cycle of research was to refine the construct of a research mindset in the context of an educational technology entrepreneur. After the first Cycle, it became clear that Hutchins' (1995) distributed cognition proposition made the most sense as a collective mindset framework to help to develop the construct in question, as edtech enterprises were more than their individual founders, and the work of various members, policies and practices together established the enterprise's interest in research as a whole.

Cycle 1 made clear that the construct must be on the level of the enterprise and it was therefore renamed as a Research-Minded Educational Technology Enterprise (RMETE) and the next Cycle should continue to pursue the development of this construct that is the goal of this Cycle, this time moving forward with the mindset on the enterprise level.

Thus, the construct in question was not that of a research-minded entrepreneur but rather of a research-minded enterprise as a whole, as the data suggest that simply looking at the CEO will not yield a comprehensive enough construct to build this capacity in other enterprises as a result of this body of work – which, as stated in the introduction (Chapter 1), is the ultimate goal of this study and motivation for my doctoral studies. The construct could thus be redefined from a research mindset in an educational technology entrepreneur to a RMETE, where *research minded* and *research mindset* are used interchangeably.

This Cycle of research was pivotal to the framing of the construct in question out of the context of the research mindset of the entrepreneur into the mindset of the enterprise as in the distributed cognition model (Hutchins, 1995). I realised that the hypothesis of the importance of a CEO with a research mindset

at the end of the exploratory Phase prior to Cycle 1, i.e. the importance of a research mindset of the entrepreneur leading the organisation, was one part of various components (seven Sub-Constructs) presented by the expert mentors participating in Cycle 1 as necessary to be a model company in EDUCATE – i.e. a Research-Minded Educational Technology Enterprise. This Sub-Construct would be called CEO Vision moving forward, and six other Sub-Constructs (Sense of Purpose, Research Mastery, Teamwork, CEO Vision, Learning Culture, Action Orientation, Engagement) would join the list to form the full picture of various items Participants believed interplay in research-minded enterprises. The following Cycle 2 will be concerned with validation of the proposed seven-Sub-Construct framework that is the result of Cycle 1.

#### **4.2.4 Cycle 2: Procedure**

The goal of this Cycle of research was to validate what was said in the previous Cycle with the same Participants (see Section 4.3.3) – EDUCATE’s Research Mentors. The Validation Workshop had two activities – the first activity was the validation survey, which was designed to be completed silently by Workshop 1 Participants. The second activity was a game designed for Workshop 1 Participants to encourage further discussion and debate in order to reveal differences of opinion regarding justification of the new construct to uncover whether mentors had any contradictions. This section outlines the procedure, analysis and results by activity and concludes with a discussion of goal amendments in the spirit of design research.

The Activity 1 survey (see Appendix F) was validated in this Cycle and concepts were debated to draw out further insights to contribute to the development of the construct. See Figures 16 and 17 for full Workshop instructions. These were read aloud to all Workshop Participants at the start of the Workshop and can be found in the full Workshop handout as seen in Appendix F. Each activity took about 45 minutes. Activity 2 started after Activity 1 was completed by all.

## Research Mindset Mentor Interview Validation Exercise

Dear Mentors,

Thank you again for your willingness to be interviewed regarding the research mindset of our Edward level 2 companies. Your contributions were invaluable to my dissertation. I am now analysing data and have come up with this list of seven constructs that have emerged that you say as a team are representative of a research mindset in an edtech enterprise (RMETE). This workshop is a chance to review, consult and debate these constructs with the view of validating my understanding of your contributions prior to visiting the companies in my next research cycle. Please feel free to have your laptop on hand or to refer to your notes if you think they will be helpful.

This dissertation is looking at edtech companies that are building learning technologies, as opposed to technologies for education technology industry in general. The goal of this cycle of research is to refine the definition of a research mindset in an edtech company. Learning technologies are those where the user is vulnerable and it is not as obvious to the user when the product is working – and thus takes the position that it is unethical not to have an evidence base in such companies. The goal of this work is to uncover the facets that make up a research mindset in the context of edtech enterprises so that we may make it possible for more companies to understand what this looks like ‘in the wild’.

Today’s goal is to validate statements with two activities (described below) to ensure that your thoughts are understood and to provide an opportunity to discuss and debate the differences in experience in order to further refine the facets of the construct of an RMETE.

### Workshop Agenda

1. 9:30–11:00: Activity 1 – Validation Survey
2. 11:15–12:30: Activity 2 – Group activity with discussion and debate

*Breakfast and snacks available throughout the morning.*

### Ethics Forms

Kindly ensure you’ve signed the ethics approval forms before we begin.

Figure 16. Cycle 2 workshop instructions – Activity 1.

**Activity 2**

This activity is an open discussion and debate. The goal is to rank the 12 Edward level 2 recipients in order from lowest to highest RMETE. Company magnets will be passed out to place on the scale on the wall of the workshop room, and a discussion and debate will ensue to come to an agreement together.

Prior to presenting your thoughts to workshop participants, please take a moment to rank your compan(y/ies) in the below box and make notes justifying why you feel they are at that point on the scale. Feel free to add to/amend your notes and positioning as other mentors share their thoughts.

Please mark your company's RMETE on the scale below.

**0 RMETE** ..... **5 RMETE**

Please justify your answer below:

Figure 17. Cycle 2 workshop instructions – Activity 2.

Activity 2 was a debate game wherein Participants were asked to rank the companies they mentored from most to least research minded. The goal of Activity 2 was to see if Participants supported or contradicted what they said in the survey. A secondary goal of the debate was to gain further insights into the definition of a research-minded enterprise which may be revealed as mentors justified why one company is more research minded than another.

*Cycle 2: Activity 1 Analysis*

All survey questions were collated into an Excel spreadsheet, and responses from the four Participants in Cycle 2 were inputted. Figure 18 is a sample of the procedure for consolidating items in the Activity 1 survey.

RMETE Construct 1: Sense of Purpose		Participant				Overall Recommendation	Notes	Supervisor Approval
No	Statement	1	2	3	4			
1	A research mindset starts with the intention to solve an educational need.	C*: replace 'solve' with ADDRESS	C*: add to end: 'need', AND/OR MAKE AN IMPACT ON AN EDUCATIONAL SYSTEM.	C*: change 'solve' to ADDRESS	T: I would star this but what about X?	Keep slight edit.*** <b>A research mindset in edtech starts with the intention to address an educational need and/or reform aspects of educational systems.</b>	<b>Discuss instances where ending is needed. Is a system change not still an educational need?</b>	Yes
2	RMETEs believe it is unethical not to have an evidence base.	T*	T*	C: not sure it is unethical. Importance of evidence ?	C: Depends on how you define unethical and evidence.	Keep. **	P3 – Different concept. P4 – I disagree that is is vaguely defined. Please confirm.	
3	RMETEs have a shared vision and clear Sense of Purpose.				T* T T T	Keep.*		

Figure 18. Except showing data analysis method.

The 'Overall Recommendations' column indicated my recommended amendments to items. There was an even number of respondents; therefore, in instances where there was a tie, two of the Participants (Participants 1 and 2) would be given a weightier vote as a result of their more extensive experience in the field than the other two Participants. Controversial cases were presented to Dr Alison Clark-Wilson, EDUCATE Research Lead, for a second opinion and marked in the column for 'Supervisor Approval'.

The star feature (A\* and C\*) was designed to give strength to the vote of a Participant to keep the statement – star ratings are meant to show confidence in moving forward with the statement as an integral part of the construct. Full discussions can be found in Section 4.3.

### *Cycle 2: Activity 1 Results*

Each of the seven Sub-Construct scores was tallied to gauge whether respondents believed the category was important to the overall RMETE construct. Tallies can be seen in Table 6.

Table 6. Workshop 1 Sub-Construct Scores

Sub-construct	Score	Comment	Decision
Sense of Purpose	4.6	Unanimous.	Keep
Research Mastery	4.3	Unanimous.	Keep
Learning Culture	4.1	Unanimous.	Keep
Engagement	4.3	It was clear that this Sub-Construct was only as a result of being situated in the EDUCATE programme. Engagement is not a part of being research minded, it does show priority of doing research which is reflected in other parts as well as Action Orientation. This is recommended to be removed.	Remove
Teamwork	3	This was thrown off balance because of one mentor (M4) saying 0 – without her it would be 4.X and marked true for most items in the category so it's worth keeping.	Keep
CEO Vision	4	Unanimous.	Keep
Action Orientation	3.8	The same mentor (M4) gave this a low score once again, however it is a passing number so it will go. Without this mentor it would have been a X.	Keep

### *Cycle 2: Activity 2 Analysis and Results*

Activity 2 audio recordings were given to an independent transcription company, and the transcript was then reviewed by the researcher and coded in NVivo. Coding was done per Sub-Construct (i.e. Sense of Purpose, Research Mastery, Teamwork, CEO Vision, Learning Culture, Action Orientation, and Engagement), and the goal was to see if the construct supported or contradicted the importance of the seven Sub-Constructs. This activity confirmed findings and goal amendments in Activity 1 as none of the responses were controversial or negated survey responses. Though they did not particularly add new insights,

feedbacks were then compiled into a Word document by Sub-Construct in order to be anonymised and inform Section 4.3.

The results of the challenge given to mentors to rank companies in order from least to most research minded in Activity 2 were not relevant as the validation exercise was purely used as a tool to extract insights and quotes. The company scores were not relevant and were simply boundary objects used as a technique to draw out further factors and to eliminate areas in which their perceptions conflicted. Coding resulted in no contradictions with the Sub-Constructs in question, and many insights into cases which will be reported in greater detail in Section 4.3.

Mentors noted in the process that due to the design of the EDUCATE programme, they had a limited view of a company – they did not see what is happening inside the company. The company would come to EDUCATE at UCL for lessons, and mentors didn't spend time in the company. In this Cycle, it became clear that findings from this Cycle would need to be validated by developers.

#### *Cycle 2: Goal Amendments in Preparation for the Evaluation Phase (DBR Cycles 3 and 4)*

Cycle 2 brought two major changes to the construct. Firstly, Engagement was taken out as the Sub-Construct emerged by virtue of being a part of the EDUCATE programme and was not in itself a stand-alone factor in a research-minded enterprise. Secondly, the construct changed from an entrepreneur-level research mindset to a Research-Minded Educational Technology Enterprise, and the information being distributed across the enterprise as proposed in the distributed cognition model (Hutchins, 1995) was confirmed, hence the construct name was changed to Research-Minded Educational Technology Enterprise (RMETE). These six Sub-Constructs and their facets (i.e. various statements within them that were validated in this Cycle) would therefore not be in the mind of the entrepreneur who leads the enterprise but rather distributed amongst individuals, objects and processes within the system. The next two Cycles made these adjustments in the survey (see Appendix G for the amended survey).

### **4.3 Discussions: Phase 1 – Development (Cycles 1 and 2)**

The goal of Phase 1 was to develop a new construct that would offer insights into how start-ups and scale-ups can be structured in order to build sound learning

tools. This new construct, entitled the *RMETE model*, emerged as a result of this Phase's methods (see Section 4.2). This section discusses the overarching findings by which the RMETE model and its six Sub-Constructs emerged.

#### **4.3.1 The Six Sub-Constructs of RMETE**

An outcome of Cycle 2 was a definition of the six Sub-Constructs of an ELLTE, which are

1. Sense of Purpose
2. Research Mastery
3. Teamwork
4. CEO Vision
5. Learning Culture
6. Action Orientation

These Sub-Constructs are presented in the order they emerged as they were coded in the notes. Further research would need to devise a hierarchy of importance, or indeed, an optimal order for presenting the Sub-Constructs to education stakeholders of various kinds. (Section 7.4 offers suggestions in this regard.)

For each Sub-Construct, the subsequent discussions are presented in the same format:

1. *Themes that emerged from the data.* This section presents the evolution of the Sub-Construct from the data in Cycle 2 including semi-structured interviews, participatory workshops and validation surveys. Discussions are structured by principal themes emerging within each Sub-Construct. Where relevant, I have selected pertinent extracts from the data to exemplify the Sub-Construct themes in this section.
2. *Definition of the Sub-Construct.* A culmination of the previous section, this section includes a discussion of each Sub-Construct's meaning and examples that illustrate the definition and presentation of a set of emerging 'Hallmark Questions', the three questions that summarise the definition and enable it to be easily explained and communicated to edtech companies that aspire to be RMETEs.

The chapter ends with a discussion of goals achieved in Phase 1: Development, and therefore implications for the design of the Phase that follows.



#### 4.3.1.1 Sub-Construct 1: Sense of Purpose

**1. Themes that emerged from the data.** The data analysis and validation processes of Cycles 3 and 4 resulted in Sub-Construct Sense of Purpose receiving a 4/5 with respect to its importance.

This section will discuss the four themes that emerged:

1. Enterprise Mission Clarification
2. Eases the Tension Between the Trade-off between Business and Education
3. Drives Evidence Collection
4. Clarifies Business Strategy

These themes are presented in the order that emerged as they were coded in the notes:

1. *Enterprise Mission Clarification.* Participant 7, one Mentor used the metaphor of a light house to capture the essence of one of the key recurring features of this Sub-Construct. They said:

Participant 7: You cannot have a research mindset if you are not very aware of all aspects and personnel of an organisation, to the vision and the organisation's 'lighthouse', which must shed the light onto every development of the organisation, that must be ensured to be evidence based.

This extract summarised the overall sentiment that Sense of Purpose gives a clear direction in which to check your compass – it tells the company where they are going so that every decision can be set up against that criteria and that everyone on the ship put their energy to help get the vessel to its destination. Discussions in this area suggest the importance of having a clear enterprise mission and reflected a common theme of the difficulty of EDUCATE Research and Business Mentors to guide companies when the company did not have a set Sense of Purpose. The evidence would suggest that this clarity is necessary for a RMETE, and that without it, efforts at helping the enterprise such as joining the EDUCATE programme could be confusing as participants didn't know the learning goals of their work. Research mentors explained how businesses were not clear on which option to choose as the education goal – not knowing if their aim was

mastery or engagement for example. Clarity of educational mission is therefore of the utmost importance to propel the enterprise to the desired destination.

2. *Eases the tension between the trade-off between business and education.*

Research mentors participating in this Cycle repeatedly noted a tension between business and education goals and the opportunity a clear Sense of Purpose gives in relaxing this tension. A RMETE exists to solve a learning problem, that should be their goal, and therefore research is necessary to ensure this goal is being met. On the other hand, the enterprise cannot do so without making wise, practical decisions on the business side in order to afford such research activities and afford to stay in business in general. Participants suggest that though this tension is ever-present, clarity around the *raison d'être* of an enterprise helps so ease this tension and make decisions that are best for achieving the overall purpose.

In a conversation in Cycle 2's Validation Workshop between Participants 2, 3 and 4, all EDUCATE Research Mentors, participants talk about what it means to research in the context of an enterprise.

Participant 2: It's [research] about being questioning, isn't it? It's about gathering data and then thinking about the implications of that and questioning those . . . you know, I think it's the balance on, you can't question everything. How do you get the right measure, you know, a company would be a nightmare if all everybody did was generate more questions at the end of every day.

Participant 3: That's why we don't work for companies.

Participant 4: But it is important to have a strategy, to purpose . . . to one target . . . you know, or some direction.

Participant 2: And that's where the goals and vision come in and that's where there's [research] ideas.

Participant 4: Yeah.

In this conversation, EDUCATE Research Mentors joke that the reason they work at the university and not researchers in enterprises is because they are always questioning. From this

statement, it is clear that through their in-depth work with enterprises, researchers know there must be a balancing of research journey with practical business decisions (allocation of employee time on research with balancing other deadlines and cost of employee time) is a necessary exercise for enterprise survival. They also note the vital importance of a clear Sense of Purpose to give a clear target and direction to measure all actions against. This reinforces the idea that a Sense of Purpose, not only to know where you are going, as the previous theme suggested (see the discussion of Theme 1, enterprise mission clarification, above), but also to help make optimal decisions when faced with trade-offs in order to get there. This seems to reflect a balance – the trade-off between research and business. The Sense of Purpose guides the way to what is important however you must therefore also know how to make it happen given your bottom line.

An excerpt that explains the trade-off from Cycle 2 Discussions by Participant 2 explains the trade-off businesses are faced with. The Participant suggests that the overall opinion of Participants that though there is no way for RMETEs to justify all decisions with evidence, they need a clear Sense of Purpose and a culture of learning (see Section 4.3.1.5) or else this trade-off appears considerably skewed towards the financial return of the business.

Participant 2: [Research in a RMETE is about] . . . good learning.

And that goes back to that culture, you know, the ethos of the company, if it's a Learning Culture, you know, then really this is . . . the fact it's research and it's like an educational style research as opposed to a market research or a product development research, it's all learning, it's all company learning because then who needs to know what, why and when in the company is more tricky, isn't it. Because you can't all possibly know every single evidence-based decision that's taken. You have to trust that you've got people in the roles that understand what their responsibilities towards that strategic sort of enterprise direction of using evidence-based, sound

evidence-based decision-making. But you can't possibly justify. . . . there isn't enough hours in the day, is there, to tell the guys, 'Well, I changed that line of code because a piece of research that so-and-so . . . ' I mean, you just can't work at that level, nothing would get done, would it? You'd be too busy reporting the evidence in your decision-making to the point. . . .

This trade-off was a recurring theme in many conversations with researchers, and it will be further researched in Cycle 3.

3. *Drives evidence collection.* Regulation in the UK, and indeed in many countries, does not require educational technologies to currently use evidence to prove their products work. Participants suggested that evidence collection is driven by companies who have a clear Sense of Purpose. It seems that RMETEs know the mission they are on and want to ensure they are on the right track, whereas enterprises that are not clear of their destination have less of a drive and indeed less of an ability to collect evidence as it is not clear what they are collecting evidence on. Participant 8 summarised the overall sentiment on this theme in saying: 'Sense of Purpose is important for collating robust evidence to make decisions', suggesting that, regulated or not, it is natural to look for evidence to ensure goals are being met when goals are clear. Though this would require further research to confirm, Participants perceive a Sense of Purpose as the motivating factor behind research activities, and therefore indeed behind becoming a RMETE.
4. *Clarifies business strategy:* Participants also suggested that Sense of Purpose allows business strategy to form more clearly. This, in turn, Participants believed, will allow for both internal and external decisions to be communicated clearly based on the clearly layer out business strategy guidance. Participant 10 summarised the sentiment shared by fellow mentors as: '*Understanding and believing in the purpose of research is key for an enterprise to build a research mindset throughout an entire company. One dream – one vision supported by research, helps with communications and strategy*'. Though the topic of

business strategy was not central to this study, as the theme recurred it was worth noting and perhaps worth exploring in further research.

**2. Definition of Sense of Purpose.** The Sub-Construct Sense of Purpose is the mission of the enterprise. The mission should answer the fundamental question of ‘what education problem are you trying to solve?’ The implications of having a strong Sense of Purpose were suggested in the above themes as a clear understanding of where the company is going, an easing of the tension between the resource trade-offs between research and business goals, a drive to collect evidence and a supportive business strategy

A RMETE can be compared to a vessel, and the Sense of Purpose is the destination it is going. In other words, a company with a strong Sense of Purpose has identified the destination it is aiming for (theme 1: clear enterprise mission), has struck a balance between business and research decisions (theme 2: eases tension of trade-off), has the right navigation system in hand (theme 3: constantly driven to collect evidence) and the right map (theme 4: clear business strategy to support goals) in order to get there.

This Sub-Construct helps to overcome the ever-present trade-off that RMETEs face between a need to earn revenue on an existing iteration of a product with research activities that give insights into how to optimally solve the education problem in question and fulfil this Sense of Purpose. A clear Sense of Purpose, it seems, helps RMETEs overcome this tension, allowing the desire to solve the education problem in question to prevail within reason. Sense of Purpose is the *raison d’être* of a RMETE, without this Sub-Construct, they are aimless, unsure what decisions are optimal and what destination is correct.

This Cycle addressed observations of this tension from the perspective of Research Mentors on the EDUCATE programme, and Cycle 3 would need to confirm this trade-off by speaking to enterprises about their experience of pursuing it given financial and practical day-to-day limitations. In keeping with all other Sub-Constructs to follow, this definition reflects the ideas of mentors within the EDUCATE programme and will need to be validated by developers themselves in a Validation Phase.

I hypothesise the following ‘Hallmark Questions’ for this Sub-Construct:

1. Why is the enterprise doing research?
2. Why is the enterprise building this product?

3. What is the vision and mission of the company – is it clear how research fits into it?

These three questions are Hallmark Questions and will be used in Cycle 6 of the Validation Phase of this study to validate the Sub-Construct with a wider group of edtech stakeholders.

#### 4.3.1.2 Sub-Construct 2: Research Mastery

**1. Themes that emerged from the data.** The construct received a 4.2/5 with respect to its importance in Cycles 3 and 4 with respect to its importance.

This section will discuss six themes that emerged from the data around this Sub-Construct, which are:

1. Affords Confidence
2. Appropriate Research Mastery
3. Reconceptualisation of Research for EdTech Enterprises, an Applied Approach
4. Managing Research Activities
5. Literature Review
6. Practicality

These themes are presented in the order that emerged as they were coded in the notes. The significance of each theme within the Sub-Construct of Research Mastery is discussed below.

1. *Affords confidence.* An important aspect of Research Mastery is the knowledge that the approach adopted does constitute sound research methodology. Participants repeatedly noted instances of false confidence (or over-confidence) in both research activities and the validity of the research data used to back claims of product efficacy and impact. The general sentiment of Participants seemed to be that the sample in question (i.e. edtech enterprises participating in the EDUCATE programme) exhibited confidence in product capabilities based on anecdotal evidence. Participants noted there seemed to be a culture of confidence in entrepreneurs when explaining their ideas, and a greater concern for selling their product or idea than finding evidence to back their claims first. Researchers considered such claims to be a sign of weakness in the Sub-Construct of Research Mastery. For example, a conversation in Cycle 2 between Participants 2, 3 and 4, all EDUCATE researcher mentors, demonstrates this point:

Participant 4: And the other way of looking at it would be to also say to us, 'What do you think the ones with no research mindset, or the lowest research mindset', you know, 'What are the indicators of that?' And it's really interesting, because although I was arguing earlier about the ones who bring their experience and that we need to take into account 15 years of teaching reading or whatever it happens to be, actually, lots of the ones where I think they're not research-minded are the parents, who just come and go, 'I'm a parent, therefore I know', and I think, 'No', you know, I mean, it's really interesting that parenting brings out almost the worst in that, the parents and they're the ones who go, 'I know'.

Participant 2: Because they micro-know a few individual children really, really well.

Participant 4: Yeah. And I think . . . I always sort of giggle at their arrogance of how you could think that what works for your one child under two, is then applicable to everyone else's children. I mean, I just think, 'How did you get that confident? I want some of that. Where did it come from?' So I think it's really interesting to think, because for me, that's an indicator of a non-research mindset.

Participant 3: It is a negative research mindset.

Participant 4: Yeah.

Participant 3: If it is the same for others, wouldn't you wonder? You might not do it, but you need to wonder if it is the same.

In this conversation, Participants express concern about the dangers that come with over-confidence as a result of ignorance of research methodology. Research mentors noted that the EDUCATE programme was able to afford a balanced confidence for those programme participants who had a growth mindset (Dweck, 2006, 2013) and were open to learning the methods, doing the hard work

and pivoting where necessary. This is important because the mindset of programme participants seems to have a large impact on their ultimate ability to be humbled by what research is, what they find out about their products and the ethics of their claims. This finding also suggests that looking at Dweck's work may prove important to choosing the right participants for a successful EDUCATE programme, as Cycle 2 Participants believe that programme participation is a waste of valuable resource without a growth mindset.

In addition to false confidence, Participants suggested that under-confidence, i.e. not knowing that what you are doing is in fact considered research that yields sound evidence seemed to be a recurring issue of note. EDUCATE Research Mentors noted a pattern of Participants who regularly collected data when working with learning in order to make the best possible decision for their products however had never engaged in formal research training and did not know they had already collected sound data coming into the EDUCATE programme. In their cases, the Research Training Programme built an awareness and confidence to proceed, and knowledge of how to refine their current methods.

Participant 4: So she arrived having written two research-based books on her area and had written a further one since. So there's kind of . . . she came with a research mindset, but she didn't think the research that she'd already done counted.

Interviewer: Yeah, she didn't have the confidence that it's research.

Participant 4: Yeah, and that wasn't in there at all, and actually, I think part of what she got out of being on EDUCATE was the confidence and has learned some perspective on her own research.

Some of the risks cited for under-confidence include (1) that work is not considered research and held to the standards that would otherwise would be, (2) that data are not collected in line with ethical guidelines, (3) that evidence is not held in high regard and shared in the company as a whole or perhaps disseminated to beneficiaries in



the wider community, and (4) that collection methods may not be as sound as they could be with very little extra effort of using tried and tested methods in the field, and perhaps even (5) that great products are not held in high regard because of a lack of knowledge that they are truly evidence-informed.

Participants noted that under-confidence in research, such as the case noted above, seemed to be less of a pattern than over-confidence in the sample; however, this would require further research prior to coming to conclusions on which is the larger issue that may be expected from such a sample in the future for programme tailoring purposes. What is known is the EDUCATE programme did see both extremes of confidence in this regard, and the Research Training Programme in EDUCATE along with one-to-one mentoring did afford a more balanced confidence for the most successful Participants.

2. *Appropriate Research Mastery.* Cycle 2 Participants perceived a point of difficulty where EDUCATE programme participants who had a background in a field other than Education research (e.g. Biology, Psychology) used methods that were not appropriate in the context of Education research. Participants noted on various occasions that EDUCATE programme participants with non-educational research backgrounds would proceed with full confidence in a methodology that in Participant opinion disregarded important aspects of the product in question, for the most part opting for quantitative and positivist research methods and disregarding learner context and pedagogical literature and theory. This sentiment is captured by Participant 3 when they were ranking companies from least to most research minded in Activity 2 in Cycle 2's Validation Workshop:

Participant 3: Company X [IS] might even be weaker than Company Y [Quip], I mean, this is an example of scientific researchers trying to make their product usable for teaching and learning, and they are working on it, but somehow, they are also doing lots of other things, so their engagement, you know,

stopped with the programmes, and so I haven't seen any improvements on there, you know. . . .

The company referred to by Participant 3 above was an made up of mostly science PhDs. Indeed, the evidence suggested that many participants with PhD-level credentials in a non-education field were less interested in the EDUCATE Research Training Programme, and it was suggested in this Cycle that they perhaps overlooked important education research activities and making education impact claims to sub-par products for a vulnerable user base.

The attitude of confidence and knowing a different field of research and knowing their own methods and literature is summarised here by Participant 4 in regard to one of her less successful companies on the EDUCATE programme:

Participant 4: And <Company X<sup>3</sup>> an interesting one although I wouldn't . . . on life and death suggest you go and talk to [them]. But she's got a PhD in the area, so she knows about research and what she does is she tries to sort of cover up [their] lack of research on education and the impact by confuddling you with sort of phonological whatever and how you learn <learning goal anonymised>. And when you . . . and I think she thought I didn't understand that research, so she'd quote research to me and I'd go and look at it and I'd go, 'Actually . . . you know, it doesn't show quite what you say it shows', so she'd claim, you know, things like the impact on brain structures and I'd be, like, 'Mm, it doesn't quite work like that'. So she's got a lot of research awareness but it's completely the wrong . . .

In keeping with many cases shared in this Cycle, Participant 4 talks about an EDUCATE programme participant who is a PhD and has a high research awareness in her field, however they lacked the awareness of the correct way to apply it to education. Participants

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<sup>3</sup> The names of the companies referred to in the analysis section of Cycle 2 is irrelevant and therefore generically <company name> is being used.

also suggested a pattern of non-education researchers exhibiting a fixed mindset (Dweck, 2006, 2013) with respect to learning education research methodology and as in the previous theme of this section, and over-confidence in their work. This is important because the confidence that came from Research Mastery in a non-education field resulted in less learning on the EDUCATE Research Training Programme. These participants were also said to spend fewer hours with their Research Mentors, instead participating in EDUCATE for other strategic business goals that the programme may have afforded them such as a larger network, sales leads and business mentorship. Participants noted that this fixed mindset (Dweck, 2006, 2013) behaviour resulted in under-development of Education Research Mastery and sub-par products.

Participant 3 below explains that non-education research experts in the EDUCATE programme often lacked contextual understanding. She also explains how they didn't reach out to her as much, sometimes not communicating at all as they over-estimated their mastery of the content in the EDUCATE Research Training Programme:

Participant 3: . . . they didn't communicate with me. They are researchers themselves, but I don't know what they know about educational research – if they understood that you know they needed to understand what is going on in schools and align their product with school activities rather than just present a product to them and expecting them to know how to use it for these purposes. . . . Yes not (you know) research understanding but you know – understand how educational technology research should be carried out to improve their product I gave them a 3.

Participant 3 gave this answer when justifying a score of 3/5 due to their lack of engagement in the Research Training Programme, lack of communications with their research mentor and overall lack of awareness and care for the contextual educational factors around the

design, development, practical deployment and use of the product in schools.

Another pattern that was noted was a lack of ability to formulate valid questions and to therefore generate useful findings in the context of the applicability of products for learning. Also, in Cycle 1, Participant 5 was asked to rank the research mindset. Though Participant 5 was more generous with their criteria than most Participants, believing that a score of zero is never possible as businesses are always asking questions, they note the lack of appropriate questions when they are not educationally valuable:

Participant 5: I don't think a company would have zero ever in terms of research mindset because building something – those people are innovating things; they are coming up with some ideas – require asking some kind of question for designing things. So . . . I'm not sure if any of the companies will ever have a zero in terms of research mindset. But I guess the problem starts when the types of questions that are being asked are not necessarily relevant to the product or not necessarily relevant to the educational problems or not necessarily relevant to the learning sciences and learning issues. So I'm not sure if it is ever possible for a company to have a zero for a research mindset but educationally valuable research mindset would be a 0 for some companies if their questions are all driven by business or innovation or economic reasons, rather than being driven by educationally valuable . . . (inaudible word).

Education Research Mastery results in asking valid research questions which forms the cornerstone of any research activities. The EDUCATE Research Training Programme was designed to develop this expertise and to welcome Participants of all backgrounds; however, the above excerpts were chosen to illustrate a pattern of non-educationally valuable Research Mastery getting in the way of this work.

3. *Reconceptualisation of research for edtech enterprises, an applied approach.* As mentioned previously, EDUCATE Research Mentors participating in this Cycle had the unique opportunity to work in the first-ever programme addressing research capacity developing in the context of edtech enterprises at such a large scale. Cycle Participants noted a development in their own understanding of research in the context of an emerging edtech enterprise through their own journey in the programme, how best to support capacity building and also the kind of research they expect enterprises to pursue that will fit with the pattern of their business practice (Clark-Wilson et al., forthcoming). The participatory nature of this Cycle (see Section 4.2.5) was designed to take advantage of the unique and invaluable contribution that these Research Mentors would be able to contribute to this study given their recently developed understanding of what research can be expected and is doable in the context of emerging edtech enterprises. At the time of interview, Cycle 1 Participants conveyed one major conviction in this regard, and that is for an edtech enterprise, the most important thing is to yield useful information, which they define as information that is both timely in nature and affordable given their resources. This practicality is of the utmost importance and is necessary for research to be acted upon – both in the sense of research activity completion and implementation of findings into product design and impact measures (see Section 4.3.1.6 for full discussion on Action Orientation for more details on this).

On the whole, the research that is conducted needs to be relevant to the edtech enterprise context and be practical for this purpose. This discussion from Validation Workshop 1 between EDUCATE Research Mentors illustrates this theme and suggests that perhaps one of the outcomes of the EDUCATE programme should be a different conceptualisation of research in this context:

Participant 4: . . . I was working doing some stuff on my Workshop on theories, because actually I'm running out of time for that for next week, and I think what the conclusion I was kind of coming to and working through the talk was that we need a different

conceptualisation of research for edtech companies as we do for research in academic.

Participant 2: Yeah.

Participant 4: Which follows from my Research for All paper, and I do worry that in how – especially the three of us conceptualise that sort of thing is with giving priority to academic notions and in particular, sort of educational technology academic notions of what counts as research, and I think for some of our companies, in terms of the development of them as companies, that might not be the most important sort of research for them to do. And it's kind of similar to the . . . your gold standard, you know, randomised controlled trial being the sort of best thing ever; for our companies, it's not in their. . . . you know, and so, how is there a different conceptualisation of research that we can have for companies.

Participant 2: Yeah.

Participant 4: And then I think it becomes interesting when you think about it in terms of schools' things, because I think teachers have a different conceptualisation or should have a different conceptualisation of research that impacts on their practise, I think they do mostly, which is learning from their own and others' experience within their own context or nearby contexts. But that's very different to academic notions of research.

In this excerpt, Participant 4 uses the example of teachers using their own ways of researching optimal practice in their context to draw a parallel for enterprises, and how they too must find their own way to do research. Participants noted that the EDUCATE programme changed very much from the first iteration, the Research Training Programme started in a very academic vein through its iterative design, its language and content became much more practical for enterprises.

Moreover, the usefulness of academic ontology in the context of supporting edtech enterprises was explored throughout the EDUCATE programme and introduced as a specific example of academia's tools perhaps being less useful for emerging edtech enterprises. Cycle 2 Participants suggested that is not necessarily useful for the enterprise to use academic language when they are speaking with their own employees and customers who do not use this language. Enterprises use research in a different way, and though this may perhaps be limiting to their ability to contribute to peer reviewed academic research, it was suggested that this is not the primary purpose of research for edtech enterprise. Their purpose is to yield practical information that will empower their teams to build stronger learning tools. Knowledge of the ontology can be limited to the individual(s) who is/are reviewing literature and perhaps a part of their role is to translate terms into relevant business practice.

The following excerpt from Cycle 2 illustrates the necessity of research for the context of edtech enterprises. In this conversation, Participant 4, an EDUCATE Research Mentor explains their own development towards understanding how academic methods and language are not always useful in edtech enterprise context:

Participant 4: He came up with this term about psychological contradiction which was about parents not wanting their children to have too much screen time but at the same time, wanting screen time to be valuable... And so, I said, 'Well, you know, we're just thinking academics are talking about dissonance and maybe looking at some of the dissonance literature', and he was, like, 'Yeah, but every parent I talk to understands when I say psychological contradiction'. I'm, like, 'Well . . . then dissonance is bloody useless', you know, dissonance being the academic concept, but actually, he was thinking about it in terms of his parents.

There is a recurring suggestion by Research Mentors participating in this Cycle that the EDUCATE training programme be conceptualised to

optimise the practical nature of evidence yielded by edtech enterprises through research activities. This was a conclusion that many came to after working with companies over the course of the EDUCATE programme and sharing realisations in excerpts like the one above as to what motivates edtech enterprise to research in the first place. EDUCATE Research Mentors noted that the design-based methodology of the EDUCATE programme allowed for the cyclical research-informed development from Research Training Programme (RTP) course materials from its academic roots towards applied and practical applications for edtech enterprises, Participants suggested EDUCATE programme participant's understanding of materials increased as the RTP was made more practical as did their propensity to gain Research Mastery and to pursue research activities.

4. *Managing research activities.* The data in this Cycle suggests that a level of Research Mastery is required by RMETEs to manage research activities effectively – whether research is conducted inside or outside of the enterprise. Contrary to the belief that the very act of outsourcing research is done as a result of lack of mastery, Participants in Cycle 2 suggested that Research Mastery is required to set the research vision and purpose, manage the initiative both inside and outside of the company and that RMETEs understand outsourcing projects that yield desired cohesiveness with company requirements requires a level of Research Mastery. Initiatives such as making sure the correct data is provided, the correct context is relayed, the company's purpose and value systems are understood (and indeed match with external research value systems) and that the information is flowing into and out of the correct departments all of which requires both management and Research Mastery in order to act as an effective bridge between teams and external researchers.

In the below excerpt, Participant 4 summarises these ideas:

Participant 4: Well, that's the outsourcing bit, isn't it, so in some ways, (inaudible 01:03:02) to state that is not sufficient to see the relevance of research and then just outsource it without being involved in some way or being critical about . . . Sometimes we just don't



know what that process of outsourcing looks like, do we? They might well have sat down . . . I mean, the fact that <Company X> went with paying IOE to do a randomised controlled trial rather than putting their product through to <Independent Charity X) to get it funded is an interesting one. Because . . . I just find that interesting, that, you know, what's the relationship between the designers and the researchers if you've paid IOE to do it as opposed to going to an external organisation like EEF, who will then appoint the evaluator rather than you actually negotiating that as part of a contract. There's something interesting in there, but there's also something really interesting in the sort of EEF wish to keep things positive or the kind of . . . do you know what I mean, how that values system is acted out in <Funder X> or <Funder Y> compared to how it might be acted out in a consultancy with the <University X> in consultancy with an independent research firm.

Participant 4 summarises the overall belief of Participants involving the productive outsourcing of research activities. Participant 4 explains that the company must consider various factors in using external research. The following excerpt is chosen as the factors mentioned were all perceived as important by Participants: the process of outsourcing, the research process and values of their partner, how free the researchers are to do pure academic research, the relationship between the designer and the researcher and finally whether the research is tied to funding.

Participant 2 below speaks about managing the scope and outcomes of the work and balancing pure academic research with practical deliverables, timelines and desired outcomes from a business perspective:

Participant 2: Yeah, I mean, I do think there's something... [to] the nature of what I call pure academic research, which is where the academic is driving the research

questions and the edtech provides a context to explore those research questions. This is a really different thing than commissioning a university to do an evaluation study for you, which is inevitably drawn up with a consultancy contract that has deliverables and timelines and doesn't really enable scope for a lot of negotiation. In one way [this] can be good, but in another way, it's more risky to the academic to be doing that than it is in a situation where they really own and control everything from the data to the ethics, to the reporting, to what gets written and published, to how those published bits get soundbites in marketing. I mean.. . they're very different ways of outsourcing really, and I suppose one could fit more with a research mindset than the other.

This excerpt highlights the importance of an individual or team within the edtech enterprise that is outsourcing having enough Research Mastery to understand the difference between the 'purity' of research that can be delivered by various partners, the scope of negotiation that the enterprise can expect and therefore their outsourcing strategy.

Participants also suggested that research in edtech enterprises is a team activity (see Section 4.3.1.3), and outsourcing doesn't exclude internal team members from engagement in the activity if relevant information is going to be yielded at the end. Research Mastery is needed irrespective of whether the research lead is within or outside of the enterprise. This will be further discussed in the section on Teamwork, however the scope that is relevant here is that teams are not excluded from working together to aid the outsourced project to have the correct context to be successful and that they are required to have some Research Management mastery. What exactly such mastery is would require further research, and will be discussed in Section 6.3, however Participants are in agreement that enterprises that outsource research are not excluded from this Sub-Construct.

5. *Literature review*. Though this could be seen as a part of Education Research Mastery, literature review emerged as a separate theme in this section due to the volume of feedback by Participants of the theme's importance and a general frustration in the inadequacy of knowledge of edtech enterprises concerning the need for solid base of information in their chosen field of operation. Participant 5 explains, the general idea that an inadequate literature review results in naïve research questions due to a lack of knowledge in the space:

Participant 5: I think they were missing the context of existing research on the terms/themes that they were working on. For instance, the company was very much interested in <learning goal X> and doing research on mindsets, and they didn't really know what is available out there in terms on this research, what has already been done – because they didn't have the appropriate background and if you don't have this background, although you are asking the right questions in your particular context, the questions you are asking might actually be naïve. And I think sometimes, some of the questions were naïve that they were asking because of the lack of knowledge in this space.

This idea of asking under-researched and naïve questions was further exasperated by the general contention that not only academic literature but all relevant information (e.g. policy documents) were seen as under-reviewed by enterprises on the whole. In the below discussion from Cycle 2, EDUCATE Research Mentors' overall sentiment is that it is unacceptable not to have a base of literature in their area:

Participant 4: So and I think I saw the key indicators of non-research mindset is when, you know, when they go, 'And this is going to solve teachers' workload problem', and you go, 'Have you read the DfE paper on teachers' workload?' and they haven't read it, then I think that's also . . . And interestingly, <Company X>, who's quite far down, they haven't

read it, and yet they were about to launch a product to market.

Participant 2: I do find that incredible.

Participant 4: I do think there's something where they're not . . . I mean, I don't mind if they haven't read Professor Bloggs from the Institute . . .

Participant 2: No, but policy documents . . .

Participant 4: But if they haven't read policy documents or, you know, TES articles.

Participant 3: Or the National Curriculum, they design something . . .

This captures the unity of opinion around Participants in Cycle 2 (which was echoed in Cycle 3 with remaining Research Mentors) that a literature review is important and provides a solid foundation to then ask valid research questions. Though there was some contention around what literature meant in this context, Participants agreed in the end that it should include both academic and practical literature.

The development of the skill of reviewing literature was emphasised and taught in EDUCATE's Research Training Programme and was a factor that the most successful companies in the programme (i.e. EdWard Level 2s) which were model RMETEs pursued and Participants suggested may need to be further emphasised systematically into the curriculum in the next iterations of the programme to further develop this skill and an appreciation for the role and importance of literature review within this Sub-Construct.

6. *Practicality.* Doing research in edtech enterprises, especially emerging ones as is the topic of this study, is rife with trade-offs. Decisions need to be made that take the health of the business into account for survival in the face of practical constraints usually pertaining to main resources (defined by Participants as time and money). Edtech Research Mastery depends on both research and business knowledge to be taken into account in order to ask the appropriate research questions and come to practical research plans. In the below excerpt, Participants suggest that business knowledge is the base, as without its research activities

cannot be designed with an understanding of practicalities which may inhibit research initiative success.

Participant 3: And, you know, in later getting to know you, in the first ones, I felt the need that these people, some of these people needed business understanding first to be able to come to educational research understanding.

Participant 2: That's interesting. So there's a foundational level of business that needs to be in place before we even see them as coming onto . . . [the EDUCATE programme.]

Participant 2 goes so far as to suggest another level of screening prior to acceptance on the EDUCATE programme that ensures enough of an understanding of business prior to the development of appropriate Research Mastery to empower it. In a similar vein, Participant 3 cites an example of a highly competent EDUCATE programme participant who do not have clarity of thought around the structure of their enterprise in order to think about the practicalities of research fitting into it.

But I want to bring another case: <Participant X> from <Company X>. She is an education PhD herself, and she worked with Masters student teachers, who helped them, you know, improving their practice in schools by collaborating, sharing problems etc. And she wants to do, she wants to repeat that process online by designing a learning online for teachers, so that they can benefit from the results. So, her research proposal, her data excerpts are all in place. The thing is, I'm wondering how successful she will be, because then she needs business side of the things, you know, how to find people to talk to. So, you know, we talked about contacting former students in the masters programme she was teaching, I said, 'Try asking them what they will do' And she found some things, but you know, there is a perfect research proposal with data or with coming data etc., does that indicate success? If she is going to be successful, then we have a question, but I think it's an interesting question, don't you think?

Here, Participant 3 talks about a case where educational Research Mastery is not complemented with business acumen and, despite high Research Mastery, they do not have confidence in the success of the enterprise as a result. This theme explores the practical challenges of Research Mastery without business acumen and suggests that perhaps a part of the Reconceptualisation of Research Mastery for Emerging EdTech Enterprise (Theme 3 above) should include aspects of business planning, knowledge and experience for successful Research Mastery in this context.

7. *Understanding affordances.* Participants had a pattern of expressing concern around false claims of the implications of the result of research activities which they owe to a lack of Research Mastery in the area of the affordances of research methods. Participants suggested that invalid or inflated claims were routinely made to a vulnerable customer as a result of a lack of understanding of research work done. Without an understanding of research methods, enterprises make claims of their efficacy and impact with permeate marketing and sales materials without understanding whether they truly do what they are saying.

Participant 2 said in Cycle 1 interviews regarding a company they mentored: 'So they realise they don't have the datasets or the robustness to think ever so deeply about efficacy, but they are interested to know the impact it has in different contexts'.

Participants suggest it is the realisation above that is important for enterprises in the programme to come to, to know what they can and cannot claim with the chosen methods and scope of research. Participants suggest that this theme is incumbent upon RMETEs to master if they are to elevate the edtech start-up ecosystem and be trustworthy producers of learning technologies.

**2. Definition of Research Mastery.** In keeping with all other Sub-Constructs, the definition of Research Mastery as a Sub-Construct emerged from the data and the themes above. Participants feedback was therefore of the highest volume in this Sub-Construct, i.e.: was the most codes in NVivo and the greatest number of emerging themes.

Research Mastery is the Sub-Construct that is concerned with the appropriate understanding of research methodology, planning and deployment in

the edtech SME context. As was seen in the themes above, Participants suggested that Research Mastery for a RMETE is education research specific, requires a re-conceptualisation of research for emerging edtech enterprises, affords confidence in doing appropriate research that yields practical research plans and useful results, is based on a rich literature of academic and practical literature, demands engagement from various teams and requires management whether it is run inside of outside of the enterprise.

The first conversation participants in the EDUCATE programme have with their Research Mentors is answering the question of what education problem they are trying to solve (Sense of Purpose), after the remainder of the programme is centred around how to generate evidence to know whether this goal is being achieved. The Research Training Programme, the module at the heart of the EDUCATE programme is all about developing Research Mastery (this was explained in further detail in Chapter 1- see Section 1.2). This module is complemented with one-to-one time with dedicated EDUCATE Research Mentors to customise learnings to their enterprise context and goals. It was the first-ever programme of its kind to endeavour to develop Research Mastery for the edtech SME context (see Section 1.2). As a result of working with EDUCATE Research Mentors, there were many insights into what Research Mastery is for edtech SMEs and how it can be developed which made the activities in this Cycle possible – chief among which was insights into what Research Mastery looks like in an edtech SME context.

Participant 2 summarised the importance of this Sub-Construct to a RMETE in this statement: *'High-quality evidence collection is a part of business practice – but how do they (i.e. edtech enterprises) know what is high-quality evidence if they don't understand what good evidence is in their context and how you get it? It is of the utmost importance for a RMETE to be competent in this Sub-Construct as without it, there is no sound evidence to support claims of product efficacy and impact'*. Participant 2 captures the essence of a RMETE who has developed Research Mastery and suggests the importance of competence in order to achieve RMETE status.

I hypothesise the following 'Hallmark Questions' for this Sub-Construct:

1. Does the enterprise have the knowledge/expertise to design appropriate research initiatives to assess the efficacy and impact of their products?

2. Is there an awareness of the appropriateness of different research methods?
3. Is there an understanding of what sound evidence is, and how it should be generated and used?

These three questions are Hallmark Questions and will be used in Cycle 6 of the Validation Phase of this study to validate the Sub-Construct with a wider group of edtech stakeholders.

#### *4.3.1.3 Sub-Construct 3: Teamwork*

**1. Themes that emerged from the data.** The construct received a 4.5/5 with respect to its importance in Cycles 3 and 4 Validation.

This section will discuss three themes that emerged from the data around this Sub-Construct, which are:

1. Whole Enterprise Representation
2. Solving Problems Together
3. Engaging External Team Members

These themes are presented in the order that emerged as they were coded in the notes. The significance of each theme within the Sub-Construct of Teamwork is discussed below.

1. *Whole enterprise representation.* Participants challenged the notion that an isolated researcher or research team can be tasked to complete research activities for or on behalf of the edtech SME, and suggest that successful planning, deployment and use of research activities can only be done through a collaborative effort with representatives of various parts of the enterprise in order to consider all relevant contexts and goals. Participants argued that due to the dynamic nature of edtech SMEs, teams would need to be systematically assembled to encompass a holistic view on the enterprise – and they should be created in such a way as to have their finger on the pulse of changes in the enterprise as they occur. Participants noted many pivots by enterprises in the 6-month period that they were on the EDUCATE programme and suggested therefore that teams need to represent the enterprise members in order to be hyper-reactive and suggested that teams would be the best way to mitigate miscommunication and take the most relevant goals and



needs to the enterprise into account in order to conduct most useful and relevant research.

2. *Solving problems together.* Participants conveyed the belief that there was a correlation with programme attendance as a team and higher achievement on the programme. This is in line with research regarding self-directed learning that states that tougher problems can be solved if teams are diverse enough and there is opportunity for collaboration, even in situations with little to no support and instruction (Mitra, 2005; Inamdar, 2004), suggesting that tougher problems require collaborative effort. Not all EDUCATE companies had more than one employee, but of those that did, most EdWard Level 2s attended EDUCATE programming in teams as much as possible. For example, <Company X> – Participant 1 and Participant 2 came to everything together. Their mentor, Participant 6 visited their office, and most team members came to the meeting and they were all involved in research in some way. In fact, they had regular weekly team meetings to discuss their research activities. At <Company X>, research was not seen as only important to the research team. Further research (see Section 6.3) would need to be conducted to assess whether there was in fact a correlation between team participation in EDUCATE and programme success (defined as receiving and EdWard level 1 and 2). As it stands, Participants noted a pattern of team attendance in many of the successful programme participants and suggested that this may be an early indicator of programme success, thus reinforcing the importance of teamwork in programme and research work and perhaps a mandatory team participation in the next version of the EDUCATE programme other similar research training accelerator programmes.
3. *Engaging external team members.* Participants further reinforce the message of the importance of teamwork by suggesting that RMETEs are successful because they collaborate with others to solve the tough problems, regardless of if the other is inside or outside their enterprise. The Participants suggested that some EDUCATE participants who had small numbers of employees (including 1 employee in some instances) still created team-like situations and this collaboration made their research approach richer and their research activities more successful.

For one-person enterprises, EDUCATE team members, and in particular the EDUCATE Research Mentor, was a great opportunity for Teamwork – one that many successful companies noted and took advantage of while other, it was suggested, did not understand the value that mentors could bring to their team and did not engage as much as they could or should have. In fact, Participants noted a pattern of feeling overwhelmed by contact from certain companies who considered them team members. The volume of emails and requests to review their work and collaborate was, in many instances, demanding more time from Research Mentors than they were allocated to provide. That being said, Participants noted that such engaged participants were overall more successful, gained a greater mastery and produced more relevant research. This suggests that that accelerator and incubator programmes that allow single employee businesses to systematically reflect with team members with expertise (such as EDUCATE) are not only nice to have but can be indispensable to developing a RMETE. It also suggests that a lack of team members is no excuse for lack of teamwork in research activity collaboration.

Participants mentioned the high level of engagement of successful EdWard Level 2s with their EDUCATE Research Mentors. In fact, mentors noted feeling overwhelmed by their engagement. In Cycle 1, Engagement seemed to be a separate Sub-Construct, however after Cycles 2, it was clear that Engagement was a recurring theme as part of the Sub-Construct of Teamwork. In this conversation Participants discuss how they wanted to engage with EDUCATE companies more but how programme hours and volume of work limited their ability to do so.

Participant 4: And I also thought a lot of the staying in touch is about personal relationships, it isn't about whether they're research-minded or not, it's almost a meeting of minds between the mentor and the mentee.

Participant 2: But I think, they can have their capacity and our capacity to stay in touch is an issue, because we couldn't possibly have stayed in touch with every company, you know, managing the expectation

about what we wanted them to stay in touch with has been part of our problems around the scale of the programme, hasn't it?

Participant 3: But we find ways of supporting if they insist on contacting us and . . .

Participant 2: Yes, we do our best, but I don't . . . I mean, there's been lots of missed opportunities, if you'd like to find out more, because you just can't keep going back with the, 'Tell me what, I mean, are you interesting?' and they reached to you again, but actually, there's a limit to how much. I don't know, I find that, because obviously a massive volume of things going on. I would like . . . there's a few companies I had the opportunity to know more from or stay more involved with, but it just wasn't feasible for us to do that.

Participants mentioned that some EDUCATE enterprises were able to get the extra support by building relationships with their Research Mentors despite mentor workload. However, Participant 2 explains the fact that there were a lot of missed opportunities as a result of very real time limitations on behalf of Research Mentors themselves.

Outside of the EDUCATE programme, Participants mentioned that their EdWard Level 2 companies sought to collaborate with various external individuals including: business networks, mentors, accelerators, incubators, investors, friends, family and life partners. Choosing the external team members outside of EDUCATE Research Mentors arose as a point to consider in this theme as without Research Mastery (see previous Sub-Construct), individuals chosen for collaboration by the enterprise were sometimes inappropriate and would not necessarily yield better results. There was a suggestion by Participants that Research Mastery is therefore a pre-requisite to effective Teamwork.

**2. Definition of teamwork.** Participants suggest that RMETEs understand that research is a team activity within edtech SMEs. Participants challenged the notion that an isolated researcher or research team can be tasked to complete research activities for or on behalf of the edtech SME, and suggest that successful planning, deployment and use of research activities can only be done through a collaborative effort with representatives of various parts of the enterprise in order to consider all relevant contexts and goals.

Successful research requires knowledge from all departments in order to make sure that business concerns are appropriately met with research questions, and also there is the suggestion that research activities in dynamic edtech SMEs are difficult and a team helps to solve problems. In one-person companies, where the consideration of the knowledge of all departments and people is irrelevant, a team can be built with an external member as a sounding board or support. For example, the EDUCATE Research Mentors were operating as external team members for some of the most engaged programme participants. In these instances, peer groups could also be engaged to help one another to solve complex issues or comprehensively think through research problems. In winter 2020, one such initiative was started where an EDUCATE EdWard Level 2 company invited fellow alumni for a monthly initiative to discuss research initiatives, successes, issues and to help one another. This initiative was interrupted due to COVID-19; however, it showed the recognition of one of EDUCATE's EdWard level 2 companies in the need to continue external team collaboration and the value in collaboration between RMETEs.

I hypothesise the following 'Hallmark Questions' for this Sub-Construct:

1. Are research initiatives conducted in teams?
2. Does the research team have a connection to the other teams in the company?
3. What systems are in place for individuals to work together on research initiatives?

These three questions are Hallmark Questions and will be used in Cycle 6 of the Validation Phase of this study to validate the Sub-Construct with a wider group of edtech stakeholders.

#### 4.3.1.4 Sub-Construct 4: CEO Vision

**1. Themes that emerged from the data.** The construct received a 4.2/ with respect to its importance in Cycles 3 and 4 Validation.

This section will discuss five themes that emerged from the data around this Sub-Construct, which are:

1. Clarity of Vision
2. Building Appropriate Teams
3. Prioritisation of Research
4. RMETE Status Continuity
5. Research Permeation

These themes are presented in the order that emerged as they were coded in the notes. The significance of each theme within the Sub-Construct of CEO Vision is discussed below.

1. *Clarity of vision.* This theme speaks to the role the CEO has in setting the Sense of Purpose and having a clear understanding of how to know whether it is being met. It speaks to the relevant setting of research goals within the short- and long-term business plan and ensuring the company mission and vision as well as the resources set aside in the business plan are in alignment with it. Participants spoke about the importance of a Clarity of Vision from leadership in how to achieve a RMETE status in their particular enterprise. It was this Cycle's Participants' contention that this Clarity of Vision should translate their Sense of Purpose into a strong strategy for how to realise RMETE status for the enterprise. This was seen by Participants as leadership's responsibility, and one that demands an understanding of the other five Sub-Constructs on a management level. Further research would need to be conducted on the depth of understanding of each Sub-Construct, and indeed how to optimise training to leadership for research management (or RMETE management) in order to perhaps optimise an EDUCATE programme for enterprise leadership. Though Participants did not feel they had enough visibility of leadership activities to speak to how this may be done, they felt this issue highlights the vulnerability of EDUCATE participants not achieving RMETE status due to the to a lack of mastery on the leadership level – despite a strong team participation. For example, Participants

highlighted a disconnect between leadership expectations of research outcomes from the EDUCATE programme and what the research can actually yield due to a lack of leadership mastery. Participants also noted a pattern of hiring inappropriate research teams due to a lack of mastery. This will be discussed further in the next theme. Participants for the most part did not have time to spend in the company to gain a view or understanding of the company as a whole, therefore insights for this theme were limited in this Cycle, and Participants suggested visiting the companies in Cycle 3 to confirm this.

2. *Building appropriate teams.* Participants had the contention that leadership must have enough of a mastery of appropriate research methods to assemble a capable research team for the edtech context and manage them appropriately. As mentioned in the section discussing Sub-Construct 2: Research Mastery, a recurring theme in this area were CEOs with scientific research background who underestimate the difference between education research in this context. Similarly, leadership hires personnel with any kind of Research Mastery, seeing a PhD as a key indicator of research skills, without having any sense of the approach they would bring to the team and whether their mastery is appropriate for a dynamic edtech SME context, thus resulting in recommendations that are less than appropriate or desirable to meet the SME's needs.

Another aspect to this theme is the effective management of teams once they are built. Managing research teams require a level of Research Mastery to link company vision with appropriate and doable research vision and expectations around timelines, budgeting and results (i.e. affordances of research proposals by research teams) which was explained in the previous theme around Clarity of Vision and, as mentioned in the previous section, would require further research to understand optimal management strategies for RMETE leadership.

3. *Prioritisation of research.* Participants noted a pattern of behaviour where EDUCATE programme participants were conflicted when faced with trade-offs between research and other business tasks and expressed the importance for leadership to set participation in

research activities as priority when faced with dilemmas. Participant 2 put it aptly, it is about keeping eyes and ears open to allocating resources at the right time as things change and are needed: ‘ . . . your eyes and ears aren’t open to what’s going on in a dynamic way around your product as it scales, and you don’t then draw down on that as an extra additional free resource, that there’s other people doing things, is really probably that you haven’t got that team, that research mindedness of the CEO, the allocation of the resource, to say, ‘This is something important we need to work on as an enterprise’. But going back the point about communication, I mean, particularly when you’ve only got one or two or three of you in the company, so much is oral’.

Participant 2 makes an interesting point as well about the ease of communication of the priorities and vision in smaller companies – and perhaps the greater difficulty of this task as companies become larger and the CEO has more people to manage. This point was not brought up by any other Participants, however it does bear mention that for the most part, the larger the company, the less involvement by the CEO in the EDUCATE programme. However, one such larger company (X= Freeformers) CEO was described by their mentor (Participant 7) as insisting on participating in the EDUCATE programme:

I know (says name of Co-Founder of Company X), he was really championing the project. I think he is probably the main reason why these two people were sent to EDUCATE. They were, as every company is, they were very busy, I think, they had a workforce to allocation to EDUCATE because (says name of Co-Founder of Company X) was championing evidence in the decisions they were taking and the research, he I think, kind of insisted that two people are running the engagement with EDUCATE.

This Co-Founder was not present at any EDUCATE events, nor did he have a particular understanding of research, but he knew the importance of research as a result of his interactions with the founder of the EDUCATE programme and championed its prioritisation in the company. Perhaps there is a correlation with difficulty of the CEO’s involvement as the company gets larger, and perhaps CEOs of medium- or large-sized companies need a different sort of training than

smaller ones (see Section 6.3) however what was common theme mentioned by Participants was the importance of the support and prioritisation of research activities.

4. RMETE Status Continuity: Participants noted a pattern where companies that they saw as successful (i.e. achieved an EdWard Level 2) were no longer doing research as leadership did not have an understanding of what the research team was doing on the EDUCATE programme thus resulting in a lack of continuity of research activities beyond the tenure of the team at the company. Participants suggested that EDUCATE companies with a lack of CEO Vision resulted in a lack of continuity of RMETE status – even if they seemed to have achieved many of the other Sub-Constructs. This was especially apparent if a member of the research team or the individual driving research left the enterprise. What resulted was a strong contention of Participants that RMETE status continuity is highly dependent on leadership understanding of RMETEs and RMETE management and encouragement of the research vision despite staff members. Participants believed that research must be encouraged from the top and leadership understanding, they believed, is incumbent on continuity of activities and research status.

The below dialogue between Participants 2 and 4 is an excerpt of the conversation during Cycle 2, Activity 2 where Participants were tasked with ranking EdWard Level 2 companies from least to most research minded. The conversation illustrates not only the previous theme of RMETE Status Continuity, but this theme of Research Permeation as well:

Participant 2: I think I might be being a bit unfair on <Company X> putting it all the way down there. I just think by virtue of the fact that someone from the company comes on EDUCATE; they've got a certain amount of research mindedness to begin with.

Interviewer: Right. Yes.

Participant 4: So it's . . . and how much is that? Is that one? Is it two? What is it? So I've sort of put [Company Name] on two because the person who did the research has



gone, but they sent her . . . and now she has left the company, but they did send her on the programme in the first place. (Theme 3: ELTE Status Continuity)

Interviewer: Right.

Participant 4: And the research that she did led to a change in their company.

Interviewer: Yes.

Participant 4: So that makes them seem a bit research-minded, but really, they're a massive company and what she did was only on one small bit of the company.

Interviewer: Yeah.

Participant 4: So . . .

Participant 2: It's hard to know.

Participant 4 is referring to a case where a highly engaged and successful participant in the EDUCATE programme left their company and the knowledge of how to maintain a RMETE status left with them. This experience points to the necessity of leadership participation or knowledge of EDUCATE programme content for RMETE status continuity. Participant 4 also mentions the fact that it was a larger company, and knowledge of this research does not necessarily permeate to the entire organisation unless there is an appreciation for research by leadership. This theme is discussed in the theme that follows.

5. *Research permeation.* In a similar vein, successful EDUCATE participants who did not have a CEO with a clear vision for research and understanding of their work on the programme experienced limited success as their work would only reflect the aspect of the enterprise the team was involved with. Without Leadership Vision for research fitting into overall strategy, the scope of research activities seemed to be limited. Research initiatives in the EDUCATE programme were born without context for what may be relevant or happening in other parts of the organisation as team members are not always privy to the entire organisation or a view on what would fit with organisational strategy.

Participants also suggested that a lack of Leadership Vision resulted in less overall use and implementation of the findings of

research activities as a result of less communication of findings to the company as a whole and less championing of the findings to relevant departments. Data in this Cycle suggests that if leadership is not involved, research ends up being confined to the vision of the person in charge and may not permeate the entire company. As was explained by Participant 2 in Cycle 1 Interviews: 'A research mindset can be seen in the way leadership explains a company's goals. Leadership team brings in evidence they've drawn on to explain the direction of company and decisions in communications. They explain decisions with evidence – a company's research mindset can be seen in the way leadership explains the company's goals. High quality evidence collection should be a part of business practice'.

Participant 2 explains a recurring theme that came up with Participants, leadership has the role to set the vision and to ensure it permeates the organisation. However, this statement takes it one step further that a research mindset can be gauged in the way leadership justifies decisions and speaks to the organisation. Discussions yielded general consensus that instances where CEOs attended the EDUCATE programme resulted in a more comprehensive research vision, more permeation and continuity of ELTE status. Further research would need to be conducted to validate this statement beyond the current sample of EdWard Level 2 companies, however the next Cycle should look at CEO involvement in successful teams from their perspective in order to explore this further as Participants admitted to having a limited view due to the fact that they did not spend time in companies and cannot be sure of CEO involvement.

**2. Definition of CEO Vision.** The role of the CEO in a RMETE is setting the Sense of Purpose and making sure the conditions are in place in the enterprise to let it come to fruition. As discussed in the themes above, these conditions include: setting the vision for research, devising a concrete plan to allow it to happen, making sure the right teams are in place or people to set up the teams, that research goals and results are communicated to permeate appropriately, prioritise research, remove obstacles so that it all happens and ensure continuity of RMETE status.

In short, CEO Vision speaks to the propensity, (i.e. both the desire and ability) of edtech enterprise leadership to guide research activities. CEO Vision includes an understanding of all six Sub-Constructs on a RMETE – it is the CEO's role to have enough understanding of each to envision how they may play out in their organisation and manage their teams in order to have all they need to do so. Indeed, what is needed for a CEO is not an in-depth understanding of research methods, but rather of research management – i.e. an understanding of what a RMETE is, its Sub-Constructs and a vision for how to implement these aspects into their company in a way that fits, is sustainable and useful.

The CEO of <Company X> that was unanimously agreed upon by Participants in Workshop 2 as having a strong vision was defined by Participant 3 as follows: 'Their vision permeates all activities of the organisation as is seen as empowering their work instead of a drain to resources'. Leadership needs to have a clear vision for how research will strengthen their offering and see it as a part of the whole enterprise and not an isolated task.

The hypothesis at the start of this Cycle was that CEO Vision would be a large part of building a research-minded organisation and the methods of this Cycle were designed with the hypothesis that the research mindedness of the CEO is a large factor in the research mindedness of an edtech organisation and indeed on EDUCATE programme success. However, methods were designed to be exploratory and to include the possibility of a distributed cognition model (Hutchins, 1995) where research knowledge was not all in the head of the CEO. Though research-minded enterprises did appear to have distributed knowledge of research in various ways, what did appear to be true was that CEO Vision is indeed significant and one of six Sub-Constructs that the data seems to point to that seem to be necessary to achieve RMETE status.

I hypothesise the following 'Hallmark Questions' for this Sub-Construct:

1. Does the CEO have a vision for how research fits into their greater organisational goals?
2. Does the research vision match the vision of the company?
3. Does the CEO make the research vision explicit?

These three questions are Hallmark Questions and will be used in Cycle 6 of the Validation Phase of this study to validate the Sub-Construct with a wider group of edtech stakeholders.

Note that due to the design of the EDUCATE programme – and the invitation to enrol any employees without specifying or recommending leadership in particular, there wasn't visibility on all CEOs and leadership by the mentor team who participated in this Cycle of research. No assumptions were made regarding CEOs other than the fact that they gave permission to their team to participate in the EDUCATE programme and therefore prescribe some value to it. Insights into leadership perspective would need to be yielded from interviews with companies in a subsequent Cycle of this research.

#### 4.3.1.5 Sub-Construct 5: Learning Culture

**1. Themes that emerged from the data.** The construct received a 4.1/5 with respect to its importance in Cycles 3 and 4 Validation.

This section will discuss three themes that emerged from the data around this Sub-Construct, which are:

1. Research Culture is not Learning Culture
2. The expert illusion
3. Balance

These themes are presented in the order that emerged as they were coded in the notes. The significance of each theme within the Sub-Construct of Learning Culture is discussed below.

1. *Research culture is not Learning Culture.* Participants believed that though a sound research culture is essential for a RMETE, it does not equate to a culture of learning for the enterprise. Ultimately, Participants held the belief that the ultimate aim of a RMETE is to establish a culture of learning – one that is open, questioning and constantly growing – and knows that learning is a constant. Participants pointed to a pattern of enterprises that did not have a Learning Culture (which they defined as an open attitude of always learning and growing) despite having large-scale research partnerships with major universities and institutions, PhD students focusing on their product and/or randomised control trials. In a representative case below, Participant 4 explains the difference between a research culture and a Learning Culture in a particular edtech SME participating in the EDUCATE programme that is a representative case:

Participant 4: . . . there's another good example of [Company Name]-like, out of the academic world now,

obviously making a . . . I mean, it's out there and it's being used, so tremendous research underpinning the design of the stuff, but just from the conversations I've had with them, thinking through what the teacher development story was or how you get this out into classrooms or how you understand fidelity of implementation and all of those other things, and they're actually doing an . . . they're doing a randomised controlled trial with [University Name] at the moment. So that's a fascinating one, because they're negotiating that. So, it's not really . . . and they've paid for it, they're actually paying University X.

Participant 4 describes how Company X, with a sound research culture, strong Research Mastery (see Section 4.3.1.2) and research partnerships, however they are missing a contextual critical thinking of how it all applies to the classroom and to teachers. In this case, randomised control trials in partnership with a reputable university are seen to yield a gold standard of evidence, meanwhile this evidence is not able to speak to contextual factors around the implementation and teacher development story that is central to success. This enterprise has a great research culture, however data in this Cycle points to the ultimate goal is beyond Research Mastery to a pattern of learning and growth, similar to Dweck's growth mindset (Dweck, 2013) mentioned in the literature review above, but on an enterprise level. The data in this Cycle suggests that the proper implementation of research evidence requires attention and many pivots and changes of dynamic edtech SMEs – and companies with a Learning Culture understand this and work it into their processes.

In the below excerpt, EDUCATE Research Mentors in this Cycle explore the attitude of continuous research and inquisitiveness embodied by this Sub-Construct:

Participant 4: . . . when I started doing (research at university X) and we'd go round lots of different departments and we'd be trying to present them with evidence that

meant that this was a good idea to use this, but it was a long time ago, so there wasn't much evidence. But you could go to the history department and say, you know, 'One lecturer in law says', and they'd go, 'Oh then, that's a good idea', because it was a subject that they thought was like theirs, and it was qualitative data which is what you're using in law and history all the time. But if you went into physiology and said, 'One lawyer said this was a good idea', and they went, 'No, no, we want a big piece of data, you know, we want lots of data that shows etc. etc.'. . . . And I think this is really similar, you know, what counts for them is what they think of as research and what we're doing in one way to contextualise EDUCATE would be, you know, bringing a new research culture into that place.

In other instances, the literature review can be appropriate and the product robust, but the implementation research is under-valued due to a lack of understanding of education research. As a result, randomised control trials may receive the bulk of budget and there may be the idea that this is the gold standard and therefore 'enough' research to prove that a robust learning tool has been developed:

Participant 4: No. <Company X> But there's . . . I mean, we don't know enough about them, we just haven't had enough time with them or anything, but there's another good example of <Company X>-like, out of the academic world now, obviously making a . . . I mean, it's out there and it's being used, so tremendous research underpinning the design of the stuff, but just from the conversations I've had with them, thinking through what the teacher development story was or how you get this out into classrooms or how you understand fidelity of implementation and all of those other things, and they're actually doing an . . . they're doing a

randomised controlled trial with <University X's Education Department> at the moment. So that's a fascinating one, because they're negotiating that. So, it's not really . . . and they've paid for it, they're actually paying the IOE. Also, it's really interesting given that they're doing that.

Participant 2: Yeah.

Participant 4: Somehow that isn't enough. They still came on this.

Participant 2: Yeah, yeah. It is, yeah.

Participant 4: I think that's quite interesting. Why did they not think was enough?

Participant 2: Why didn't they think that was . . . when is enough? Yeah, can you ever get enough research?

Participants are speaking about a company built by researchers, who have strong Research Mastery and research partnerships with universities, and yet they understood EDUCATE's value in developing their understanding further, and they also understand that you can never have enough research and that learning is never done, it is rather a culture with a RMETE.

2. *The expert illusion.* There was a recurring theme noted in this phase where EDUCATE participants who were themselves PhDs and experts in their own fields believed research mentorship would not add to their knowledge. Participant 3 explains that the founder of a participating company in EDUCATE was interested in only the business workshops and mentorship, they had a PhD in science and didn't feel they needed to work on the research side. Learning culture starts from humility at the top and seems to be a greater test when researchers from other fields come to education research and assume they know and are not open to learn'. Participants noted a pattern of fixed mindset towards learning by those with prior developed expertise in their field (Dweck, 2006) which they believed would inhibit the ability of their enterprise to achieve a RMETE status. On the flip side, many of the EdWarded companies were led by humble participants in the EDUCATE programme, listened to and acted on advice suggested by their mentor, came prepared to mentoring sessions with questions and consulted

and debated with a view to learn and grow (Dweck, 2006) – qualities characterising the growth mindset proposed by Dweck.

Some programme participants, on the other hand, were more expert than they knew, didn't call their systematic evidence collection research as they were not familiar with social science research methods. Participant 3 explains one such case of an EDUCATE participant without Research Mastery but with a strong Learning Culture:

I feel I could give them a 5/5 research mindset score even though they might not have had the confidence that they had data and was doing proper research) because they had the curiosity and thoughtfulness. Other people might not have given them a 5 but I'm not like that. They are sole owners, they never took the time out to think about these things and make a document that, in some sense EDUCATE forced them to take time to think but they had the data and were evidence based in their approach anyway. They collect data as part of their everyday stuff. They didn't need to collect more data (as part of her EDUCATE research study)- they collect data regularly.

Participant 3 is describing an instance where the interviewee did not yet have the Research Mastery that would come with participation in the EDUCATE Research Training Programme, however they did have a culture curiosity and culture of learning established in their company. This openness resulted in them yielding so much data that once they gained the knowledge of Research Mastery from the EDUCATE Research Training Programme, they realised they had been collecting high-quality evidence all along. This excerpt also implies that the mindset that comes with a Learning Culture can lead to Mastery, and is perhaps more important than mastery of research (i.e. confidence that comes with mastery that what you are doing is research) – is the importance of being curious, thoughtful, open and inquisitive. The sole owner referred to here was always curious and evidence based in their approach, but it was not until the EDUCATE programme that they realised what they did was evidence collection, however the curiosity that came from her Learning Culture was key to following through with research activities – her openness and desire to learn drove her to do so.

EDUCATE Research Mentors interviewed in this Cycle mentioned situations where research was in fact used as a way of



going around a Learning Culture, confusing individuals by using academic terminology and doctoral credentials to hide a lack of Learning Culture. This quote illustrates one such case:

Participant 4: And [Company Name] is an interesting one although I wouldn't . . . on life and death suggest you go and talk to her. But she's got a PhD in the area, so she knows about research and what she does is she tries to sort of cover up her lack of research on education and the impact by confuddling you with sort of phonological whatever and how you learn elocution. And when you . . . and I think she thought I didn't understand that research, so she'd quote research to me and I'd go and look at it and I'd go, 'Actually . . . you know, it doesn't show quite what you say it shows', so she'd claim, you know, things like the impact on brain structures and I'd be, like, 'Mm, it doesn't quite work like that'. So, she's got a lot of research awareness but it's completely the wrong . . .

Here a researcher with a fixed mindset, who would score very low on this Sub-Construct attempts to confuse their research mentor in order to appear knowledgeable and expert in their field instead of taking the opportunity in mentor meetings to learn as much as possible from their expertise. A fixed mindset results in the missing of many learning opportunities, which in turn will amount to many missed opportunities to improve upon the SMEs learning technologies in question.

3. *Balance*. Participants noted that a Learning Culture requires a balance of asking the right questions and knowing when to stop collecting evidence and using it to make concrete business decisions based on research findings. Practical decision-making when faced with trade-offs emerged as a significant theme in this section, participating researchers unanimously noted that business acumen underpins appropriate research for RMETEs. In this excerpt from a conversation

in Workshop 1, Participants note the difference between academics doing research and research on a RMETE context:

Participant 2: It's about being questioning, isn't it? It's about gathering data and then thinking about the implications of that and questioning those . . . you know, I think it's the balance on, you can't question everything. How do you get the right measure, you know, a company would be a nightmare if all everybody did was generate more questions at the end of every day.

Participant 4: That's why we don't work for companies.

Participant 3: But it is important to have a strategy, to purpose to one target, you know, or some direction.

Participant 2: And that's where the goals and vision come in and that's where there's ideas.

Participant 2: Yeah.

Participants tie research back to the Sense of Purpose (see Section 4.3.1.1) and to business strategy in order to trade-off between asking further questions and coming to a useful decision. This also speaks to the importance of a clear vision (see Section 4.3.1.4), and clear sets of goals for teams (see Section 4.3.1.3) that encourage a Learning Culture while setting boundaries and goals to succeed with daily tasks.

**2. Definition of Learning Culture.** Learning culture is a similar construct to Dweck's (2013) growth mindset, however, it is on the enterprise level. When an enterprise has the knowledge that you must always keep learning in the edtech industry and employees are both open to and facilitated to do so, there is a Learning Culture. Companies have a posture of learning – they know they need to always learn, and this is integrated into their perspective in all they do. Learning is not something you do once and understand what your customer needs and if your product 'works' – it is something you are constantly doing. This Sub-Construct is about genuinely wanting to understand; it is about proactively seeking knowledge that will help to get closer to achieving your purpose. EDUCATE provides a framework on which companies could build; some were more effective because of the Learning Culture that they possessed and the growth mindset their company brought to the programme.

Participant 2 went so far as to say it is the ultimate goal of a RMETE to establish a Learning Culture in the organisation, while Participant 7 commented in Cycle 3 validation survey that 'Learning culture is the absolute basis' for a RMETE. There is a general acknowledgement that this is very difficult to achieve, as establishing a culture of learning – a growth mindset – on a company level requires ongoing and concerted effort by the entire enterprise. Leadership must invest in a culture of learning, not just in a research project or programme – they lead teams to keep their eyes and ears open to question, learn and grow in perpetuity.

Participants believe it is the CEO's goal to champion this culture. Participants suggested that it is through the consistent articulation of CEO Vision, complemented by established processes and encouragement of individual actions that such a culture can be established.

I hypothesise the following 'Hallmark Questions' for this Sub-Construct:

1. Is the enterprise always learning?
2. Is there a culture of openness to knowledge?
3. Are there systems in place to share knowledge inside the enterprise?

These three questions are Hallmark Questions will be used in Cycle 6 of the Validation Phase of this study to validate the Sub-Construct with a wider group of edtech stakeholders.

#### *4.3.1.6 Sub-Construct 6: Action Orientation*

**1. Themes that emerged from the data.** The construct received a 4/5 with respect to its importance in Phase 3, Validation.

This section will discuss three themes that emerged from the data around this Sub-Construct, which are:

1. Most Important Sub-Construct
2. Confidence
3. Sustained Action

These themes are presented in the order that emerged as they were coded in the notes. The significance of each theme within the Sub-Construct of Action Orientation is discussed below.

1. *Single most important Sub-Construct.* In the first Workshop validation (Cycle 2), all Participants unanimously agreed that without action (which they define as doing research and acting on the results), it is

obvious that the enterprise is not a RMETE. In fact, Participants in the first round of validation agreed that the single most important question to ask in order to gauge in RMETE is to ask what research they have done as it has the ability to quickly indicate where their priorities lie. Participants unanimously agreed that this is the most important Sub-Construct as it is the proof of being a RMETE – and without action all efforts in other Sub-Constructs are pointless.

2. *Confidence*. Confidence emerged as a theme in Research Mastery -the confidence of knowing the research plan is sound social science research, however Participants believe that Action Orientation requires a degree of confidence in mastery of all other six Sub-Constructs in order to proceed with product pivots. Participants noted unfavourable results of research which were not acted upon by enterprises that did not have confidence to make changes. A confidence to act implies the culmination of other Sub-Constructs, of efforts to learn and understand what research is, to set goals and to invest in doing the research and to then have the confidence to lean on the evidence to make decisions and pivot the company accordingly.
3. *Sustained action*. Participants held the contention that ongoing Action Orientation is the proof of the culmination that all other Sub-Constructs are working in unison. Participants pointed to EDUCATE companies that did research once in order to receive an EdWard Level 2, however did not continue beyond receiving the award were unable to achieve this sustained action, i.e. the proof of the unity of all Sub-Constructs, and the ultimate proof, they believe, of a RMETE.

**2. Definition of Action Orientation.** This Sub-Construct is concerned with the ability of the enterprise to act on its research vision. Action Orientation can be broken down into two components: (1) doing the research and (2) implementing changes based on evidence yielded from research. RMETEs do research in order to act on findings – they expect to pivot constantly, and leadership has to build flexible processes to accommodate for changes. This Cycle's data points to the dynamism of the edtech SME, and this Sub-Construct expects constant change as RMETEs act on their learnings in perpetuity.

Participant 2 summarised an enterprise with Action Orientation as; they appointed researchers, they've written up the study, they published and shared

their knowledge, they made decisions about their product design based on learnings, they pivoted business practice based on evidence of what works and they are constantly reviewing how to streamline the research Cycle in their organisation. The survey section concerned with this Sub-Construct was the shortest of all six Sub-Constructs (see Appendix G) as the construct is simply concerned with the ability to act on research plans and implement findings.

I hypothesise the following 'Hallmark Questions' for this Sub-Construct:

1. Was the research plan acted upon?
2. Is the evidence that is generated acted upon?
3. How do you balance business goals with educational goals when implementing research findings?

These three questions are Hallmark Questions will be used in Cycle 6 of the Validation Phase of this study to validate the Sub-Construct with a wider group of edtech stakeholders.

#### **4.4 Conclusion**

I began this Cycle of research with the goal of developing a new construct that described a *research-minded educational technology entrepreneur*. After an exploratory Phase, my hypothesis was that the entrepreneur (defined at the leadership of the organisation) would be the most important component in creating evidence-led learning technology enterprises.

After Cycle 1, it became clear that CEO Vision is one of multiple (seven at the time) Sub-Constructs of a RMETE. All information shared in Cycle 1 interviews was summarised into a survey to be validated in Cycle 2 with the same group of expert Research Mentors. In this stage, six Sub-Constructs remained: Sense of Purpose, Research Mastery, Teamwork, Learning Culture and Action Orientation. The survey was revised based on Cycle 2 feedback to get ready for the Evaluation Phase (Cycles 3 and 4), where more EDUCATE Research Mentors and EDUCATE Business Mentors were invited to validate the construct.

The goal of this Cycle was to develop a new construct for an Evidence-Led Learning Technology Enterprise, and this was indeed achieved.

The overarching research question I was seeking to answer in this study is, *How can we develop a research mindset for educational technology entrepreneurs?* As a result of Cycle 2, I was then able to revise this question to be more precise for Cycle 3. The overarching research question would now be,

*What theoretical framework supports edtech enterprises to build evidence-informed products and services?*

This question is rephrased to operate at the enterprise level due to learnings in this Cycle and the conclusion that this knowledge is distributed across the company in six Sub-Constructs and not only dependent on the entrepreneur(s) in question. It is also more precise in that it indicates the development of a theoretical framework instead of generally asking how such a capacity can be developed. Finally, it moves away from the research mindset, a construct that is not appropriate on an enterprise level where data in this Phase suggested that knowledge is distributed and moves to build evidence-informed products and services, which is more accurate, as it is the goal behind the implication of a research mindset.

This research question will be answered through four research objectives, which are summarized below.

1. *Explore the features of a research-minded entrepreneur within the context of edtech.* Section 4.2 in this Cycle articulated fully the process of development and exploration of features of a research-minded entrepreneur in this context. Section 4.3.1.2 expanded on the role of the research-minded entrepreneur of the edtech enterprise, and Appendix G points to all the validated facets of CEO Vision in detail.

A finding of the explorations of in Cycles 1 and 2 yielded that the CEO Vision is one of six Sub-Constructs of a RMETE. All Sub-Constructs are presented and discussed in Section 4.3, and all facets of each Sub-Constructed can be found listed in the RMETE survey in Appendix G.

2. *Explore if and how a research mindset is distributed across individuals within an organisation.* In Cycle 1, I explored whether a research mindset is distributed with distributed cognition question in the first Cycle. The was found to be true, and the construct was in fact shifted in scope from the research mindset of an individual to the propensity of the enterprise to conduct research. This allowed for the more precise naming of the construct from a research mindset in edtech entrepreneurs a Research-Minded EdTech Enterprise and an exploration of six Sub-Constructs (Sense of Purpose, Research Mastery, Teamwork, CEO Vision, Learning Culture and Action

Orientation) that are distributed amongst staff and team members in varied ways. This hypothesis, however, needs to be evaluated with other research and business experts in the next Phase.

3. *Assess whether EDUCATE's definition the EdWard Level 2 is appropriate.* In order to assess the current definition, it would be necessary to validate this Cycle's findings with companies in the field. Only after speaking to enterprises will the RMETE be validated enough to comment on whether RMETE is a useful framework and whether there were elements that mentors on the EDUCATE team (i.e. the Participant in Cycles 1 and 2) were blind to because of the design of the programme (seeing teamwork in action, seeding CEO and Leadership Vision, guidance and support of research activities, etc.). This would allow for commentary on the appropriateness of EdWard criteria and suggestions for amendments. However, prior to doing so, there is a necessary Evaluation Phase where these constructs are further checked prior to being sent out for validation.
4. *Offer guidelines on how to develop an understanding of research and evidence in edtech enterprises.* This Cycle did not address this item; however, it did shed light on the fact that this item may be out of the scope of this study will justify later in Section 7.4. The focus in this study was to allow the theory to stabilise so that further research can be conducted on how it may be operationalised.

The goal moving to Cycles 3 and 4 was to evaluate the new construct in preparation for validation with SMTs and wider stakeholders. The Phase will move forward to evaluate the emerging RMETE survey both by EDUCATE edtech companies and the greater stakeholders in the edtech ecosystem to see if EDUCATE Research and Business Mentor beliefs stand outside the context of the EDUCATE programme.

## **Chapter 5: Part 2 – Evaluation Phase (Design-Based Research Cycles 3 and 4)**

### **5.1 Introduction**

The goal of this chapter is to evaluate the new construct developed in the previous Phase of this study and to assess it with other researchers with experience with edtech entrepreneurs and finally with the EDUCATE business team. The chapter ends with a discussion of findings and next steps for further validating and refining the construct based on results from this chapter.

### **5.2 Methods**

This Evaluation Phase, as seen in Figure 19, is the middle two Cycles of this study, whose goal it is to further assess the viability of the construct ahead of the Validation Phase with edtech companies and the global edtech ecosystem.

#### ***5.2.1 Evaluation Phase Participants (DBR Cycles 3 and 4)***

##### *Cycle 3 Participants*

In this Cycle, the four remaining members of the EDUCATE Research Mentor team were invited to evaluate information presented by Previous participants. Participants in this survey were research team members whose mentee companies did not have EdWard Level 2s. The aim of this Workshop was to test the survey with a higher level of scrutiny with those who were not involved in the initial interviews, were unfamiliar with my methods and had never before seen the content of the surveys. The idea was to further test and stabilise the survey prior to testing it 'in the wild' (Hutchins, 1995).

#### ***5.2.2 Cycle 3 and Cycle 4***

The content of workshops conducted in the Evaluation Phase were identical in content and they were administered in the morning and afternoon of the same day. The purpose of Workshop 2 (Cycle 3) and Workshop 3 (Cycle 4) was the evaluation of the RMETE construct outside the original expert Participants. Both sets of Participants received a revised version of the survey that included amendments that had been made after Cycle 2 (see Appendix G), and Participants were given 90 minutes to complete it individually and in silence.



Validation procedure was identical to that used in the previous Cycle; see Section 4.2.5 for a detailed description of how this activity was analysed.

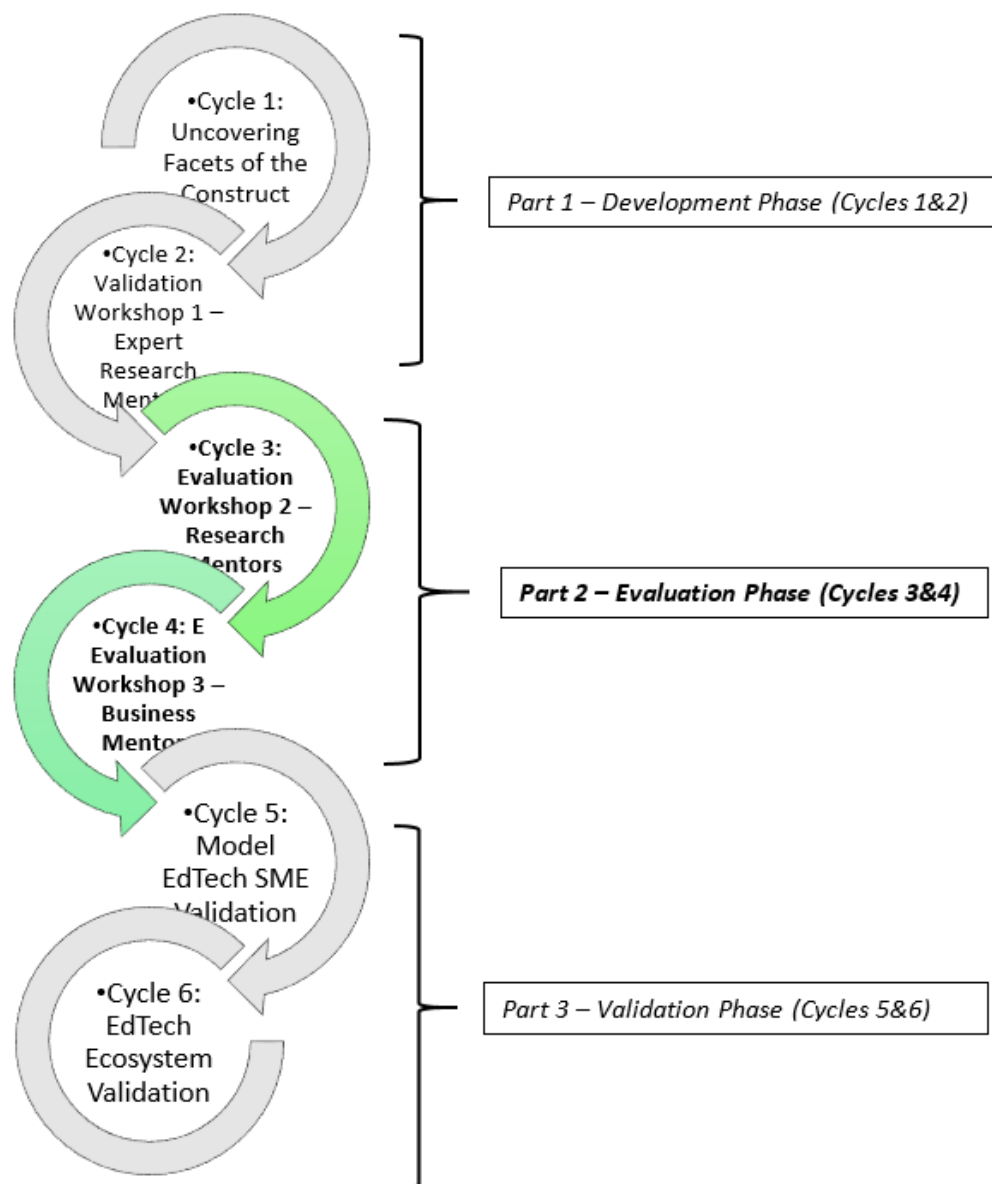
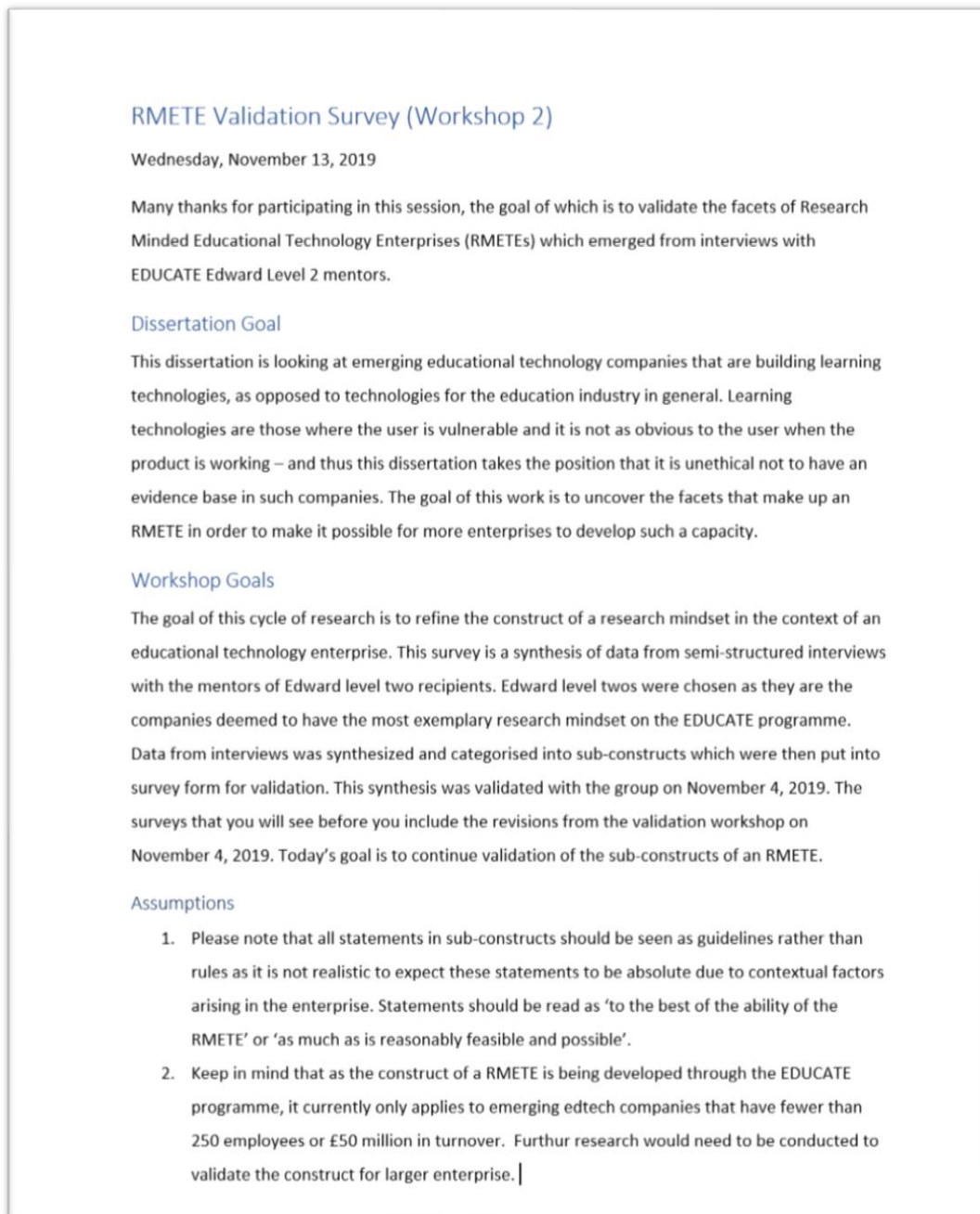


Figure 19. The two Cycles of Phase 2.

The one major difference in approach related to Activity 2 as it was not the debating game originally conceived for Cycle 2 but rather an open-ended question. The open-ended nature of this question was Sanders and Stappers (2008) in order to allow for Level 3 or 4 creativity so as not to be limiting for those Participants in these Cycles that wanted a blank canvas to offer ideas and thoughts. Cycles 3 and 4 were also analysed in identically to Cycle 2 (See 4.2.4).

Instructions for this Cycle of workshops are in Figures 20 and 21. Prior to beginning, all Participants signed an ethics form (see Appendix D). I read the

survey instructions aloud to all Participants, and I gave them an opportunity to ask questions regarding the context of the study and any general questions prior to beginning. As Participants were not aware of the first two Cycles of research in this Cycle, the study goal and the goal of the Workshop, Participants were provided this context by being read aloud the script on the first page of the Workshop handout. They were taken through all relevant assumptions and clarified on the use of vocabulary. Please see Figures 20 and Figure 21 for full script and instructions.



The image shows a document titled "RMETE Validation Survey (Workshop 2)" dated Wednesday, November 13, 2019. The document contains the following sections:

- RMETE Validation Survey (Workshop 2)**  
Wednesday, November 13, 2019
- Many thanks for participating in this session, the goal of which is to validate the facets of Research Minded Educational Technology Enterprises (RMETEs) which emerged from interviews with EDUCATE Edward Level 2 mentors.
- Dissertation Goal**  
This dissertation is looking at emerging educational technology companies that are building learning technologies, as opposed to technologies for the education industry in general. Learning technologies are those where the user is vulnerable and it is not as obvious to the user when the product is working – and thus this dissertation takes the position that it is unethical not to have an evidence base in such companies. The goal of this work is to uncover the facets that make up an RMETE in order to make it possible for more enterprises to develop such a capacity.
- Workshop Goals**  
The goal of this cycle of research is to refine the construct of a research mindset in the context of an educational technology enterprise. This survey is a synthesis of data from semi-structured interviews with the mentors of Edward level two recipients. Edward level twos were chosen as they are the companies deemed to have the most exemplary research mindset on the EDUCATE programme. Data from interviews was synthesized and categorised into sub-constructs which were then put into survey form for validation. This synthesis was validated with the group on November 4, 2019. The surveys that you will see before you include the revisions from the validation workshop on November 4, 2019. Today's goal is to continue validation of the sub-constructs of an RMETE.
- Assumptions**
  1. Please note that all statements in sub-constructs should be seen as guidelines rather than rules as it is not realistic to expect these statements to be absolute due to contextual factors arising in the enterprise. Statements should be read as 'to the best of the ability of the RMETE' or 'as much as is reasonably feasible and possible'.
  2. Keep in mind that as the construct of a RMETE is being developed through the EDUCATE programme, it currently only applies to emerging edtech companies that have fewer than 250 employees or £50 million in turnover. Further research would need to be conducted to validate the construct for larger enterprise. |

Figure 20. RMETE Evaluation Workshop Instructions

Vocabulary

Please note that a Research Minded Educational Technology Enterprise is abbreviated as a RMETE. *Enterprise* may be used interchangeably with *business*, *company* and *corporation*. The *CEO*, *founder* and *leadership* is used interchangeably to refer to the head of the enterprise.

Ethics Forms

Kindly ensure you've signed the ethics approval forms before we begin.

Figure 21. RMETE Evaluation Workshop Instructions, Part 2.

I then read instructions for Activity 1 aloud to Participants, once again giving them a chance to ask questions regarding the instructions prior to proceeding silently to complete the survey (Figure 22).

Activity 1: RMETE Construct Validation Survey

Below are six sub-constructs of a research mindset that have emerged from interviews. Statements within each sub-construct were said at least once and sometimes unanimously in mentor interviews. The purpose of this activity is to get your opinion on the various statements. Activity 1 is designed as an individual activity to be completed silently.

For each item, please circle one of the following: **T for true**, if you agree with the statement; **C for true with corrections**, if you believe the item is true given your in-line corrections; **D for delete**, if you completely disagree with the statement. Please also mark: the **star symbol (★)** if the item is **necessary** to have to achieve a research mindset and mark **L2** if, *though you agree with the statement, you feel it is an advanced or aspirational ask* and not necessary to have be considered a research minded enterprise in this context. Please feel free to justify your response along the columns or in-line.

At the end of each section, please report on the scale how you feel about this facet's importance within the context of a research mindset.

Example:

Please mark the importance of Research Mastery in the RMETE construct on the scale below.

Desirable .....X.....Must Have

Space has been allocated to justify your response and to make general comments on the sections should you wish. Please feel free also to mention any items you feel are missing or any examples of experiences you have had with EDUCATE companies that help to illustrate a point.

Figure 22. RMETE Evaluation Workshop 2, Activity 1 instructions.

Participants took approximately 60 minutes to complete surveys. Once all Participants had completed a survey, I read Activity 2 instructions aloud. Please see Figure 23 for Activity 2 instructions.

Activity 2: Exemplary EDUCATE Enterprises

Choose the two EDUCATE companies you have interacted with that you feel have the highest RMETE and mark where they fall on the below scale.

0 RMETE ..... 5 RMETE

Please justify your answer below:

Figure 23. RMETE Validation Workshop 2, Activity 2 instructions.

This procedure had two goals: firstly, to see if EdWard Level 2 was truly the best measure of research mindedness, and secondly, to elicit further justifications of research mindedness. In keeping with Cycle 2, the score was irrelevant and used as a tool to extract comments and insights regarding the construct under development (i.e., RMETE).

#### *Approvals Process*

The approvals process was identical to Cycle 2 (as described see section 4.2.5 for description) where all survey questions were collated into an Excel spreadsheet (as seen in Figure 18 of Section 4.2.5), and the 'Overall Recommendations' column indicated my recommended amendments based on equal vote count of Participants. Controversial cases were presented to Dr Alison Clark-Wilson, EDUCATE Research Lead, for a second opinion and marked in the column for 'Supervisor Approval'.

### *Evaluation Phase Analysis: Cycles 3 and 4*

The goal of this Phase of survey evaluation was to stabilise. Once results were stabilised, the items could be validated within the context of the EDUCATE programme and would be ready for further validation. In these two Cycles, the RMETE surveys were administered in an identical way, but in two different workshops: one Research Mentors (Cycle 3) and one Business Mentors (Cycle 4). Results were analysed together by combining all data into a spreadsheet identical to the one presented in Cycle 2 (section 4.2.5); where suggestions were controversial, I presented my determinations to Dr Clark-Wilson, Research Team Lead, for approval, exactly as I did for Cycle 2.

### *Cycles 3 and 4 Results*

Items further stabilised in this Cycle, with all six Sub-Constructs being unanimously approved and no statements being deleted. However, feedback and amendments were highly helpful in reviewing phrases for clarity in preparation for Cycle 3.

Although it was not a goal of this Phase, another outcome was a hypothesis of how facets in the construct might interact with one another. In Figure 24, I hypothesise that ELLTE facets presented and validated in this Cycle interplay with one another in certain steps and in a cyclical order. The below model attempts to show their interaction in practice. Cycle 3 methods will present how it will be validated.

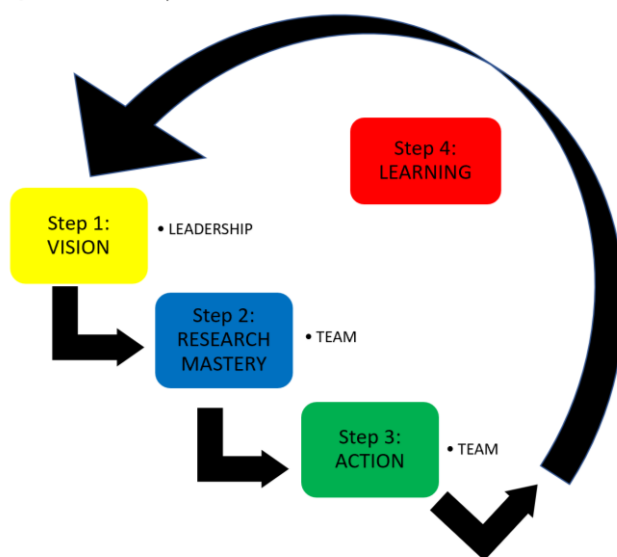


Figure 24. ELLTE Action Model.

## **5.2.3 Evaluation Phase Construct Revisions**

### *5.2.3.1 Refining Construct Name*

One of the most significant results of Phase 2 was the need to name the construct more precisely. It began as the Research-Minded Educational Technology Enterprise (RMETE) as my initial hypothesis was that the founder of the enterprise, and in particular their personal research mindset, was the most crucial factor for building evidence-informed educational technologies. This assumption was underpinned by the Cycle 2 literature review (see Section 3.3.7), which defined and explored the concept of mindset as an attitude of the individual. However, within the frame of this exploratory study, the literature review on distributed cognition (see Section 3.3.9) introduced the possibility that the knowledge and ideas of the enterprise are not confined to the mind of the entrepreneur of the enterprise. The multiple Cycles of research that took place during Phase 1 (see Chapter 3) adopted distributed cognition as a more appropriate framework within which to understand edtech enterprises that are evidence informed. Consequently, the name of the construct was amended to the Evidence-Led Learning Technology Enterprise (ELLTE) to reflect the construct more precisely. This section introduces and discusses the six Sub-Constructs of an ELLTE that emerged during the study.

### *5.2.3.2 Hypothesising the Construct in Action: ELLTE Action Model*

The ELLTE Action Model is a hypothesis attempting to depict how these six Sub-Constructs might interact in practice. The model proposes that ELLTEs Sub-Constructs follow a research Cycle which seem to follow four steps. This hypothesis emerged following interviews with Participants during Phases 1 and 2. The ELLTE Action Model suggests the four steps as in Figure 25.

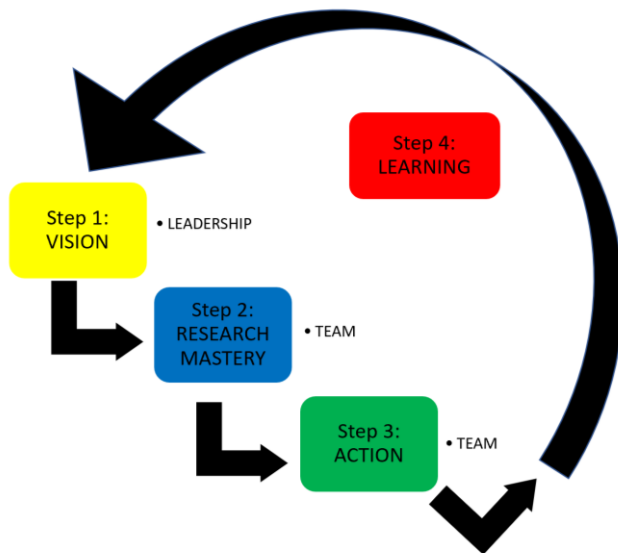


Figure 25. ELLTE Action Model.

Each step of this model is now outlined.

Step 1: Vision is mostly the responsibility of leadership – to make sure the vision of the overall business is in line with research vision and to create a plan so that the team has priority and incentive to carry out this vision.

Step 2: Mastery refers to Research Mastery – it refers to an understanding of how education research works as it is the responsibility of the team. Leadership should have enough mastery of research to set the vision but not for execution – it is the team that must have a depth of mastery.

Step 3: In the Action Phase, it is the team that is charged with the execution of the initiative.

Step 4: Learning outcomes of the experience are fed back to leadership so that they may take learnings into consideration for the next Cycle.

The ELLTE Action Model was then used as a boundary object in conversations with Participants in Cycle 5 to assess its validity as an accurate abstraction of reality.

#### **5.2.4 Recommendations**

There are two major limitations to the construct that has been developed: (1) It has made assumptions about the EdWard Level 2 enterprises in the EDUCATE programme without their confirmation of said assumptions by EDUCATE team and (2) it has been developed in the EDUCATE programme and must be validated by individuals within the edtech section but beyond the current context.

### *Assumptions about EDUCATE EdWard Level 2 Enterprises*

At this stage in the research, the emerging construct has many assumptions regarding the enterprise context; research is limited by the impression of Research Mentors. As a result, this new construct will be validated by EdWard Level 2 companies themselves in the next Cycle.

### *Assumptions about Greater Use of the Construct*

The goal of this study is to develop knowledge that will be beneficial for edtech enterprises to build evidence-informed products that are useful for the ecosystem. At this point, the Sub-Construct and their facets have stabilised and passed the internal evaluation with EDUCATE Research and Business experts. Clear definitions emerged, which were shared in discussions, and the construct name was changed to an Evidence-Led Learning Technology Enterprise to more accurately reflected the construct in question. An ELLTE Action Model was also hypothesised, proposing how these Sub-Constructs might interact in action.

As such, the next Cycle would also need to test the framework on a sample outside the EDUCATE programme that represents a cross section of stakeholders in the edtech industry. Their impressions of the construct of an ELLTE, its six Sub-Constructs and many facets as outlined in the ELLTE Survey (see Appendix H) will be important in the validation of the framework for its practical use.

My recommendation was that the next Phase have two Cycles: Cycle 5, in which EdWard Level 2 companies were given a chance to validate and give feedback on their experience and the validity of this construct, and Cycle 6, in which a sub-section of greater edtech stakeholders (enterprises, researchers, pupils, educators, policy makers and investors) from a cross section of localities and nations had a chance to participate.

If ELLTE stabilised in Cycle 6, this thesis would conclude with addressing sub-question 3, namely '*assess whether EDUCATE's definition of the EdWard Level 2 is appropriate*', as well as allowing for a conclusive discussion around the overall research question: *What theoretical framework supports edtech enterprises to build evidence-informed products and services?*



## Chapter 6: Part 3 – Validation Phase (Design-Based Research Cycles 5 and 6)

### 6.1 Introduction

The goal of Cycles 3 and 4 was to evaluate ELLTE, a new construct that would work as a theoretical framework to support edtech enterprises to build evidence-informed products and services. This was done through workshops with the expert Research and Business Mentor teams of the EDUCATE programme (see Section 5.2). The goal of the Validation Phase was to validate on two levels, firstly with EdWard Level 2 EDUCATE companies (i.e. EDUCATE ELLTE companies) in Cycle 5, and secondly with stakeholders in the greater edtech ecosystem outside of EDUCATE in Cycle 6. Ultimately, the Validation Phase sought to test the ELLTE framework ‘in the wild’ (Hutchins, 1995) to see if it stood to answer the overarching research question of this study: **What theoretical framework supports edtech enterprises to build evidence-informed products and services?** This Cycle also aimed to ‘*assess whether EDUCATE’s definition of the EdWard Level 2 is appropriate*’ and, if not, to offer suggestions on changes.

### 6.2 Methods

The two Cycles of the Validation are visualised by Figure 26.

This Validation Phase’s data are grounded in the knowledge of two communities of practice: Cycle 5, EDUCATE EdWard Level 2 SMEs, and Cycle 6, members of the global edtech ecosystem. Cycle 5’s goal was to validate ELLTE with the EDUCATE companies on whose programme experiences previous Cycle Participants modelled the construct. The Cycle validated ELLTE with a range of edtech stakeholders in the greater ecosystem outside of EDUCATE – this was done via a Workshop at the European EdTech Network meeting in Oulu with a group of 40 members of the edtech ecosystem from around the world.

Methods in Cycle 5 followed a similar pattern for Cycles 2, 3 and 4, for reasons justified in the sections that follow.

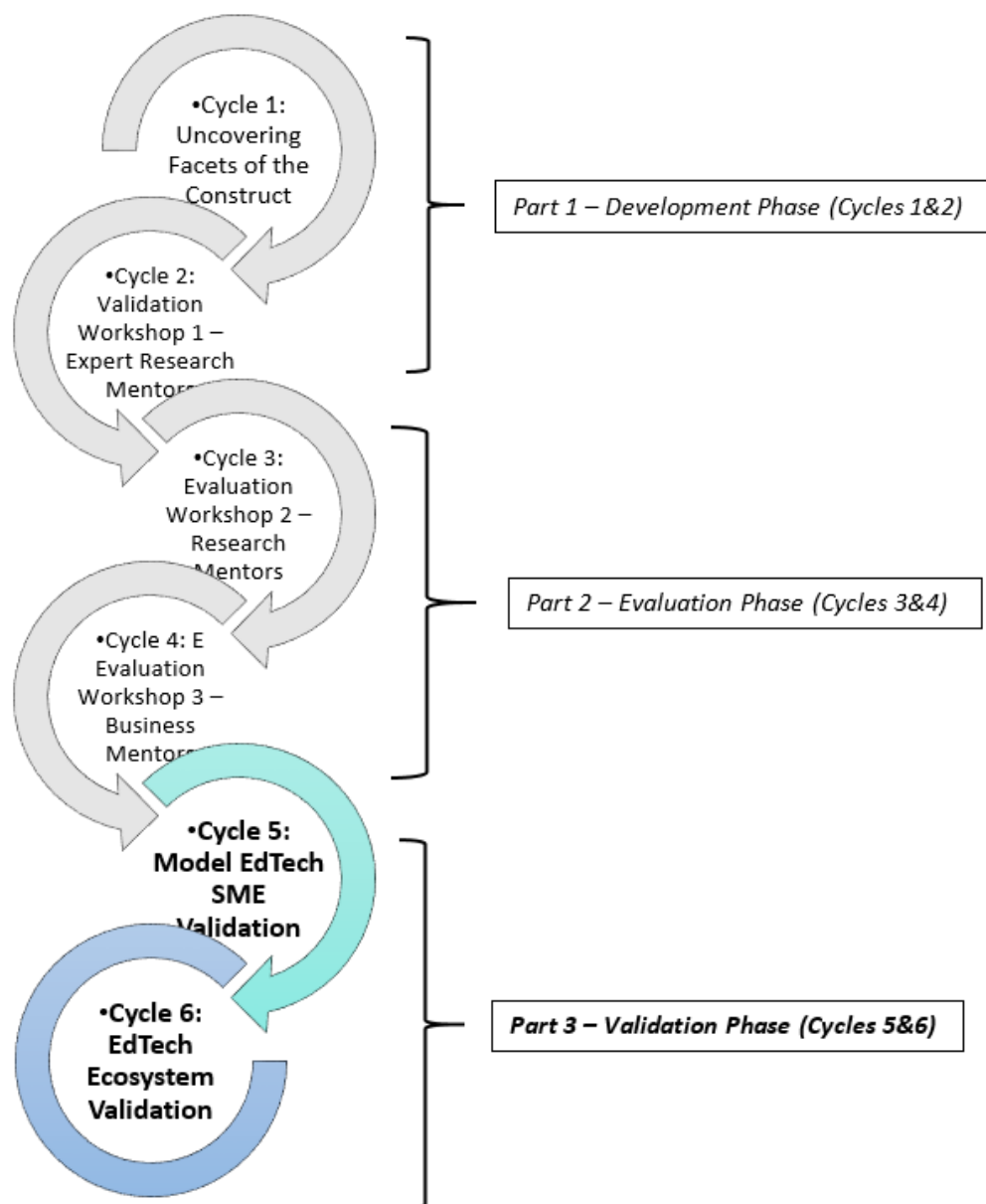


Figure 26. The two Cycles of Phase 3.

### 6.2.1 Cycle 5: Participants – EDUCATE EdWard Level 2 Companies

This construct was developed based on the EDUCATE Research and Business Mentors' perceptions of their experiences with EDUCATE EdWard Level 2 companies; therefore all 14 EdWard Level 2 companies that were referred to in Cycle 1 were invited to participate in the research Cycle, of which nine were able to participate in this Cycle. Reasons for non-participation included that the EDUCATE participant had left the company or the timing of Cycle 5 interviews did not work for the company.

### **6.2.2 Cycle 5: Procedure**

Interviews were held in Participants' offices or via Zoom and were scheduled for 90 minutes. Interview materials included (1) a printed ethics form, to be filled out or sent via email to complete online at the start of the interview (see Appendix D); (2) a printed ethics brochure to be reviewed at the start of the interview (see Appendix D); (3) a printed ELLTE Construct Validation Survey to be completed during the interview or emailed at the start of the interview, completed during the interview, and emailed back at the end (see Appendix H); and (4) recording tools (Microsoft OneNote for primary recording and iPhone standard phone recorder for back-up recording).

#### *Step 1. Reading the Script*

An identical procedure was followed for every interview. Every interview began with an informational introduction, during which I read the following script:

Hello, thank you for being here – it's so nice to see you again. I'm nearing the end of my doctoral studies. The purpose of today is to try to get a better picture from you of what a research minded edtech enterprise looks like in practice. The goal of today is to validate the definition of what an Evidence-Led EdTech Enterprise looks like and to get your opinion on a model designed to explain the process of research in an edtech start-up. Your feedback is invaluable in this process as you have been identified by the EDUCATE team as a model company. I really appreciate your time.

I know I said that there would be a survey to do before this – but I thought I would save you some time and fit it all in our 1.5 hours today. So, if you don't have any questions we can get started with the survey.

This was done to ensure that Participants and I had the same expectations going into interviews and that I could answer any general questions.

#### *Step 2: Ethical Approvals*

Participants were then asked to review the UCL-approved ethical brochure and to sign the ethics form (see Appendix D). This was done to ensure that all ethical forms were understood and signed prior to any other engagement with Participants, in line with UCL guidelines.

#### *Step 3: Interview Part 1 – ELLTE Validation Survey*

I then read the first page of the ELLTE Validation Survey (see Appendix H) and answered any questions regarding how to fill out the survey. Participants were prompted to complete the survey. See Figure 27 for a full script.

Participants had as much time as they needed to complete the survey.

## ELLTE Construct Validation Survey

January/February 2020

Thank you for participating in this landmark study the goal of which is to validate the construct of an Evidence-Led Learning Technology Enterprise (ELLTE). You have been identified as a model ELLTE and your feedback is invaluable to this process.

### Ethics Forms

Kindly ensure you've signed the ethics approval forms before we begin. Information brought up today is part of a study and we are doing recordings. Here is the consent form which explains that everything will be anonymized when published. I would like to formally acknowledge and thank you in my doctoral dissertation for participation as a model company and I can mention your case in published papers moving forward, however there will be no mention of you without your explicit approval.

### Context of Study

As you know, we've worked with 252 companies on the EDUCATE programme. In doing so, our team of research mentors have built further expertise in educational research in the context of edtech entrepreneurship and many ideas and hypotheses have arisen from this engagement. We really don't know if we've got it right - so now we are bringing them to you to get your perspective on things. Companies taking part in this study are all different size and stages of development and I'd like to see if I am on the right track with understanding what it means to be a research minded edtech enterprise.

### Dissertation Goal

This dissertation is looking at emerging educational technology companies that are building learning technologies, as opposed to technologies for the education industry in general. The goal of this work is to uncover the facets that make up an ELLTE in order to make it possible for more enterprises to develop such a capacity.

Figure 27. ELLTE Validation Survey, page 1.

Survey validation was the first part of the interview for two reasons: (1) The central goal of this Cycle was to validate this survey 'in the wild' (Hutchins, 1995), and I wanted to ensure Participants had as much time as they needed to answer questions, and (2) the survey would allow for an introduction to the construct in detail prior to the semi-structured portion that followed, where Participants would be able to expand upon survey statements.

#### *Step 4: Interview Part 2 – ELLTE Action Model*

The final portion of the interview was semi-structured. I read the following script to each Participant:

For the first part of the interview, you reviewed the facets of an ELLTE. The model of the last page of the survey packet (see the last page of ELLTE Construct Validation Survey for a model image) attempts to show Sub-Construct interaction in practice. From the research so far, it seems

that ELLTEs follow certain steps in a cyclical order. After going over each step together I would like to get your opinion on whether you agree that this is how the steps work in practice.

Step 1: Vision is mostly the responsibility of leadership – to make sure the vision of the overall business is in line with research vision and to create a plan so that the team has priority and incentive to carry out this vision.

Step 2: Mastery refers to Research Mastery – it refers to an understanding of how education research works as is the responsibility of the team. Leadership should have enough mastery of research to set the vision but not for execution – it is the team that must have a depth of mastery.

Step 3: In the Action Phase, it is the team that is charged with the execution of the initiative.

Step 4: Learning outcomes of the experience are fed back to leadership so that they may take learnings into consideration for the next Cycle.

As in previous Cycles, central to the development of this Cycle was the employment of participatory design principles to allow for the opportunity to co-design the ELLTE construct with Participants. The ELLTE Action Model was chosen as a strategic boundary object to allow this Cycle's Participants to take part in the design process according to their level of ability. This opportunity to co-design the ELLTE Action Model was seen as a practice in further validation and a means to extract details not otherwise shared in the ELLTE Validation Survey commentary.

Once again, I gauged the expertise level of Participants according to Sanders and Stappers (2008): 'In order for them to take on this role, they must be given appropriate tools for expressing themselves' (p. 12; see Table 3). In Cycles 1 and 2, where Participants had the greatest expertise, methods were designed along Levels 3 and 4 in Table 3. In Cycles 3 and 4, where Participants' level of expertise moved lower, methods were designed along Levels 2 and 3 for validation.

I identified Participants as Level 2 (adapting, i.e. 'providing scaffolds that support and serve people's need for creative expression at the "making" level'; Sanders & Stappers, 2008, p. 14) for two reasons: (1) Though they are the closest examples of EDUCATE ELLTEs, the EDUCATE programme had just ended and they did not have an opportunity to reflect on and use their knowledge, thus the implementation of research processes was still relatively new within their organisations, and I did not want to overwhelm them by giving them open-ended Level 3–4 questions, and (2) as this project is an academic exercise, and they were being presented with a theoretical construct and an

abstract framework, I wanted to give them a more concrete and visual model to work with in order to help frame their responses.

I then read aloud the following set of prompts to scaffold the conversation. These questions were used as talking points to scaffold the conversation and were by no means answered exhaustively; rather, questions were presented as talking points, and Participants answered items that stood out most to them or for which they had experiences and opinions.

1. Regarding Step 1 – Vision: What is your company and research vision? Was it made explicit? How do they inspire the team? Who leads your research strategy? Why do they do research? (That is, what is the value they see in research?) Did they always have a research strategy? Do you have an outline? Who is involved in that?
2. Regarding Step 2 – Mastery: Who worked on the study? Did it relate to the vision? In what way? Where did you develop your Research Mastery and was it adequate for the task? What was the research goal of the study you did with EDUCATE? Is this the only study? What were the other goals?
3. Regarding Step 3 – Action: What happens next with the project you designed on EDUCATE? How about the other research projects has your company done? How many times have you been around the loop? What were the barriers and what were the facilitators to making research happen in your company? Do you have more research support or resources?
4. Something for Step 4 – Learning: How does your feedback loop work? Who does it and what does it look like in practice? How would you facilitate communications about research findings? Who feeds back to whom and how? What might be better in your opinion and what are the barriers?
5. Regarding ELLTE Action Model: Overall, do you agree with this figure or does it look different in your organisation? Do you feel anything is missing? Feel free to sketch changes if you do not agree in any way with the model.

As previous Cycles, it must be noted that Participants were not discouraged from sharing higher level feedback and ideas in conversation and were given the chance to operate at Level 4 with open-ended questions;

however, the design of the workshops did not depend on this level of expertise, and indeed feedback was often given appropriate to the aforementioned assumed level of Participants.

### **6.2.3 Cycle 5: Analysis**

All survey feedback for Interview Part 1 was compiled into an Excel document that was structured identically to Cycle 2's compilation document (see Appendix H). The compilation and data analysis process was identical to that done for the survey in Cycles 2–4 (see Section 4.2.5).

All data for Interview Part 2 were then compiled into NVivo. The goal of this Cycle was not to validate the ELLTE Action Model but rather to use the model as a tool to scaffold conversation alongside semi-structured interview questions that were relevant to each step of the model. After survey completion, to further assess whether Participants were in agreement with each Sub-Construct and whether ELLTE was an accurate abstraction of practice, all semi-structured interview notes were coded in NVivo by Sub-Construct of relevance under 'Yes, statement is in agreement with the current definition of the Sub-Construct' or 'No, statement is not in agreement with the current definition of the Sub-Construct'. Cycle 2, items were coded by theme to uncover the emerging definitions of each Sub-Construct from the data. The goal of the Cycle was validation, therefore items were coded 'Yes' or 'No' within each Sub-Construct category in NVivo depending on if feedback supported or negated data from the last Cycle in order to achieve the goal of this Cycle, which was ELLTE validation. These statements were then used to feed the discussions that follow.

### **6.2.4 Cycle 5: Results**

Cycle 5 interviews were completed the week prior to Cycle 6; therefore, in-depth analysis was not done until Cycle 6 was complete. However, survey responses were reviewed in order to identify whether any contentious items should be deleted. There were no such items; therefore the same version of the survey was given to Cycle 6 Participants for validation.

The only significant change at this point was a further refinement of the construct naming, as it became clear from Cycle 5 data that it is not realistic to expect model companies always to be led by evidence; rather, developers suggested that *evidence-informed* is a more accurate term for what can be expected of model companies in practice. As such, the construct itself was

renamed from ELLTE (Evidence-Led Learning Technology Enterprise) to ELLTE (Evidence-informed Learning Technology Enterprise) prior to the EETN Workshop. After Cycle 5, it became clear that implying that model edtech enterprises can always be led by evidence is both unreasonable and inaccurate – they are faced with trade-offs and make evidence-informed decisions wherever possible. Participants unanimously shared this feedback, and the construct was adjusted accordingly. Please note that the 'I' of informed was not included in the acronym for ease of pronunciation in the forthcoming Workshop and, as it is hyphenated, was considered one word.

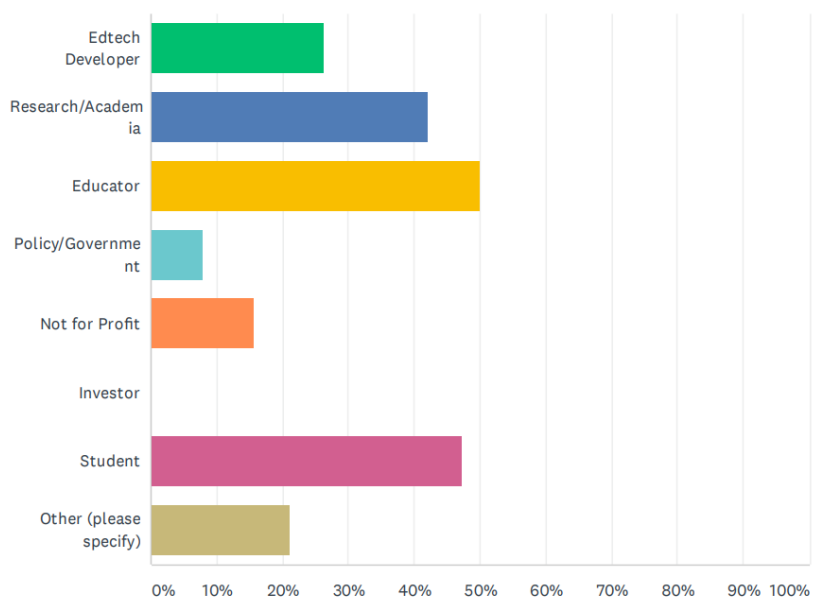
### **6.2.5 Cycle 6: Participants – EETN Workshop**

This Cycle of research was designed to further validate the construct with a Workshop at the European EdTech Network (EETN) conference in Finland in February 2020. I was given a 1.5-hour Workshop in which to implement the survey with workshop Participants. This Workshop was the first test in the wild and an opportunity to share findings with Participants from a cross section of countries and backgrounds in the edtech ecosystem who were interested in the most recent work in edtech. A brief introduction to the EDUCATE programme (see Appendix I) was followed by the survey, which was administered on SurveyMonkey. Once the survey was complete, I initiated a discussion of the Sub-Constructs to gauge whether there were disagreements with the content overall. Figure 28 shows the demographics of the 40 participants in the programme, who comprised a cross section of edtech developers (26%), researchers/academics (42%), educators (50%), policy makers/government (8%), not for profits (16%), students (47%) and other stakeholders in the edtech ecosystem (21%). These roles were not mutually exclusive, and respondents could indicate as many labels as they identified with in their current work.



## Q11 Your work: (please mark all that apply)

Answered: 38 Skipped: 2



ANSWER CHOICES	RESPONSES
Edtech Developer	26.32% 10
Research/Academia	42.11% 16
Educator	50.00% 19
Policy/Government	7.89% 3
Not for Profit	15.79% 6
Investor	0.00% 0
Student	47.37% 18
Other (please specify)	21.05% 8
Total Respondents: 38	

Figure 28. Cycle 6 Participants.

A brief description of the EETN follows.

The EETN is a project co-founded by the European Commission that brings together edtech experts, innovators, higher-education professionals and students in order to connect the best specialists with the most creative minds from all over the Europe and provide them with the most relevant edtech content, to foster innovation in the field of higher education on the European market.

We would like this innovative platform to become a place where ideas, solutions, information and best practices in the field of edtech can be exchanged between all the parties, to boost the development of the European edtech sector.<sup>4</sup>

<sup>4</sup> <https://eetn.eu/>

The EETN is a 3-year project funded by the European Commission within the Erasmus+ Strategic Partnership for Higher Education programme. It is the first strategic partnership in the EU to bring together *teachers, researchers, students* and *entrepreneurs* in the field of education and digital technologies, through university-managed innovation programmes, including incubators and accelerators, in order to promote digital methodologies and pedagogies that will ultimately improve higher education systems in Europe.

Four leading European universities – IE University, University College London, KU Leuven and Oulu University of Applied Sciences – decided to join their efforts, using their knowledge and broad experience in the field of edtech to create this unique, collaborative space for all the players on the European edtech scene and beyond.

#### **6.2.6 Cycle 6: Procedure**

Two of the items in original Sub-Constructs of the ELLTE framework as seen in the ELLTE Survey (Appendix H), *Sub-Construct 4: Teamwork #6* and *#8*, were revised to fit with the context of the survey implementation:

1. *Teamwork #6*: A one-person company can engage in teamwork – collaborating with community (e.g. EDUCATE programme mentors and other participants) as an extension of their team to work through research issues.
2. *Teamwork #8*: Ideally, a CEO, research and business team should attend EDUCATE research training and discuss all together each role's perspective and realise research solutions that are useful for the entire organisation.

To amend the survey to be appropriate for testing 'in the wild' (Hutchins, 1995), these items were changed:

1. *New Teamwork #6*: A one-person company can engage in teamwork – collaborating with external edtech community as an extension of their team to work through research issues.
2. *New Teamwork #8*: Ideally, a CEO, research and business team should attend research meetings and discuss all together each role's perspective and realise research solutions that are useful for the entire organisation.

Rather than assigning a score between 1 and 5, survey responses were simplified to three options, True, False and Comment, which I judged to be easier for Participants in the context of an online survey done in a Workshop setting. See Appendix J for the full survey and responses.

The wider edtech community comprises a range of stakeholders from any background and country, with varying familiarity with EDUCATE; therefore, the introduction at the start of the survey was altered to accommodate this context (see Appendix I). As I anticipated a wide range of experience and expertise, I decided to design this Cycle's processes at a Level 1, where I would try 'leading people who are on the "doing" level of creativity' (Sanders & Stappers, 2008, p. 14). As such, the survey was further amended to simplify response types so as not to overwhelm respondents, and two presentations were prepared to share the purpose of the survey and the goal of the EDUCATE programme prior to starting the Workshop.

### **6.2.7 Workshop Description**

Participants in some cases had never heard of the EDUCATE programme, and others were academics and policy makers who closely followed the programme. Because of the wide range, there was a need to explain the purpose and context of the study multiple times. Firstly, I explained the programme at the end of a keynote on the first morning of the programme, where Dr Alison Cark-Wilson explained the EDUCATE programme in general. The Workshop itself then reviewed the content presented at the first keynote. The Workshop started with an introduction to the goals of this study, the context of EDUCATE and a summary of the survey itself (see Appendix K). The agenda, which can also be found in the presentation slides, was as follows:

1. Introductions
2. Why Do We Need It?
3. Activity 1: ELLTE Diagnostic Survey
4. The 6 Elements Explained
5. Activity 2: ELLTE Applied
6. Activity 3: Reflection

As in Cycle 5, surveys were done during the Workshop with me present to offer clarifications to Participants as they responded to surveys and to prevent misunderstandings due to lack of contextual knowledge. After the brief,

Participants were given as much time as they needed to complete the survey on their mobile phones or computers via SurveyMonkey, after which I defined each Sub-Construct, one at a time, and respondents were able to ask questions and share their thoughts, comments and opinions on the Sub-Constructs and statements on the survey. This part of the Workshop was designed to gauge whether there were any further disagreements or red flags that would be made evident in order to further validate the ELLTE framework.

### **6.2.8 Cycle 6 Results**

The survey results proved to be highly stable. All statements were agreed with, and any supporting comments were mostly positive. Please see Appendix J for full response rates and how all statements stabilised.

The discussions that followed were largely positive; respondents felt they could relate to the Sub-Constructs and were interested to learn more about the framework. They also had questions and points of clarification, but there was no expression of disagreement in the Workshop; rather, there was overall interest and agreement with regard to the framework. Perhaps if the Workshop had been longer and there had been fewer people, there would have been a greater opportunity to explore disagreements, but as it stood, the sentiment was positive in discussions. In fact, there was so much interest that it was difficult to stop discussions to keep to the allotted time, as Participants appeared to be eager to learn more about the framework. It was clear that the community has an appetite for the framework. Due to circumstances with previous speakers going over time, the Workshop did not have much time for discussion, which was a weakness of the Workshop – the 30 lost minutes would have yielded interesting insights.

### **6.3 Discussions**

This discussion is organised with respect to each Sub-Construct, and it includes insights yielded from Participants in Cycles 5 and 6, after which the following themes will be discussed:

1. Sub-Construct Hierarchy
2. Balancing Trade-offs
3. Barrier and Facilitators
4. ELLTE Action Model

These discussions are followed by conclusions for this Cycle, in which I revisit the goals and the overarching findings.

### **6.3.1 Sub-Construct 1: Sense of Purpose**

There was general agreement by Participants that Sense of Purpose is vital, and that evidence of the purpose being met needs to permeate the entire organisation. Participant 19 (Company E, Cycle 5) summarised the Sub-Construct's importance by saying, 'Company vision (+ product development) must start with the problem to be solved. This challenge creates the "Sense of Purpose"'. This follows the idea that Sense of Purpose captures the company's very existence, which for an edtech company should be inextricably linked to answering the question of what education problem is being solved and setting the vision based on this.

There was also agreement that this purpose should permeate the entire organisation as seen in Survey Statement 8 in Sub-Construct Sense of Purpose: 'The whole company should have a sense of the purpose of research; this information shouldn't be an isolated department'. Participant 21 (Company G, Cycle 5) gave it a T\*, highlighted the word 'department', and wrote, 'This is key, research needs to be something that is part of all elements of the organisation'. Participants representing model EDUCATE companies agreed that the entire organisation can and should be expected to embody the Sense of Purpose.

As expected, Participants brought a more practical perspective when compared with the Participants in Cycles 1 to 4. This Cycle's Participants showed a pattern of noting the real-life trade-offs faced in the working environment as a result of their experience with edtech enterprises. Participant 17 (Company C, Cycle 5) gave a 4.5 rating to the Sub-Construct, illustrating a concern about trade-offs faced on the journey:

The purpose is the guiding light for any future products or initiatives that may be developed. The more clarity there is in the purpose, the easier it is to prioritise activity and determine the relevant research. It can help give focus to the business.

There are two caveats in the case of an edtech start-up:

1. Money is so challenging, and you can't do any activity without money so this becomes the number one driver for many decisions. Although, ultimately the purpose will likely win out over money, the outcome may be to wind up all activity rather than go against the purpose (which I don't necessarily see as a bad thing).

2. Team members don't always have the breadth of expertise required – sometimes we have to bring in people who are only interested in their job delivery and who will not concern themselves with purpose (not ideal but this is the reality especially with limited resources).

Participant 17 summarised the above statement by saying, 'There is also the tension between what someone knows is the right thing to do and what is

possible to do in the company with given resources'. This tension, they propose, is overcome by having a Sense of Purpose in order to be able to navigate the two concerns stated above to the best of their ability. It must be noted that almost all Participants mentioned the first concern of limited financial resources as a trade-off issue; however, Participant 17 was the only one to mention the possibility that the staff may not care for the company's purpose. In contrast, Participant 18 (Company D) believed that when there is Clarity of Vision and it permeates the entire organisation, the staff who do not believe in the purpose do not stay for the long term.

Participants unanimously agreed that the key factor is to be clear about the purpose and make sure it permeates all departments, so that the best decisions can be made when faced with trade-offs and challenges. Participant 20 (Company F) explains the struggle of not having a clear Sense of Purpose:

The company doesn't have a clear vision for the business – it's woolly . . . there was a vision when the company was founded – that clearly stopped. . . . The person now in charge of product talked to a lot of people and is attempting to roll everyone's ideas into a cohesive vision... so leadership goes to everyone to try and gain unity, but people go off on tangents a lot.

Participant 20 explained how the enterprise they work for hires people who understand research and go through the ELLTE Action Model (research Cycle) at an individual level, and how they now have someone in charge of product who is attempting to understand what each person is doing to bring it all together. They explained how it would have been much more cohesive and functional to have the purpose laid out for all staff, as their Research Mastery without a Sense of Purpose resulted in the entire organisation being pulled in various directions and therefore unable to achieve a single purpose.

### **6.3.2 Sub-Construct 2: Research Mastery**

Research Mastery was the primary goal of the EDUCATE programme; therefore, in Cycle 5, Participants agreed Research Mastery is a priority. However, they also spoke to the confidence that the programme afforded them in setting out the research vision and uniting it with their Sense of Purpose: Participant 21 (Company G, Cycle 5) mentioned that 'EDUCATE was a great way to learn more about research – EDUCATE helped with confidence to set out our research vision'. Until EDUCATE, Participants in Cycle 5 implied they did not

have the know-how to articulate their research vision, not knowing what evidence was realistic to expect from their research activities.

The EDUCATE programme was built out of a need to support enterprises to be evidence-informed and as a research accelerator. There was a general sentiment from Cycle 5's Participants of the support needed in order to gain a better understanding of this Sub-Construct. In response to statement 19 in the ELLTE Validation Survey in Sub-Construct CEO Vision, 'a CEO of an ELLTE understands research enough to have appropriate expectations from research initiatives as far as goals, timelines and use of resources and to plan accordingly'. Participant 16 (Company B, Cycle 5) commented, 'OMG/ I wish. In the real world we make do'. Seen in this Cycle was that Participants may need a tailored programme on the CEO level to help with ELLTE management that allows them to understand Research Mastery and other Sub-Constructs in the context of leadership. (See Section 6.3 for an elaboration of this idea.)

Participants believed an ELLTE is a work in progress, and Research Mastery skills in this context are in their infancy. Indeed, the EDUCATE programme was developed out of a need to explore Research Mastery for edtech SMEs, and it is too much to expect that model companies (especially smaller ones) have research posts filled and Research Mastery within the organisation from the start. Participant 18 (Company D, Cycle 5) gave the lowest score on Research Mastery, 2.7/5, with the following justification:

All companies should aspire to these standards; however, the idea that certain skills are attained, or posts filled feels prohibitive. A small start-up should not feel that they cannot add value or make a positive impact simply because they lack resources; but they should seek advice, work hard to assimilate best practice and prioritise research function into their company growth strategy.

The Participant clarified that Research Mastery is not something that is achieved from the moment of inception of the enterprise. While the ELLTE framework offers goals for companies to aspire to, Participants did not believe it reasonable to expect ELLTE status at all times. This implies that perhaps when faced with limited resources, aspiring ELLTEs should first develop Sub-Constructs in order of priority, opting for the development of Sub-Construct 6: Learning Culture, which Participants suggested is more important than Research Mastery (see Section 4.3.1.6). Statement 12 is also seen as an advanced expectation: 'An ELLTE must have at least one team member who understands educational research design' – especially for small enterprises. Participants both directly and

indirectly shared the assertion that Learning Culture rather than Research Mastery is needed from inception to move towards an ELLTE and that the CEO leads this culture and these priorities. Participants suggested that Learning Culture and CEO Vision were the most important, as the CEO sets an open culture of growth, learning and priorities. Section 6.3.7 presents a hierarchy model and suggests Sub-Construct dependencies as a result of learnings after the two Cycles of this Validation Phase.

The theme of Research Mastery for an ELLTE being a unique context was confirmed by most Cycle 5 Participants, noting that research for ELLTE in particular is different from academic research. Participant 16 said, 'In schools you have real people, you can't do research in the purest form'. As a result of EDUCATE, Participant 16 was able to approach research in a more practical way, understanding the context of their users and their business needs and balancing them to yield achievable research. Data showed a unanimous belief by Participants in the importance of pragmatic research practices in enterprises that yield timely and actionable results.

Though Participants unanimously agreed with ELLTE Survey Statement 5 – 'An ELLTE must maintain knowledge of relevant literature (academic, policy, practice and market), to ensure research questions are insightful and productive' – they also largely agreed that it is difficult. Participant 21 (Company X, Cycle 5) summarised the sentiment: 'Just a note – this is hard. No single place to go to find out all latest research into the areas you are working'. Participants also mentioned the difficulty of accessing journals and databases outside of academia. Almost half of the Cycle 5 Participants believed being up to date with relevant literature was an advanced expectation because of the time required for the ongoing task. Participants suggested strategic external partnerships to help with this.

The only statement that was deleted in Cycle 5 from the ELLTE Survey was Statement 14 in this Sub-Construct, which read, 'Dissemination of research in a peer-reviewed research journal should be a goal of any research-minded enterprise'. On the whole, Participants did not believe it is realistic to expect this. While some believed that this expectation was dependent on the enterprise goals and target market, most disagreed with the statement as it was written as a goal of an ELLTE. Participants believed for the most part that it is not worth the time and resources, especially as customers would not see publishing in academic



journals as adding value. Additionally, Participants expressed concern that research timelines do not work alongside business timelines, and published work would not reflect the product, which would have gone through many iterations and may be unrecognisable by the time the article is published. Although there was agreement that publishing in a reputable journal is a positive activity, Participants held the contention that the lack of accessibility (both due to paywalls and concerns around understandability of language and style) of articles made this activity not an optimal use of SME resources.

Similarly, Statement 16, which reads 'A ELLTE has a responsibility to disseminate findings for the greater community to benefit', was controversial, as some Participants believed there should be an amendment to say the responsibility only lies where there is a moral imperative to contribute to the ecosystem, as they believed it is not the primary role of ELLTEs to spend their resources doing so, and indeed dissemination may make them vulnerable to sharing their intellectual property. On the whole, however, Participants agreed that an ELLTE should find a way to disseminate findings in a way that is mutually beneficial to them and the greater ecosystem, and that this should be articulated as part of the research plan.

### **6.3.3 Sub-Construct 3: Teamwork**

In Cycle 5, there was alignment from Participants with insights from previous Cycles as to the importance of Teamwork. Participant 19 (Company E, Cycle 5) gave a 5/5 rating to the Sub-Construct and shared the overall sentiment of Participants with the statement, 'If research is going to permeate a company culture, the whole team must be aligned + open to the research findings + fully engaged in the implementation'. Participants did not believe this work can be done without Teamwork.

Cycle 5 Participants also agreed with the suggestion from Cycle 2 that it is the CEO's role to bring teams together and to guide them with a clear vision (Sense of Purpose) and goals for their team. Participant 18 (Company D, Cycle 5), when asked to comment on Teamwork, rated it as a 4/5 and spoke about values that they use to guide their teams: 'Partnership + Pride. where Partnership = teamwork, both internally and through collaboration with other studies and schools, and Pride = taking pride in the quality of our work, then of our colleagues and of our students'. This is an example of leadership that has clearly articulated

their vision (Sense of Purpose) and has been able to manifest the vision into the way teams are built and motivated through clear values and definitions. This insight from Participants in Cycle 3 suggests that Teamwork is dependent on Sense of Purpose, which is dependent on the CEO having a clear Vision for the ELLTE.

#### **6.3.4 Sub-Construct 4: CEO Vision**

The general sentiment of Participants is summarised in the following two quotes by Participants in Cycle 5. Participant 17 (Company C, Cycle 5) said, 'The CEO Vision is the driving force of the company so it must be strongly aligned', and Participant 21 (Company G) commented, 'Without support from the very top, research will not permeate into all parts of the organisation'. Participants believed the foundation of all efforts towards establishing and maintaining an ELLTE comes down to the CEO's Vision being clear, strongly aligned with the facets of ELLTEs, communicated to the enterprise and supportive of all teams in order to achieve goals.

The belief in the importance of this Sub-Construct was relayed by Participant 18 (Company D, Cycle 5), who gave a 5/5 rating to the Sub-Construct and explained,

A company's research function and CEO Vision must be so fully aligned if that company is to produce a product or service that attains its educational/social/moral mission. The alternative is misaligned/conflicting strategies, inefficiency an unhealthy culture that places and individual's ego above the customers' needs of the value of the wider team.

This Participant was summarising a belief by Participants that the heart of an ELLTE is leadership – one that is willing to prioritise the well-being of learners over their ego, and understands prioritising evidence is the only way to do so. Participants believed a strong CEO Vision is foundational to all the rest of the Sub-Constructs and incumbent upon ELLTE status achievement.

A new theme that was introduced in this Cycle was the importance of CEO Vision buy-in from the enterprise. The previous Cycle Participants suggested that for research to permeate the entire organisation, there must be a directive from the top for clear communication to all; however, in this Cycle, the idea of not just clear communication but enterprise buy-in arose as a point of note. Participant 19 (Company E, Cycle 5) gave a 5/5 rating to the Sub-Construct and said, 'It is the CEO's role to set the company vision and to ensure that research (evidence) informs the company's strategy – and the inspire the "buy-in" from the whole

team' – introducing the role of the CEO to inspire interest of the team into the work of an ELLTE and suggesting that the role is more complex than clear communication. The CEO requires a strategy to evoke interest in operating as an ELLTE. The buy-in aspect is new in this theme – it is an additional dimension that mentors did not have visibility on.

Participants from the largest companies in this Cycle indicated a belief that the experience of running an ELLTE changes dramatically depending on the size of the SME (SME defined as 1 to 250 employees). Participants from the largest companies disagreed with Statement 6, 'The CEO of a ELLTE drives the research vision' – perhaps because there is variation of the ELLTE experience from small- to medium-sized companies – and Participants believed that as their companies got larger, the CEO appointed leaders who were more specialised in fitting a research vision into the CEO's overall vision of the enterprise, which the CEO then approved. Participants did not feel that any enterprise is exempt from the CEO setting an overall vision and having research as a priority – giving it a budget and putting someone in charge of setting the research vision; the mastery of research methods and planning, Participants felt, would no longer fall on the CEO.

In a similar vein, Statement 8, 'In an ELLTE, the CEO has a basic understanding of education research design', received similar feedback to the above by Participants representing larger companies. As the CEO does not set the research plan, they do not feel that basic understanding is necessary. Participants from the larger companies in the sample also did not believe CEOs should have to participate in discussions guiding the research vision of the team (see Survey Statement 23). In contrast, Statement 12, 'In an ELLTE, there is strong vision at the senior leadership level around the role that research plays as an integral element of all the company does', received a unanimous 'True' rating by all Participants in Cycle 5, suggesting that perhaps the Sub-Construct definition should be changed to encompass leadership rather just the CEO if CEOs have less involvement of research management as companies get larger. In that case, the name of the Sub-Construct would then change to Leadership Vision instead of CEO Vision to reflect this change. Further research with a greater representation of Participants from larger model ELLTEs would be required in order to be conclusive on this item.

The need for an RCT course that is specialised for ELLTE Leadership (Research Management) stream on the EDUCATE programme arose in Cycle 5 as it became clearer the goals of the CEO are different from their teams. Participant 21 (Company G, Cycle 5), a member of leadership said that 'EDUCATE was a great way to learn more about research – EDUCATE helped with confidence to set out that vision'. However, this Participant realised they were out of their depth and hired someone who they describe as 'confident enough to say these are the standard ways of testing'. Unfortunately, as Participant 21 did not have enough mastery of research, they did not realise they had hired someone from a different field who proceeded with confidence but did not yield them the optimal evidence for their task and the CEO didn't have the mastery to realise this. This speaks to the need for a course on research management that is different from the Research Training Programme, which is designed for leaders to build capacity in those skills requires to manage ELLTEs (see Section 6.3) as there seems to be a recurring pattern of CEOs that feel they are out of their depth to do research but also don't know how to hire and manage it.

#### **6.3.5 Sub-Construct 5: Learning Culture**

Participants pointed to Learning Culture as being of the utmost importance – that it should be the CEO's goal to maintain this culture. Participants believed that a culture of learning, which encompasses all the statements laid out in the survey (see Appendix I), is a pre-requisite to most other Sub-Constructs given the dynamic nature of the emerging edtech enterprise. Participants believed that it is not the mastery of research but the openness to learning and more specifically curiosity that drove these businesses to join the EDUCATE programme, and it is this curiosity that drives their continued learning, ultimate achievement and maintenance of an ELLTE status. With resources like EDUCATE available in the ecosystem, Participants' ELLTEs cannot be established without curiosity, openness and a growth mindset, which they believed to be the cornerstones of all their achievements. Interestingly, almost all Participants described themselves and/or their organisations as 'curious' and used curiosity interchangeably with a Learning Culture.

Participants referred to the importance of a growth mindset (Dweck, 2013) and Learning Culture in the organisation that goes beyond Research Mastery and

that needs to permeate the attitude and mindset of the organisation as a whole. In reference to statement 7 of Sub-Construct 2, Research Mastery, 'An ELLTE should have at least one team member who understands what kind of research would be appropriate to meet their education goals', Participant 16 commented that it is not enough to have one member with this mastery, as the rest need to be open minded. Participant 15 (Company A, Cycle 5) went so far as to say, 'There is no room for anyone in an ELLTE who is not constantly learning'. Though others did not express the belief that all employees must embody this culture or leave the organisation, there was agreement that there should be a culture of learning for ELLTEs to be successful, sharing statements more aligned with Participant 20 (Company F, Cycle 5), who said, 'I don't think it's possible to have any functional start-up without a Learning Culture', and Participant 19 (Company E, Cycle 5), who said, 'Learning culture should underpin a company's activities whatever the sector. Seems indispensable for edtech'.

Participant 18 (Company D, Cycle 5) mentioned their recruitment strategy was based upon finding individuals who are aligned to this value: 'From even before <Company D> participated in EDUCATE, Learning Culture and curiosity was one of our core values. The above list of requirements forms the basis of our job description we used while recruiting, and we encourage all members of the team to take an active interest in all aspects of our product's design, educational impact and incremental improvement'. This Participant went on to say that those individuals who do not fit in with this core value often do not last in the organisation, as it is so much a part of the culture that they often do not feel it is a long-term fit. Participants believed that the CEO must lay out the vision and values in order to establish a Learning Culture and that this culture is very much dependant on leadership – implying Sub-Construct dependencies that were not apparent in the previous Cycle.

### **6.3.6 Sub-Construct 6: Action Orientation**

There was agreement with the conceptualisation of this Sub-Construct by Participants. It was the least contentious – everyone agreed with all statements. Participant 18 (Company D, Cycle 5) gave this Sub-Construct a 5/5 rating. They embody the spirit of this Sub-Construct of an ELLTE as it was defined in Cycle 2 with the following statement as to the Sub-Construct Action Orientation's importance: 'This is entirely at the foundation of <Company D> as a product – we

are a service to our students and schools and do not believe for a second that we are as good as we can be. It's fundamental that we gather as much data as we can to continually iterate on the product, prioritise our development roadway and measure the change to make our service as effective as possible for our users'.

There was general agreement in Cycle 5 about this Sub-Construct; therefore, insights were simply offering a view into the reality of the experience of the Sub-Construct in the enterprise. Chief amongst those contributions by Participants was the suggestion that enterprises that are successful at Action Orientation are systematic in their approach to data collection in the sense that the process is either somewhat automated or processes are in place for regular data collection and feedback within model companies. Participant 22 (Company H, Cycle 5) explained how the EDUCATE programme helped them to systematise their efforts by starting small and replicating their research. The Participant had a background in qualitative research, but EDUCATE's mastery was more 'hyper-specific, focused and practical – this was designed for action', and they used this study as benchmark and replicated it. Participant 20 (Company F, Cycle 5) gave a 5/5 rating, saying, 'Making appropriate research part of BAU [business as usual] means all new joiners have to get into the research mindset. (It's a great way to get people into the mindset . . .)'. This once again shows how leadership can set patterns in the organisation to put people into a certain mindset – if research becomes a part of daily tasks; however, this contention is contrary to the overall belief by Participants that it is the Learning Culture, the growth mindset, curiosity and openness to learning that start the journey to research and indeed drive it to be fruitful and constantly improve.

Participants in Cycle 5 expressed the difficulty of balancing when to offer feedback and to whom – how often to meet, when to report formally and informally, what kind of data to collect, when to act on the evidence; model companies implied that they go through a constant reflection process to develop and refine systems that work for them. Each of the Participants interviewed presented a unique method of reflection that worked within their company structure, culture and goals, with examples ranging from data collection and trend analysis as a central role of the product manager to monthly review meetings, informal slack channels and weekly pizza and data-sharing team dinners. Participant data relayed in Cycle 5's data analysis process was compiled and showed that model enterprises systematised a good portion of their data

collection, so the loop continued both in smaller and larger Cycles with major changes and research projects.

A major challenge Participants suggested was summarised by Participant 17 (Company C):

What can be hard with action: is the prioritisation with the product enhancements and fixes – can move faster with the education research is faster than product development – needs to adjust the management of the tech team. Findings are not always positive things – evidence shows you have the amend but then you have to wait and prioritise on the tech side – that’s very hard.

Some Participants suggested that transparency with the team and general teamwork and consultation are key to overcoming implementation challenges.

Participants in Cycle 5 did not negate the idea put forward by Participants in Cycle 2 (the EDUCATE expert Research and Business Mentors) that Action Orientation is the most important Sub-Construct in indicating whether a company is an ELLTE, as it is indicative of the foundation and other building blocks being in place – agreeing that the prioritisation of doing and acting upon research is the key indicator of research mindedness.

### **6.3.7 ELLTE Sub-Construct Hierarchy**

An insight that was unique to the Validation Phase was the suggestion that there is a hierarchy of ELLTE Sub-Constructs. Cycle 5 findings first suggested that Sub-Constructs have dependencies. These dependencies are best explained using the metaphor of a building (see Figure 29).



Figure 29. ELLTE Sub-Construct Hierarchy Model.

Figure 29 suggests that Participants believed Leadership Vision (Sub-Construct CEO Vision) to be the foundation. Participants unanimously agreed on the integral role of leadership as the foundation of the building. Participant 21

(Company G, Cycle 5) said, 'Without the CEO on board, research will not be valued at the right level across all elements of the organisation. I think this is fundamental to the success of a research function in an organisation'. Leadership must set the tone and prioritise creating a culture of learning (Sub-Construct Learning Culture), and this openness then helps them understand more about the education problem they are trying to solve. Participants held the contention that Sense of Purpose evolves as an organisation learns and grows and therefore that Learning Culture precedes all, even the *raison d'être* of the enterprise. Armed with a Learning Culture that is open to setting a purpose for the organisation – and to establish the learning problem they are trying to solve, their vision and mission for how to do so – they know that they will be constantly reviewing and improving the Sense of Purpose of the organisation. After this point, teams are established, led by the CEO, and hired within the same Learning Culture and with knowledge of the purpose and understanding of being open and flexible to growth and change at all times. Team members and the CEO then gain various amounts of Research Mastery in order to put the research plan and yielded evidence to action. Action is seen as the roof of the building, and as mentioned in Cycle 2, it is the single most important indicator that an ELLTE is established. As explained in Cycle 2 discussions, the first and most indicative question that should be asked of an enterprise when approaching them is what research have they done, as this question points to whether there is a roof to the building and whether it is worth exploring to see if the foundation is in place. Without the roof, it is clear that the enterprise is not on the path to becoming an ELLTE – as action is the most important indicator of a path to prioritisation and establishment of evidence-informed decision-making.

It should be noted here that of the eight Participants interviewed in this Cycle, five of the Participants were the CEO of their companies and primary participants in the EDUCATE programme, and all Participants were supported by their CEOs to be at the programme as part of their vision for the enterprise. This means that all of model companies interviewed in this study stood on a strong foundation according to the model.

This model would require further research to be validated on a larger scale (see Section 7.4). Upon validation, results of this model would have implications for optimal training of ELLTEs, which would be able to serve the edtech SME community by further optimising their time on training programmes.



### **6.3.8 Balancing Trade-offs**

The idea that ELLTEs must balance business and research concerns was highlighted repeatedly in every interview in Cycle 5. Trade-offs were first identified as a theme in the Development Phase (Cycles 1 and 2); however, the theme became even more prevalent in Cycle 5 as Participants had a pattern of citing business constraints and financial losses that came with pursuing research activities. The need to balance business and research concerns, or in business speak- the trade-offs was highlighted repeatedly in every interview in Cycle 5. Participants believed that, though there should be an evidence base for decisions made within the enterprise, there had to be a balance between what is viable and what it is wise to do. Participant 16 (Company E, Cycle 5) said, 'If you want to be a successful business you need to know what the balance is'. The same participant mentioned the EDUCATE programme gave them sufficient Research Mastery to be able to set a balanced strategy – not to focus so much on conducting research, which has been the previous strategy. EDUCATE helped them to understand what one can and cannot research and the affordances of various approaches in order to optimise research spending. Company B concurred with this view in their conclusion that EDUCATE's Research Training Programme was vital to the enterprise in learning to strike this balance and optimise resources for the most useful evidence to empower their purpose and business.

In Cycle 2, Participants were briefed on the survey (see Section 4.3) with the caveat that every statement should be read 'to the best of the ELLTE's ability'. This was done out of an anticipation of these trade-offs that had emerged as a theme from Cycle 1. Hence, an early finding was that ELLTEs would always have to balance business circumstances with research goals, and it would not be possible for an ELLTE to achieve all of the Sub-Construct statements all of the time, which Cycle 5 Participants also agreed was an unreasonable expectation. Products needed to be released, deadlines needed to be met and teams had limited amounts of time and resources. This Cycle confirmed that there are no hard and fast rules with ELLTEs – as Participants in both Cycles agreed that statements in the survey lived within trade-offs of the business world.

Participant 19 offered insights from their experience as a model company, Company E, that transparency of activities and open lines of communication with teams is the way forward to combat this challenge: 'There are always trade-offs

available funds, available resource, which markets should we focus on? This is part of running a business in general. In edtech business you have to get used to it'. Company E follows a policy of transparency about trade-offs; teams expect to talk about trade-offs, and everyone knows what the data show and why they went forward in a certain way. Participant 19 shared an anecdote where data showing that their new feature was not optimal came to light in the middle of the feature's release. The Participant decided that they would release the product and look for further evidence, as well as get ready to ready to change the feature in the next release. Participant 19 remarked that this was possible due to their agile development environment and recommended flexible working environments for ELTEs to better balance trade-offs such as these. Participant 19 also mentioned that the release was only perused as evidence showed that the feature was sub-optimal rather than detrimental to the user's learning experience- assuming the feature is not a detrimental thing but rather incremental change. Cycle 5 findings shows that systematic and constant feedback loops and flexible working environments allowing for constant product updates and pivots are key to balancing trade-offs. In summary, Participants believed transparency is the best antidote to managing trade-offs that are a part of ELLTE business practice, and that they must be knowingly to the best of the ability of the organisation.

### **6.3.9 Barriers and Facilitators**

Table 7 is a summary of the barriers and facilitators to research that are a synthesis of the barriers and facilitators shared by Cycle 5 Participants. It is worth noting that almost unanimously, time was identified a barrier, closely followed by resource limitation barriers, both monetary and human capital. Curiosity, defined by participants as the capability of leadership to build a Learning Culture, was almost unanimously mentioned as an enabler.

Table 7. Barriers and Facilitators to Researching in Model Enterprises

Barriers	Facilitators
<ol style="list-style-type: none"> <li>1. Time: research fitting the pace and timelines of the rapidly changing, dynamic edtech enterprise</li> <li>2. Money: financial resource limitations to support research activities</li> <li>3. Priority: research activities not seen as priority by leadership</li> <li>4. Access to academic journals: literature is both difficult to access and to understand by developers</li> </ol>	<ol style="list-style-type: none"> <li>1. Curiosity: an established learning culture in the enterprise</li> <li>2. Priority: leadership prioritizing research activities in staff tasks and job descriptions</li> <li>3. Planning: carving out certain days and time to do research work</li> <li>4. Partnerships: having close ties to institutions that can collaborate, facilitate or enrich research activities</li> <li>5. Accountability: in the context of the EDUCATE programme, having to get research work done by certain deadlines, and at a high standard.</li> <li>6. Support: help completing research tasks, such as the support given by EDUCATE Research Mentors</li> <li>7. Agility: flexible company structures allow for pivoting and acting upon evidence efficiently</li> </ol>

Table 7 shows the interrelationship between all of the Sub-Constructs, make the true sense of the ELLTE difficult to define and related to the idea expressed by Participants in Cycle 5 that it is unreasonable to expect all facets described in the ELLTE survey to be enacted at all times. This is vital information for researchers to enable them to better understand the context of companies when building collaborative research relationships and is useful in EDUCATE 2.0.

### **6.3.10 Enterprise Size Matters**

Participants in Cycle 5 alluded to how the size of the company impacts the ELLTEs experience within any research-focused experience such as EDUCATE. This study and the EDUCATE programme focused on supporting the emerging edtech enterprises defined as SMEs, which had 1–250 employees. Companies taking part in Cycle 5 represented the spectrum of SME sizes. Participants mentioned in interviews how they felt some of the Sub-Construct statements may be more or less difficult to enact as enterprises grew. The single factor that was mentioned by Participants the most was the shift in the role of the CEO as the company got larger, distributing much of the leadership of research activities to other leaders in the enterprise. Participants believed that CEO Vision might become diluted in larger enterprises where the CEOs themselves might be less involved, resulting in less understanding of the vision by the wider team. Management of an ELLTE requires the systematic communication of vision regardless of the size of the organisation, and especially as enterprises grow in

number. Findings suggest that in larger enterprises, most of the mastery and management of research would come from senior leaders the CEO appoints to manage research activities as part of their greater vision. In this regard, there was a suggestion to shift the name of Sub-Construct 2, CEO Vision, to Leadership Vision in order to encompass both the small- and medium-enterprise experience as an ELLTE. Future iterations of the EDUCATE programme may explore different training programmes for companies of varying size given the unique challenges that come with the achievement and maintenance of an ELTE status as enterprises grow.

### **6.3.11 ELLTE Action Model**

The goal of the ELLTE Action Model was to serve as a boundary object to aid in the understanding of how the Sub-Constructs manifest themselves in different enterprises. The ELLTE Action Model was designed as an artefact to stimulate conversations with Participants about their enterprise and what research processes looked like in action. The model emerged after data in Cycles 4 and 5 suggested that though every enterprise is different, this model was attempting to predict how Sub-Constructs interact in practice. In this Cycle, respondents agreed that the model, though highly simplified, provides an accurate abstraction of the research Cycle that takes place within an organisation and was confirmed as an effective boundary object that can be used as a tool for researchers approaching edtech enterprises to understand their research process. The general opinion of Participants was that the ELLTE Action Model is an appropriate abstraction of the research loop that takes place within their organisations. However, the Cycle 5 Participants added a number of caveats to the ELLTE Action Model to provide important contextual information that would enable researchers to better understand each company's context.

- *Size and timing of research loop.* There are many little feedback loops. Loops can be small or large and happen both sequentially and all the time simultaneously.
- *Leadership role.* Leadership involvement is often more fluid, not just looped at the end but throughout.
- *Learnings go everywhere.* The learning feeds back not just to vision but into product – it guides absolutely everything, and vision changes less than product.

- *Consider trade-offs.* The ELLTE Action Model does not consider trade-offs. Though the point of the model is to understand the research Cycle within organisations, there should be a warning to users that trade-offs are not represented by the model.
- *Learning culture.* A Learning Culture is the pre-requisite to the loop working – teams have to stay open.
- *Research vision.* The vision includes the team.
- *Leadership supports research.* Research activities are not seen as possible/sustainable without the support of leadership.
- *Vision.* Vision is everything, and it's a conversation.
- Research Mastery is a research team.
- *Strategic feedback.* Learning how and when to feed back is key.
- Steps 2 and 3 are like a Venn diagram, and learning encompasses people outside.
- *Micro-Cycles.* They do a similar thing to this Cycle – but smaller Cycles do little experiments and run them in half-hour Cycles.

With the above considerations, together with the semi-structured interview questions employed in Cycle 5, the ELLTE Action Model can be used as an effective boundary object for researchers when approaching edtech enterprises, especially for doing case studies in order to understand ELLTE research loops in more detail and how they manifest in companies of varying sizes, purposes and stages of development. The case constructed below is an example to help depict using this boundary object, together with semi-structured accompanying questions for each step (see Section 5.2.2).

#### Case 1: Company E, Participant 19

The CEO of a small company of fewer than 10 people explains that a step before establishing the vision is asking the question – what is the problem they want to solve as a company? They had many ideas of what the product should be from experience but felt they should check it. They launched and immediately started to collect data. The CEO joined the EDUCATE programme and began a journey. EDUCATE was their opportunity to formalise and analyse data from a product perspective – no one in the company had the exact right skills. The CTO joined her at EDUCATE because he cared about gaining the research know-how to ensure their edtech product is achieving their purpose and everyone at their

enterprise was excited to see if their solution works. The CEO and CFO never made a conscious effort to get their team to care, but because the Sense of Purpose was a part of the enterprise ethos, everyone cared about solving the problem. The CEO said, "If you've got a real mission, it's not hard to find people who are excited by it." The CEO was highly committed– the CEO attended the EDUCATE Research Training Programme and taught it back to the whole team including administrative support, salespeople and technical staff. The whole way through, presented it to their team, and they did the theory of change and logic model (all the activities and assignments) together. Leadership belief was that they have to have buy-in from the entire team in order to build a robust product. The team met all Sub-Construct Teamwork facets as leadership made them a priority. The team had a Learning Culture, were all curious and open to learning. Everyone was involved the whole time, so everyone was talking about it. Then the action: They carried out the research plan and changed the product based on it. A major barrier was time: the CEO expressed that the EDUCATE Research Training Programme was very hard work. It helped to overcome the barrier with planning – certain days and times were assigned to doing EDUCATE work. They agreed with the model, and the most exciting thing to this CEO was that after EDUCATE, research was embedded in the culture. The CEO said they have always been a curious company – their EDUCATE Research Mentor was surprised they had collected so much data; however, the danger was they were not systematic until EDUCATE. The Action Model is embedded in their culture and is now systematic. They believe there is an obligation everyone has when selling to schools and parents to systematically collect data and embed this model in a way that works for their company. They have built an agile environment in order to be flexible and implement changes and to plan the next sprint releases of their product as they find evidence. They are all about transparency – if they are in the middle of a feature release and they get evidence that something can work better, they announce this to everyone and use that release to observe the product and then implement the change in the next sprint if data point to the same evidence. They are constantly feeding back to the team, reflecting and learning – there are lots of constant feedback loops.

The case above shows how the ELLTE Action Model served as an effective tool to frame the conversation in order to understand the research Cycle within enterprises.

### **6.3.12 Summary of Sub-Construct Revisions**

The Cycle 5 and 6 data analysis process resulted in the following revisions to the overarching ELLTE framework and its Sub-Constructs:

1. Construct name change from ELLTE (Evidence-Led Learning Technology Enterprise) to ELTE (Evidence-informed Learning Technology Enterprise) to reflect the reality of decision-making more accurately in model companies.
2. The Sub-Construct Research Mastery name has been changed to Research Know-How, as the word Mastery has connotations of level of research acumen that is not in line with the definition of research knowledge required in this context. Know-How aligns with the level of research proficiency expected at this stage.
3. Sub-Construct 2: CEO Vision name changed to Leadership Vision as Participants in Phase 3 (Validation Phase) believed that the role described in the Sub-Construct definition is not just that of the CEO of the enterprise but Leadership in general, suggesting the Leadership is a more accurate term for the construct.
4. One statement was removed from ELTE survey – and the data analysis confirmed that the overall survey had stabilised.
5. Given the proposed dependencies, the Sub-Constructs were re-numbered to reflect their order of importance more accurately, as revealed by the research data. The new numbering of Sub-Constructs is as follows:
  - Sub-Construct 1: Leadership Vision
  - Sub-Construct 2: Learning Culture
  - Sub-Construct 3: Sense of Purpose
  - Sub-Construct 4: Teamwork
  - Sub-Construct 5: Research Know-How
  - Sub-Construct 6: Action Orientation

These findings are updated in the final version of ELTE Validation Survey found in Appendix I.

#### **6.4 Conclusion of Part 3 – Validation Phase (Cycles 5 and 6)**

The goal of this Phase was to validate the constructs of the ELTE on two levels, firstly with model EDUCATE companies, and secondly with stakeholders in the wider edtech ecosystem outside of EDUCATE. Ultimately, Cycle 3 sought to test the ELTE framework ‘in the wild’ (Hutchins, 1995) to support me to answer the overarching research question of this study: *What theoretical framework supports edtech enterprises to build evidence-informed products and services?*

This Cycle has further validated the ELTE framework, where Participants unanimously agreed to keep all six Sub-Constructs through a highly stable survey. Only one statement was discarded from the Survey, which describes each Sub-Construct’s elements in detail and serves as a detailed theoretical framework that can support emerging edtech enterprises to build evidence-informed products and services. The ELTE Action Model serves as an abstraction to illustrate how Sub-Constructs generally interact in practice and can be used as a tool to aid in planning how the model may align with prospective ELTEs’ processes. Through the guidance of the survey and definitions for each Sub-Construct presented in the previous Cycle, my findings offer a process through which learning technology enterprises can use the ELTE framework to assess their current structure and provide a compass to move towards becoming an ELTE.

This Cycle also aimed to ‘*assess whether EDUCATE’s definition of the EdWard Level 2 is appropriate*’ and, if not, to offer suggestions on changes.

EDUCATE’s current definition at the heart of the EdWard Level 2 is whether enterprises applied the research that they designed in the EDUCATE programme. This is centred around Sub-Construct 2, Action Orientation, which was found in Cycle 2 (see Section 4.3.1.6) to be the single most important indicator of research mindedness by EDUCATE Research Mentors. It is the proof of enacting the ELTE Action Model at least once and therefore is adequate and appropriate for EDUCATE. In order to deserve ELTE status, however, an EdWard Level 3 could be introduced where enterprises need to show how they have systematised data collection so that the ELTE Action Model is largely a part of business as usual. I believe this is too much to ask from an EdWard Level 2 and that the current definition at the heart of the EdWard is highly appropriate.



## **Chapter 7: Conclusion and Further Research**

In this study, I set out to develop a construct to support the edtech industry in developing evidence-informed learning tools. Through the context of the EDUCATE programme, the first-ever research accelerator for emerging educational technology enterprises, the overarching research question I sought to answer was, *What theoretical framework supports edtech enterprises to build evidence-informed products and services?*

The four main objectives were as follows:

- 1. Explore the features of a research-minded entrepreneur within the context of edtech.**
- 2. Explore if and how a research mindset is distributed across individuals within an organisation.**
- 3. Assess whether EDUCATE's definition of the EdWard Level 2 is appropriate.**
- 4. Offer guidelines on how to develop an understanding of research and evidence in edtech enterprises.**

Ultimately, this study aimed to demystify the research experience for edtech SMEs such that it becomes a part of their DNA and to offer principles and guidelines on how best to develop a *research mindset* in edtech entrepreneurs and their enterprises.

### **7.1 Summary of Key Findings**

#### **7.1.1 Key Theoretical Contributions**

This study contributed to the evolution of the construct of research mindset and established that a research mindset is not a fixed mindset that is identical for all edtech SME. The ELTE has six Sub-Constructs which are capacities distributed amongst enterprises of varying size in different ways. The final Sub-Constructs are as follows:

1. Leadership Vision
2. Learning Culture
3. Sense of Purpose
4. Teamwork
5. Research Know-How
6. Action Orientation

The validated ELTE survey (see Appendix I) outlines each facet of the Sub-Construct.

These six Sub-Construct, along with major implications of each are summarised in the following sections.

#### *Sub-Construct 1: Leadership Vision*

**Definition of Leadership Vision.** The role of Leadership in an ELTE is setting the Sense of Purpose and ensuring that the conditions are in place in the enterprise to enable it to come to fruition. These conditions include: setting the vision for research; devising and overseeing a concrete plan to allow it to happen; making sure the right teams are in place or that there are people to set up the teams; communicating research goals and results to permeate appropriately; prioritising research; removing obstacles so that it all happens and ensuring continuity of ELTE status.

**Implications of Leadership Vision.** This Sub-Construct implies that Leadership Vision is necessary for a learning technology enterprise to be evidence led and that this vision must encompass all Sub-Constructs of an ELTE. Leadership Vision implies the following:

1. As illustrated in the ELTE Hierarchy Model, Leadership Vision is the foundation of all other Sub-Constructs. ELTEs are hyper dependent on leadership having mastery of the facets of this Sub-Construct as outlined in the ELTE Survey.
2. The EDUCATE programme should address the need for a course in Research Management that covers all facets of this Sub-Construct, as outlined in the ELTE Survey.
3. Enterprises who do not have leadership representation in the EDUCATE programme will be expected to struggle to maintain ELTE status continuity beyond the tenure of the employee at the organisation.
4. When leadership is not involved in research strategy, the enterprise is expected to have less comprehensive research plans that do not permeate the overall needs of the organisation.

### *Sub-Construct 2: Learning Culture*

**Definition of Learning Culture.** Learning culture is a similar construct to Dweck's (2013) growth mindset; however, it is on the enterprise level. When an enterprise has the culture that it is always necessary to remain open minded and keep learning in the edtech industry, and employees are open to do so, there is a Learning Culture. Companies have a posture of learning – and this is integrated into their perspective in all they do. For example, research is not something you do once and understand what your customer needs and if your product 'works' – it is something you are constantly doing. This Sub-Construct is about genuinely wanting to understand; it is about proactively seeking knowledge that will help the enterprise to get closer to achieving its purpose. Whist EDUCATE provided a framework on which companies could build research proficiency; some were more effective due to the Learning Culture that they possessed and the growth mindsets their companies brought to the programme.

**Implications of Learning Culture.** This Sub-Construct implies that a clear and strong Learning Culture must exist for a learning technology enterprise to be evidence led and that it must permeate all levels of the business. Learning Culture implies the following:

1. The primary goal of the leadership of an ELTE is to establish and maintain a Learning Culture in their organisation, as outlined in the ELTE Survey.
2. Without a clear vision and set of goals, this Sub-Construct could result in less efficient workplaces that have more questions than answers. Leadership Vision is required balance this culture with concrete goals.
3. The establishment of a Learning Culture must be differentiated from the establishment of a research culture in the EDUCATE programme. Both are important but distinct in an ELTE; however, this has not been differentiated in the programme to date.

### *Sub-Construct 3: Sense of Purpose*

**Definition of Sense of Purpose.** The Sub-Construct Sense of Purpose is the core mission of the enterprise. The mission should answer the fundamental question of 'what education problem are you trying to solve?' The implications of having a strong Sense of Purpose were suggested in the above themes as: a

clear understanding of where the company is going; an easing of the tension between the resource trade-offs of research and business goals; a drive to collect evidence; and a supportive business.

**Implications of Sense of Purpose.** This Sub-Construct implies that a clear and strong Sense of Purpose must exist for a learning technology enterprise to be evidence led and that it must permeate all levels of the business. Sense of Purpose implies the following:

1. All members of the enterprise should be clear on its Sense of Purpose. If team members cannot answer the question, *What education problem are we solving?*, the enterprise is unlikely to meet the criteria of an ELTE.
2. Leadership must play a large role in establishing the *raison d'être* of the enterprise and communicating its mission throughout the enterprise.
3. A research strategy is incumbent upon ELTEs so they may yield evidence that ensures the enterprise has achieved its purpose.

#### *Sub-Construct 4: Teamwork*

**Definition of Teamwork.** My overarching finding is that ELTEs understand that research is a team activity within edtech SMEs. Participants challenged the notion that an isolated researcher or research team can be tasked to complete research activities for, or on behalf of, the edtech SME and suggested that successful planning, deployment and use of research activities can only be done through a collaborative effort with representatives of various parts of the enterprise in order to consider all relevant contexts and goals.

**Implications of Teamwork.** This Sub-Construct implies that Teamwork must exist for a learning technology enterprise to be evidence led and that lack of capacity is no excuse for lack of teamwork as it is possible for external collaborators to be engaged in a variety of ways. Teamwork implies the following:

1. An early indicator of EDUCATE programme success (as defined by the achievement of an EdWard level 2) is participant attendance in teams of two or more. This study recommends that the EDUCATE programme require participants to attend in teams.
2. Future iterations of the EDUCATE programme may leave more time for mentor engagement, especially for smaller companies.

3. Future iterations of the EDUCATE programme may have a greater emphasis on teamwork by participants and a module focusing on research team development and external team engagement.

#### *Sub-Construct 5: Research Know-How*

**Definition of Research Know-How.** In keeping with all other Sub-Constructs, the definition of Research Know-How as a Sub-Construct emerged from the data and the themes above. The EDUCATE programme was a Research Training Programme with the remit to teach research skills for capacity building in the edtech SME context. Participant feedback featured the most relation to this Sub-Construct; i.e. it comprised the most codes in NVivo and the greatest number of emerging themes.

**Implications of Research Know-How.** This Sub-Construct that Research Know-How must exist for a learning technology enterprise to be evidence-informed and that it must permeate all levels of the business. Research Know-How implies the following:

1. The EDUCATE programme has the opportunity to review its Research Training Programme based on the findings of this study, ensuring all facets of the validated ELTE Survey pertaining to Research Know-How are addressed, and that those Sub-Constructs that are pre-requisite to Research Know-How in the Sub-Construct Hierarchy Model are included in the curriculum as well.
2. The EDUCATE programme can be further developed to optimise content based on the goals of the learner. This study suggests having a separate research management stream that is aimed at ELTE leadership and their integral role in guiding research in the organisation. Leadership of the learning technology enterprise needs to have enough Research Know-How to hire the right people, i.e. researchers with educational Research Know-How in an emerging edtech enterprise context; maintain oversight of the research strategy; and have realistic expectations of the research process.

#### *Sub-Construct 6: Action Orientation*

**Definition of Action Orientation.** This Sub-Construct is concerned with the ability of the enterprise to act on its research vision. Action Orientation can be broken down into two components: (1) conducting the research and (2)

implementing changes based on evidence yielded from research. ELTEs conduct research in order to act on findings – they expect to pivot constantly, and leadership has built flexible processes to accommodate changes. This research has highlighted the dynamism of the edtech SME, and it is this Sub-Construct implies that ELTEs maintain this dynamism as they pivot their products and enterprise as a whole, based on evidence yielded from research Cycles in perpetuity.

**Implications of Action Orientation** My research findings concluded that Action Orientation is the most important Sub-Construct to assess whether an enterprise is an ELTE as it is proof of a research mindset. An Action Orientation must exist for a learning technology enterprise to be evidence-informed as the construct implies that the enterprise not only conducted research but also pivoted their product and organisation according to findings. Action Orientation implies the following:

1. The single most important question to ask an edtech SME to gauge their research mindedness is, *What research have you done?*, as without action efforts in all other Sub-Constructs are rendered pointless.
2. Sustained Action Orientation is proof that all other Sub-Constructs are working in unison and is the greatest indicator of an ELTE.
3. The definition that is at the heart of the Edward Level 2, i.e. carrying out a research plan, is appropriate in assessing the research mindedness of a learning technology enterprise. The ELTE Hierarchy Model shows that Action Orientation is dependent on the support of all other Sub-Constructs.

This section summarises the 6 Sub-constructs of the ELTE Framework and their implications. Complete descriptions can be found in Chapter 4 (Section 4.3.1) and Chapter 6 (Section 6.3). The final ELTE Survey can be found in Appendix I.

#### *ELTE Sub-Construct Hierarchy Model*

An insight that was unique to the Validation Phase was the suggestion that there is a hierarchy of ELTE Sub-Constructs. My research findings concluded that ELTE's Sub-Constructs have dependencies. These dependencies are best explained using the metaphor of a building (see Figure 30).

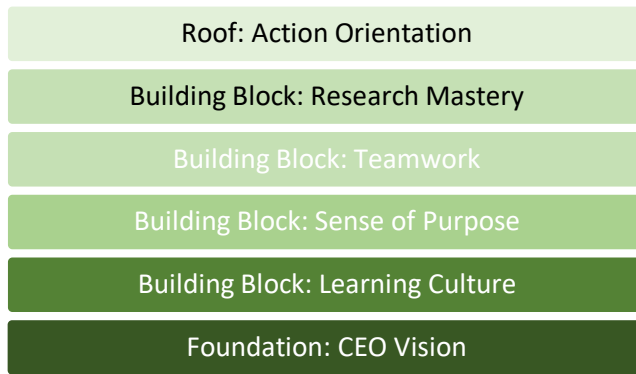


Figure 30. ELTE Sub-Construct Hierarchy Model.

What Figure 30 suggests is that Participants believe Leadership Vision (Sub-Construct CEO Vision) is the foundation. Participants unanimously agreed on the integral role of leadership as research will not be prioritised and valued across the organisation without leadership setting the vision and mandate. Leadership must set the tone and prioritise creating a culture of learning (Sub-Construct Learning Culture) as a priority, and this openness then helps them to understand more about the education problem they are trying to solve. Participants in this study held the contention that Sense of Purpose evolves as you learn and grow, and therefore that Learning Culture encompasses all, even the *raison d'être* of the enterprise. Armed with a Learning Culture that is open to setting a purpose for the organisation – and to establish the learning problem they are trying to solve, their vision and mission for how to do so – teams within ELTEs know that they will be constantly reviewing and improving the Sense of Purpose of the organisation. After this point, teams are established, led by the CEO, and hired within the same Learning Culture and with knowledge of the purpose and understanding of being open and flexible to growth and change where possible. Team members and the CEO then gain various amounts of Research Know-How in order to put the research plan and yielded evidence to action. Action is seen at the roof of the building, and as became evident during Cycle 2, it is the single most important indicator that an ELTE is established. When first approaching an enterprise, foremost is to inquire as to the research the enterprise has already completed; the answer will be indicative of how much of a foundation is in place to support the “roof” of the building. Without a roof, the enterprise will not be on the path to becoming an ELTE, as action is the most important indicator of evidence-informed decision-making.

### **7.1.2 Key Methodological Contributions**

The ELTE Survey (Appendix I), offers a robust set of descriptors of the facets of every Sub-Construct. This Survey provides a research-based instrument to assess whether an edtech enterprise is indeed an ELTE, the result of which might inform the targeting of training programmes in order to develop the specific competencies needed to develop skills. For academics, it provides a research framework and enables specific questioning around the granular facets of each Sub-Construct with clarity around what each Sub-Construct entails.

In the event that academics approach the subject with less granularity, Hallmark Questions were devised to help elaborate the Sub-Constructs to enterprises in more casual Workshop formats. These Hallmark Questions are presented below.

#### *The Hallmark Questions of Sub-Construct 1: Leadership Vision*

1. Does Leadership have a vision for how research fits into their greater organisational goals?
2. Does the research vision match the vision of the company?
3. Does Leadership make the research vision explicit?

#### *The Hallmark Questions of Sub-Construct 2: Learning Culture*

1. Is the enterprise always learning?
2. Is there a culture of openness to knowledge?
3. Are there systems in place to share knowledge inside the enterprise?

#### *The Hallmark Questions of Sub-Construct 3: Sense of Purpose*

1. Why is the enterprise doing research?
2. Why is the enterprise building this product?
3. What are the vision and mission of the company – is it clear how research fits into them?

#### *The Hallmark Questions of Sub-Construct 4: Teamwork*

1. Are research initiatives conducted in teams?
2. Does the research team have a connection to the other teams in the company?
3. What systems are in place for individuals to work together on research initiatives?



### *The Hallmark Questions of Sub-Construct 5: Research Know-How*

1. Does the enterprise have the knowledge/expertise to design appropriate research initiatives to assess the efficacy and impact of their products?
2. Is there an awareness of the appropriateness of different research methods?
3. Is there an understanding of what sound evidence is and how it should be generated and used?

### *The Hallmark Questions of Sub-Construct 6: Action Orientation*

1. Was the research plan acted upon?
2. Is the evidence that is generated acted upon?
3. How do you balance business goals with educational goals when implementing research findings?

These Hallmark Questions were used successfully to explain each Sub-Construct when presenting ELTE for the first time to stakeholders from the wider edtech ecosystem (enterprise, research, pupils, researchers, investors and policy makers) at the European Educational Technology Network as reported in Cycle 6 (see Appendix L).

If academics have limited time to engage with SMEs, the single most effective question that was shown to provide a quick evaluation of an ELTE was suggested in Cycles 1 and 2 through discussion with expert Participants. Discussed in detail in Section 4.3.1.6, this question is simply, *What research have you done?* This has been found by expert Research Mentors to be the most effective means of assessing whether an enterprise is an ELTE as Sub-Construct 6 validates some evidence of the remaining five Sub-Constructs and indeed is incumbent upon an evidence-informed enterprise.

In instances where an effective tool is needed to get to know an edtech enterprise in practice, the ELTE Action Model should be used. This model is a boundary object (Akkerman & Bakker, 2011) serving as a bridge between the academic and business communities, as was the goal of this study. The model together with semi-structured discussion questions (outlined in Section 6.2.2) and considerations outlined in Section 6.3.11, served as an effective boundary object for researchers when approaching edtech enterprises to understand how the ELTE framework has uniquely manifested within the structures of their organisations.

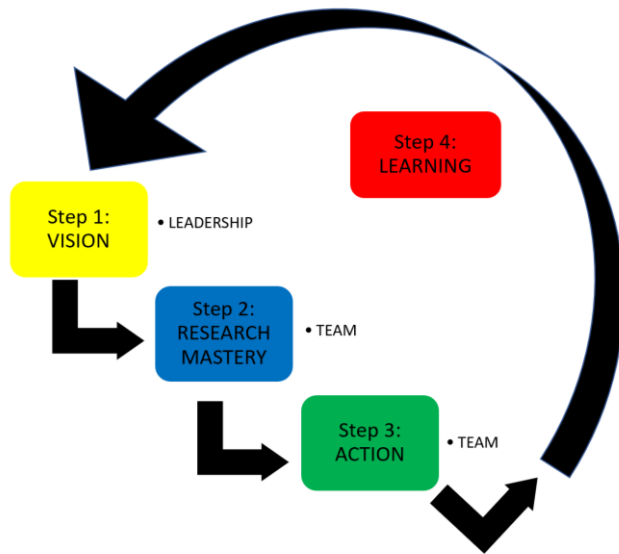


Figure 31. ELTE Action Model.

The ELTE Action Model should be used as a boundary object to help make visible the ELTE research loops in more detail and how they manifest in companies of varying sizes, purposes and stages of development. The case study presented in Section 6.3.11 is an example of one such case study to help depict using this boundary object, together with semi-structured accompanying questions (see Section 6.2.2).

## 7.2 How the ELTE Framework Relates to Existing Bodies of Knowledge

In this section, I relate each of the final Sub-Constructs to the existing bodies of knowledge by focussing on systematic studies relevant to each Sub-Construct. True to the tradition of learning sciences in which this thesis is situated, the literature relating to the ELTE framework are interdisciplinary, bringing together literature from various research areas. As is the tradition of the learning science community for over three decades, ideas in the review will come from scientists with different academic backgrounds and ideas regarding theory and methods, each contributing unique insights from a different perspective (Hoadley & Van Haneghan, 2011; Sommerhoff et al., 2018). Table 8 summarises different research disciplines that are relevant to the emerging themes. Not only are the areas of study different but the natures of the epistemological positions, methods research traditions employed are vastly different and almost incomparable. Hence, the goal of the following literature review was to show how findings might link with these other areas.

Table 8. Summary of Bodies of Literature Relevant to Themes within Sub-Constructs

Sub-construct no.	Sub-construct name	Themes	Relevant bodies of literature (research traditions in bracket)
1	Leadership Vision	<ol style="list-style-type: none"> <li>1. Clarity of Vision</li> <li>2. Building Appropriate Teams</li> <li>3. Prioritisation of Research</li> <li>4. ELTE Status Continuity</li> <li>5. Research Permeation</li> </ol>	Leadership, Management, Entrepreneurship
2	Learning Culture	<ol style="list-style-type: none"> <li>1. Research Culture is not Learning Culture</li> <li>2. The expert illusion</li> <li>3. Balance</li> </ol>	Growth Mindset, Company Culture, Learning Culture, Learning Organisation, Organisational Development, Organisational Behaviour
3	Sense of Purpose	<ol style="list-style-type: none"> <li>1. Enterprise Mission Clarification</li> <li>2. Eases the Tension Between the Trade-off between Business and Education</li> <li>3. Drives Evidence Collection</li> <li>4. Clarifies Business Strategy</li> </ol>	Social Entrepreneurship, Management, Entrepreneurship, Business Administration, Organisational Behaviour, Organisational Theory
4	Teamwork	<ol style="list-style-type: none"> <li>1. Whole Enterprise Representation</li> <li>2. Solving Problems Together</li> <li>3. Engaging External Team Members</li> </ol>	Company Culture – Team work/Team composition
5	Research Know-How	<ol style="list-style-type: none"> <li>1. Affords Confidence</li> <li>2. Appropriate Research Mastery</li> <li>3. Reconceptualisation of Research for EdTech Enterprises, an Applied Approach</li> <li>4. Managing Research Activities</li> <li>5. Literature Review</li> <li>6. Practicality</li> </ol>	Emerging Educational Technology
6	Action Orientation	<ol style="list-style-type: none"> <li>1. Most Important Sub-Construct</li> <li>2. Confidence</li> <li>3. Sustained Action</li> </ol>	Growth Mindset (Related to Sub-Construct 2)

Each of the Sub-Constructs is now focused on in turn.

### **7.2.1 Sub-Construct 1: Leadership Vision**

Literature in leadership research confirms the dependence of all other Sub-Constructs, and indeed all enterprise direction, culture and action in general,

on the Leadership Vision, confirming the data in the last Cycle suggesting other Sub-Constructs are dependent on leadership direction (Kam, Risavy, Perunovic, & Plant, 2014), and this Sub-Construct is so much a part of powering other Sub-Constructs. A comprehensive literature review of the critical success factors of technology start-ups concludes the critical importance of human capital leadership and the team that they establish in the survival of start-ups (Santisteban & Mauricio, 2017; Zaech & Baldegger, 2017). This is a relatively new area of research (Cornelius, Landström, & Persson, 2006); however, my findings have highlighted the critical importance of leadership in these delicate and dynamic organisations, whose foundation and development are dependent on leadership (Zaech & Baldegger, 2017).

The widely accepted definition of leadership by Bass and Stogdill (1990) states,

Leadership is an interaction between two or more members of a group that often involves a structuring or restructuring of the situation and the perceptions and expectations of members . . . Leadership occurs when one group member modifies the motivation or competencies of others in the group. Any member of the group can exhibit some amount of leadership. (pp. 19–20)

This suggested that perhaps the CEO is not the only leader of the organisation and that in this study, agreeing with the sentiment of Cycle 5 participants that name of this Sub-Construct should change from CEO Vision to Leadership Vision to reflect reality more accurately (Section 6.3.12). As with Teamwork, this Sub-Construct has a body of general research that can help with interventions that may deepen understanding of how to work with edtech leaders; however, research partnerships would need to be forged to explore the ELTE context further.

Smith and Petersen (as cited in Legrand et al., forthcoming) proposed that the mindset of education entrepreneurs can be characterised by four attributes: (1) visionary thinking, which is in line with the data from this study and the need for the establishment and communication of the Sense of Purpose by leadership; (2) belief in the possibility of change despite obstacles, which is characterised by their Sense of Purpose as the *raison d'être* of the organisation; (3) results and impact orientation, which is in line with Research Know-How and Action Orientation as ELTEs want to capture high-quality evidence and pivot business practice accordingly; and (4) the drive to build organisations to actualise their vision, which is characterised by the existence of the enterprise as a whole and

its purpose. Further studies can be conducted to go more in-depth on the review of this literature by Smith and Petersen (as cited in Legrand et al., forthcoming) and by Legrand et al. to enrich the understanding of this Sub-Construct moving forward.

### **7.2.2 Sub-Construct 2: Learning Culture**

Starting with the assumption argued in the previous section, leadership sets the tone and culture of an enterprise (Kam et al., 2014). D. Anderson and L.A. Anderson (2002, p. 98) explain that ‘culture is to organisations as mindset is to individuals’. They suggest that culture could be viewed as the collection of individual people’s mindsets that merge into a set of shared agreements that represent the values, operating principles and stories of an organisation. Culture drives what is acceptable within and for the organisation and is initially forged by the organisation’s founders:

These leaders put their own cultural mark on their organization while it was in its early, formative stages. There is nothing wrong with this; it is just what happens when people organize and work together over a period of time. Culture forms whether we want it to or not. The only variable is what it forms into. In the field of organization development, we talk of ‘indicators of culture’ such as: Leadership style; Communication patterns; Decision-making styles; Use of information. (p. 98)

This quote embodies the essence of culture that emerged in Cycle 2 and its interdependence on leadership guidance. In their book *Beyond Change Management*, D. Anderson and Anderson stated that ‘culture is to organizations as mindset is to individuals’ (p. 98). In a systemic review of the body of work exploring the correlation between leadership and Learning Culture, research found that leadership is key to establishing an organisation that is constantly learning (Xie, 2019) and confirms the contention that this type of transformational leadership skill can be taught in order to establish and maintain a learning organisation. These findings deeply enrich the understanding of this Sub-Construct and encourage a further exploration of these transformational leadership techniques in the context of edtech entrepreneurship. The findings also suggest that the methodology of teaching transformational leadership can be highly enriching for the ELTE context and perhaps an impactful addition to a leadership stream in the EDUCATE programme.

In the case of ELTEs, Cycle 2 suggests that we are aiming to set a Learning Culture, an organisation whose members understand that they must

always be learning and growing – a feat that is best described by Dweck (2006, 2013) and explained in detail in Cycle 2’s literature review (refer to that section for more detail on a growth mindset). A growing body of literature is looking at learning organisations and interventions that will aid the development of a growth mindset for team members, giving a competitive edge for human resource development (Han & Stieha, 2020) which should be further researched to test applications in the context of the ELTE. It should be noted that much of this research is at the intersection of leadership, teamwork and growth mindset – and further research may be needed to explore in more depth how the three concepts interrelate.

### **7.2.3 Sub-Construct 3: Sense of Purpose**

The Sub-Construct of Sense of Purpose is summarised well by Peter Drucker in management literature in the 1970s (Alegre, Berbegal-Mirabent, Guerrero, & Mas-Machuca, 2018). Drucker (1973) explained, ‘a business is not defined by its name, statutes or articles of incorporation. It is defined by the business mission. Only a clear definition of the mission and purpose of the organization makes possible clear and realistic business objectives’ (p. 59). Drucker presented the contention that a mission statement is the company’s reason for being and therefore the way it should be differentiated by other businesses as opposed to differentiation by name. Management literature in mission statements generally agrees that a mission should be clear both inside and outside of an organisation, and this clarity is the catalyst for a heightened Sense of Purpose in the organisation, which in turn is necessary for clarifying business strategy and is widely accepted in literature as the first step of strategic planning (David, 1989; Strong, 1997).

In the social enterprise literature, Legrand et al. (forthcoming) mentioned a spectrum that exists between the balance, on one hand, of social benefit over shareholder wealth (Phillips, Lee, Ghobadian, O’Regan, & James, 2015; Rey-Martí, Ribeiro-Soriano, & Palacios-Marqués, 2016) and, on the other hand, in a more balanced double bottom line where both are valued equally. In either case, as social enterprises (which many edtechs define themselves as) measure their success to varying amounts by the social benefit, it is therefore necessary for them to have a clearly laid out mission that drives the Sense of Purpose in the organisation, which results in their overall alignment to this Sub-Construct as

defined not only by Drucker's contention of mission but also in the relative strength of social enterprises to be geared towards the achievement of this Sub-Construct in alignment with definitions and themes that emerged in this study.

#### **7.2.4 Sub-Construct 4: Teamwork**

A comprehensive systemic review confirms a deep body of research devoted to the strategic assembly of teams that relates to the definition of Teamwork in my findings (McEwan, Ruissen, Eys, Zumbo, & Beauchamp, 2017). This body of research suggests teamwork interventions, citing extensive empirical evidence that suggests teamwork can be improved through interventions such as training, thus allowing a depth of knowledge that can enrich the strategic implementation of this Sub-Construct into edtech enterprises. Collaborations with teams such as the Team Mindset Lab at Boise University,<sup>5</sup> led by Dr Soo Jeoung Han – whose mission is to understand how team mindsets (thoughts, beliefs and expectations) might improve enterprise performance and to research such interventions – would be beneficial to cater empirical research to the edtech SME context, and specifically the ELTE context.

#### **7.2.5 Sub-Construct 5: Research Know-How**

There has not been enough work done to support edtech SMEs to develop research capacity, and as explained in literature published by EDUCATE research team members, this is the unique initiative of EDUCATE (Clark-Wilson & Weatherby, forthcoming; Cukurova, Luckin, & Clark-Wilson, 2018). Section 1.2 explained how EDUCATE is filling this gap through the Research Training Programme and mentorship of developing research know-how appropriate for edtech SMEs. The literature in Chapter 2 (Section 2.2) explains the underpinning research of the EDUCATE programme and will not be repeated here. Data in this study supported the importance of this Sub-Construct, and no themes emerged that were in conflict with the purpose of the programme. This may also be due in part to the design-based research (Clark-Wilson & Weatherby, forthcoming) approach to the Research Training Programme, where it was updated to meet user needs and refined for appropriateness with each research Cycle. It may also be due in part to Participants being EDUCATE team members; however, this issue was reconciled in this Cycle, where the appropriateness and need of this

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<sup>5</sup> See <https://www.boisestate.edu/opwl-team-mindset-lab/>

(and all other) Sub-Construct(s) were checked by stakeholders outside of the EDUCATE programme. As it stands, there are no updates from Cycle 1's literature review in this thesis around Research Know-How.

### **7.2.6 Sub-Construct 6: Action Orientation**

Action Orientation has the unique power to encompass other Sub-Constructs. Perhaps as Sub-Construct 6 is the final touch of all other action and attitude, it is deeply related to and can be seen as the proof of a growth mindset. This Sub-Construct has two parts, and both require openness and humility – first to learn and second to pivot if findings require such changes. See the previous Sub-Construct for reference to the mindset literature that drives this action.

## **7.3 Limitations of Study**

This section discusses the significance of the ELTE construct on a theoretical as well as a methodological level.

A theoretical limitation of this work is that claims cannot be made until they are tested 'in the wild' (Hutchins, 1995). These are speculations based on the EDUCATE programme mentors who did not have a view of what was happening on the ground in the workplace and varying prior experiences of working with edtech SMEs. Though Phase 3 of this study focused on perspectives of EDUCATE enterprises as well as wider ecosystem stakeholders, a larger sample of edtech stakeholders would need to be engaged globally to validate the survey involving quantitative methods.

Upon reflection, I maintain that taking Glaser and Strauss' (1967) grounded approach was the only appropriate methodology to meet the goals of this exploratory study. This approach allowed me to co-design with the EDUCATE Participants and model companies and to take a unique opportunity to design a novel construct with experts.

A strength of this data set was that the EDUCATE programme was situated in London, a multicultural cosmopolitan city, making EDUCATE's participants and alumni highly diverse with respect to ethnic, cultural and socio-economic background and target market. Though I am uncertain if results would be similar if the EDUCATE programme was situated in a different part of the world, perhaps being situated in London allowed for greater global context in the dataset. The promising findings from Cycle 6 revealed how, in a conference in Oulu, Finland, 40 representatives of the global edtech ecosystem found the



framework applicable to their contexts. Though there were representatives from around the world, the sample is not large enough to validate findings on a global scale, and further studies are needed here.

Cycle 6 was the most 'wild' (Hutchins, 1995) Cycle – individuals had no experience in the EDUCATE programme and varying amounts of Research Know-How in the context of edtech start-ups. I sensed a great deal of confusion around the concept of an ELTE and, until it was explained in detail, there was a steep learning curve, first around the acronym of ELTE and what it stood for and then around understanding the Sub-Constructs and also the EDUCATE programme and its various parts. In retrospect, perhaps a well-produced video with more visual aids around the EDUCATE programme that explained its purpose and need, as well as the ELTE and the Sub-Constructs, would have been a useful tool prior to beginning the survey to better understand concepts and mitigate feelings of being overwhelmed. The keynote and the introduction were only enough for Participants in Cycle 2 and Cycle 5, who were a part of the EDUCATE programme and had greater understanding of the context surrounding the development of the ELTE. For those not familiar with EDUCATE, there were too many new things to learn, and I felt the learning curve was steeper than it needed to be. That being said, the ideal scenario would be to validate with stakeholders in the edtech ecosystem who had experience with evidence-informed edtech enterprises; however, as this is a new domain, this will be harder to achieve, and the aforementioned ideas can help in the interim to improve future validation workshops with partners around the world.

A more colloquial and self-explanatory title shift from an ELTE to a Research-Minded EdTech Enterprise would also aid in understanding the purpose of the construct and avoiding technical language for the purposes of filling out the Survey. I had to answer a few questions at the start of the Workshop in this regard. I also got tips on how to make the wording more accessible on the survey, and in the future, I would test the survey on a sample before sending it out to a larger number of Participants.

Another option would be to ask future Participants to fill out the survey ahead of time after watching a briefing video, avoiding the time pressure of a Workshop. The issue with this is two-fold: (1) They may not do it, and (2) they may forget controversial items they came across by the time they get into the Workshop, therefore lessening conversation. In this regard, perhaps there can be

an exploration of shortening the survey in future group Workshop settings, making the language easier and renaming the Sub-Constructs to be more self-explanatory outside of academia.

#### **7.4 Further Research**

While there are many avenues to pursue in this very new area, the four areas I feel to be most relevant to furthering the goals of this study follow.

##### ***7.4.1 Further Research 1: Prioritisation of Sub-Constructs***

Research Questions: Which Sub-Constructs are most important to develop first?

Are there dependencies and a hierarchy of Sub-Constructs?

Hypothesis: The ELTE Sub-Construct Hierarchy Model is a theory emerging in the Validation Phase of this study that needs to be further validated in order to assess whether suggested dependencies are an accurate abstraction of reality (see Figure 31).

##### ***7.4.2 Further Research 2: ELTE Leadership Training***

Research Questions: How do you develop Vision? What would an EDUCATE programme focusing on ELTE management look like?

Background: Leadership Vision was hypothesised to be the most important factor at the start of this study.

Hypothesis: Leadership need to understand key facets of each Sub-Construct without too much cognitive load.

##### ***7.4.3 Further Research 3: ELTE Research Methods***

Research Questions: What are the most used research methods in EDUCATE ELTEs? Can they be mapped by size and stage of growth of the edtech enterprise so edtech enterprises know what to expect as ELTEs? Can research methods training therefore be more tailored to the size and stage of growth of the enterprise to relieve cognitive load and save time?

Background: The EDUCATE Research Training Programme is extensive, and perhaps some methods are irrelevant in the context of an ELTE or at the size and stage of growth of given enterprises. This research project aims to map the use of research methods by model EDUCATE companies to further optimise research know-how training, if possible.

Hypothesis: Many similar methods are being used, and the Research Training Programme can be redesigned to focus more on the specific ELTE needs.

#### **7.4.4 Further Research 4: ELTE Case Studies**

Research Questions: How did model companies enact the six Sub-Constructs of an ELTE in their business processes?

Background: Develop a series of business case studies using the ELTE Action Model (and accompanying semi-structured questions as demonstrated in Cycle 5 of this study; Section 6.2.2) for aspiring ELTEs to learn from. These can be used in the EDUCATE programme to enable a clearer vision for aspiring ELTEs.

Hypothesis: They are all different and, looking closely at the challenges they face and the systems they put in place to systematise their efforts, will service other aspiring ELTEs to learn from their example.

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## Appendices

## Appendix A: EdWard Selection Criteria

Level	Criteria	Evidence required
Level 1: Evidence Aware	<ul style="list-style-type: none"> <li>• Our company attended the majority of events on the EDUCATE programme.</li> <li>• Our company made use of the UCL LEAN platform.</li> <li>• Our company engaged positively with the programme team.</li> <li>• Our company has reflected on what we learned during the EDUCATE programme and the impact of this on our approach to developing our business or product/service.</li> <li>• Our company has developed a logic model or theory of change for our product or service.</li> <li>• Our company developed a research proposal with an explicit research question/questions that demonstrate our understanding of relevant research concepts.</li> <li>• Our company feels 'research ready'.</li> </ul>	<ul style="list-style-type: none"> <li>• Min. 12 hours of attendance at EDUCATE programme events</li> <li>• Populated UCL LEAN boards (both Business and Research)</li> <li>• Logic Model/Theory of Change submitted</li> <li>• Research Proposal submitted</li> </ul>
Level 2: Evidence Applied	<ul style="list-style-type: none"> <li>• Our company satisfies the criteria for Evidence Aware.</li> <li>• Our company has contributed further to the EDUCATE programme and its community, for example by helping other cohort members or making suggestions on how to improve the EDUCATE participant journey.</li> <li>• Our company has achieved a particular insight, change, or breakthrough in its approach as a result of participation in the programme.</li> <li>• Our company has developed a particularly robust research proposal and is making progress on conducting this research and communicating its outcomes.</li> </ul>	<ul style="list-style-type: none"> <li>• Evidence submitted</li> <li>• Evidence submitted</li> <li>• C28 OR evidence submitted</li> <li>• Evidence submitted</li> </ul>

## **Appendix B: Interview Questions**

### *Introduction*

1. We meet in an elevator and I've never heard of your product before (and I'm not in the education industry): how do you pitch your product to me?
2. I'm walking by your stand at MWC, just looking for new, interesting ideas to invest in or recommend to my investor friends. I have five minutes. Can you demo your products for me?

### *Theme 1: Story (Who the Entrepreneur Is, Their Story, Their Motivation)*

3. Tell me your story. How did your background lead you to this?
4. What is your company vision and mission?
5. What motivates you?
6. What was your greatest challenge in the process?
7. What do you feel was a major victory?
8. What are your short- and long-term goals for the business?
9. How do you define success? (What does success look like?)
10. What's your legacy?

### *Theme 2: The Golden Triangle (Design Process – How They Engage the Other Two Points, to What Extent They Engage the CEBPD Model)*

11. Where do your ideas come from?
12. How are you structured as a company?
13. Tell me about the process from idea to product/service.
14. How has the process changed?
15. How do you engage the other two points in the golden triangle? What does success with working with them look like?
16. What is some advice you would give to yourself starting out on creating a good process?
17. What research are you looking at? Are you engaging with other researchers? Do you feel that the research is understandable? How would you prefer for it to be packaged for optimal use for entrepreneurs? What gaps do you see in research that you are following?

### *Theme 3: Interaction with EDUCATE*

18. Why did you join EDUCATE? (Goals)
19. Do you feel that the goal(s) were met?
20. How was your experience? (Were you directly involved?)
21. What were your favourite aspects?



22. What did you wish the program offered?
23. Did you find the research aspect interesting/difficult?
24. To what extent did you follow the research related to your field before EDUCATE? What publications would you read?

*Theme 4: The Environment*

25. What programmes, other than EDUCATE, have you participated in?
26. What support do you wish you had?
27. What structures/programs/other mechanisms are missing in the edtech ecosystem?
28. What are the difficulties of having an edtech business in London? (Have you heard of anything better elsewhere?)
29. What are the benefits of having an edtech business in London?
30. What do you wish was different? How do you think it can change?
31. Which external stakeholder(s) have affected your work most?
32. Is there anyone you admire that you would like to see profiled here?

*Theme 5: General Advice*

33. If you had to tweet your younger self some advice, what would it be?
34. Now you can elaborate: what general advice would you give to your younger self?
35. What advice would you give to the larger edtech community? (To any stakeholder)

## **Appendix C: London EdTech Ecosystem Activities**

Complete list of events and activities attended during the period September 2017–March 2019

### **London EdTech Ecosystem Activities**

#### *Conferences*

Westminster High Education Forum, March 2019

BETT 2019, BETT 2018, January

Panel Moderator on Applying an Evidence-Base to EdTech the International Market, BESA Launchpad, October 2018

EDUCATE Investor Summit and Demo Day, December 2018 (also attended two other demo days)

London Festival of Learning, June 2018

Learning@Scale Conference, June 2018

International Society of the Learning Sciences Conference, June 2018

Artificial Intelligence in Education Conference, June 2018

London EdTech Week, June 2018

London Tech Week, June 2018

Nimbus Ninety Converge 2018, May 2018

#### *Events and Workshops*

London Business Awards, February 2019

META Training, January 2019

EDUCATE cohort workshops, classes, events, September 2017 – present

EDUCATE Tableau Data Dive, February 2019

EATR Test Adaptation with EDUCATE Research Team, November 2019

Tmrw Institute Investing in EdTech Event, October 2018

Institute for Ethical AI Launch at the Speaker's House, October 2018

EdTech Podcast Festival, September 2018

IOE Debates, 2018

Whole Education, February 2018

UCL Impact Evaluation Consulting Project, Spring/Summer 2018

GDPR Workshop, November 2017

London Teach Meet, November 2017

Nesta Impact Investment Workshop, November 2017

BESA EdTech House of Lords Reception, November 2017

HMC (The Headmasters' and Headmistresses' Conference), November 2017  
DebateMate 10<sup>th</sup> Anniversary Launch, October 2017  
Emerge Cohort Launch, October 2017  
EDUCATE Teacher Track Working Group, October 2017  
BESA Media Training, October 2017  
F6S Pitch Day, October 2017  
BESA Launchpad, October 2017  
ISTE 2017, July 2017

#### *Meetings*

EDUCATE Town Hall Meetings (Quarterly), April 2018  
EDUCATE Research Team Meetings (Bi-Monthly), January 2018- Present  
EDUCATE Advisory Board Meeting (1)  
EDUCATE Steering Group (2)  
EDUCATE Project Management Meetings (2)  
EDUCATE Investor Working Group  
EDUCATE Edwards Working Group  
Supervisory Meetings (Monthly Since October 2017)  
Founders4Schools Advisory Board Meeting (2)  
EDUCATE Partners' Meeting (Weekly), October 2017- October 2018  
DFE EdTech Advisory Meeting, October 2017  
UCLC EdTech Project Initial Company Meeting, October 2017

#### *Company Visits*

Visited 5 edtech companies (2 small, 3 medium) – will not disclose their names for privacy purposes

#### *School Visits*

St Paul's School, November 2017  
Eton, January 2019

#### **United Kingdom**

Opening Keynote, EdTech Expo 2018, Liverpool UK, December 2018  
Cambridge University Student Focus Groups, March 2018

#### **United States**

Conference call with University of Pennsylvania Graduate School of Education team regarding respective projects, April 2018  
Dr Barbara Kurshan, University of Pennsylvania Graduate School of Education  
Seminar at UCL Knowledge Lab for EDUCATE Research Team, October 2018

University of Pennsylvania Graduate School of Education – Education  
Entrepreneurship Workshop in San Francisco, March 2019  
Digital Promise, in person March 2019, Conference Call, October 2018  
3 Silicon Valley Company Visits (2 large, 1 small) – will not disclose their names  
for privacy purposes  
3 Silicon Valley Accelerator Visits, March 2019  
Meeting with Silicon Valley Based EdTech VC, March 2019

### **Canada**

Meeting with Minister of Research and Innovation regarding Vector Institute for AI  
in Education, July 2017  
Meeting with Director of TheDMZ Accelerator – Globally Ranked No.1 University-  
Based Research Accelerator at Ryerson University, July 2017

### **France**

Meeting with LearnSpace edtech Accelerator January 2019  
French EdTech Networking Reception at BETT 2019

### **Spain**

South Summit edtech track in Madrid, Spain, October 2018

### **Finland**

ERASMUS+ PhD Exchange – Hosted Finnish PhD student for idea exchange in  
EdTech, June 2018  
European EdTech Network (EETN) Launch Meeting including planning Oulu  
University  
EETN Launch Meeting, March 2019  
(Planning to attend EETN Finnish Week, February 2020)

### **Israel**

MindCET Accelerator Reception and Pitch Day, June 2018  
(Invitation to visit MindCET Israel, month to be determined 2020)

### **Denmark**

LearnT EdTech Programme Visit, September 2018

### **Switzerland**

Zurich EdTech Accelerator, April 2018  
Conference Call Follow-up with Zurich EdTech Accelerator, January 2019

### **Belgium**

EETN Launch Meeting, October 2018

### **United Arab Emirates**

Global Education and Skills Forum, Dubai 2018

**Japan**

Japanese Government Scholarship Award for Study Week at Waseda University,  
Tokyo, November-December 2017

Waseda Academy School Visit, December 2017

**Global**

Meeting with World Bank Education Team regarding EdTech, June 2018

## Appendix D: Participant Ethical Approvals

### Institute of Education



### Developing A Research Mindset in Educational Technology Founders in the EDUCATE Programme, Doctoral Dissertation

#### Consent Form

If you are happy to participate in this study, please complete this consent form and return to Anissa Moeini in person, or at the address below.

	Yes	No
I have read and understood the information leaflet about the research.	<input type="checkbox"/>	<input type="checkbox"/>
I agree to be audio/video recorded during the project.	<input type="checkbox"/>	<input type="checkbox"/>
I understand that if any of my words are used in this dissertation or related reports and presentations, they will not be attributed to me without my explicit permission.	<input type="checkbox"/>	<input type="checkbox"/>
I understand that I can withdraw from the project at any time, and that if I choose to do this, any data I have contributed will not be used.	<input type="checkbox"/>	<input type="checkbox"/>
I understand that I can contact Anissa Moeini at any time and request for my data to be removed from the project database.	<input type="checkbox"/>	<input type="checkbox"/>
I understand that the results will be shared with the EDUCATE partners and collaborators and in research publications and/or presentations.	<input type="checkbox"/>	<input type="checkbox"/>

Name \_\_\_\_\_ Signed \_\_\_\_\_

Date \_\_\_\_\_

Anissa Moeini  
Doctoral Student  
UCL Knowledge Lab  
UCL Institute of Education  
23-29 Emerald Street London WC1N 3AL  
[anissa.moeini.17@ucl.ac.uk](mailto:anissa.moeini.17@ucl.ac.uk)

### **Participant Information Sheet for Doctoral Dissertation**

UCL Research Ethics Committee Approval ID Number: TBD  
Data protection registration number: Z6364106/2019/03/35

#### **YOU WILL BE GIVEN A COPY OF THIS INFORMATION SHEET**

**Title of Study: Developing A Research Mindset in Educational Technology Founders in the EDUCATE Programme**

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**Department: UCL Knowledge Lab, UCL Institute of Education, University College London**

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**Name and Contact Details of the Researcher(s): Anissa Moeini [anissa.moeini.17@ucl.ac.uk](mailto:anissa.moeini.17@ucl.ac.uk)**

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**Name and Contact Details of the Principal Researcher: Professor Rose Luckin [r.luckin@ucl.ac.uk](mailto:r.luckin@ucl.ac.uk)**

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#### **1. Invitation Paragraph**

As a participant in the EDUCATE project, you are invited to take part in the parallel UCL doctoral study that aims to evaluate the impact of the programme on participants' products, services, processes and mindsets.

Before you decide, it is important for you to understand why the research is being done and what participation will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask Anissa Moeini if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

#### **2. What is the dissertation's purpose?**

Anissa Moeini is keen to involve participants of EDUCATE project in a collaborative research study that aims to:

- Evaluate the impact of the programme on EDUCATE participants' products, services and processes.
- Assess whether the project builds a research mindset in participants
- Co-design a tool that helps to build research mindsets
- Publish and disseminate the outcomes of the EDUCATE project primarily in the form of a doctoral dissertation, and secondarily in blogs, conference presentations and articles in peer-reviewed academic journals and books.

#### **3. Why have I been chosen?**

All EDUCATE project participants are being invited to also take part in this research study.

#### **4. Do I have to take part?**

It is up to you to decide whether or not to take part.

If you decide to take part you should keep this information sheet and sign and return the attached consent form. You can withdraw from the research at any time by contacting Anissa Moeini without giving a reason and without it affecting any benefits that you are entitled to as an EDUCATE project participant. If you decide to withdraw you will be asked what you wish to happen to the data you have provided up to that point in time.

**5. What will happen to me if I take part?**

You will be involved in interviews, action research and participatory design sessions taking place during the term of Anissa Moeini's doctoral dissertation starting April 2019 and ending in December 2020.

**6. Will I be recorded and how will the recorded media be used?**

Anissa Moeini may audio and/or video record your activities during interviews and in-company observations, which she may use for analysis for the doctoral dissertation and for illustration in conference presentations and lectures. No other use will be made of them without your written permission, and no one outside the project research team will be allowed access to the original recordings.

**7. What are the possible disadvantages and risks of taking part?**

We do not anticipate any disadvantages or risks to you or your company by taking part in this research.

**8. What are the possible benefits of taking part?**

Whilst there are no immediate benefits for you if you participate in the research project, it is hoped that this research will support you and the wider educational technology community by:

- developing a deeper understanding of how research mindedness can be fostered and build in educational technology entrepreneurs
- developing case studies of EDUCATE project companies that may also be a useful resource for your company to use in its marketing and communications strategy.

**9. What if something goes wrong?**

In the first instance you should contact Anissa Moeini ([anissa.moeini.17@ucl.ac.uk](mailto:anissa.moeini.17@ucl.ac.uk)) or her supervisors Professor Rose Luckin ([r.luckin@ucl.ac.uk](mailto:r.luckin@ucl.ac.uk)) or Dr Alison Clark-Wilson ([a.clark-wilson@ucl.ac.uk](mailto:a.clark-wilson@ucl.ac.uk)).

However, if you would like to take your concern or complaint further, please contact the Chair of the UCL Institute of Education Research Ethics Committee, Dr Lynn Ang ([l.ang@ucl.ac.uk](mailto:l.ang@ucl.ac.uk)).

**10. Will my taking part in this project be kept confidential?**

All the information that Anissa Moeini will collect about you (and your product or service) during the course of the research will be kept strictly confidential. You (and/or your product or service) will not be able to be identified in Anissa Moeini's doctoral dissertation or any ensuing reports or publication.

In some cases where you (and/or your product or service) consider it beneficial to be identified in articles and publications, Anissa Moeini will seek your explicit permission to do so.

**11. Limits to confidentiality**

Confidentiality will be respected unless there are compelling and legitimate reasons for this to be breached. If this was the case we would inform you of any decisions that might limit your confidentiality.

**12. What will happen to the results of the research project?**

The data collected during the research will be primarily used in the writing of Anissa Moeini's doctoral dissertation and secondarily used in publications and for dissemination activities throughout the project. The doctoral dissertation will be shared with you upon completion and all other publications will be made available on the EDUCATE website ([www.educate.london](http://www.educate.london)).



The data collected during the course of the project might also be used for additional or subsequent research.

### 13. Data Protection Privacy Notice

**Notice:**

The data controller for this project will be University College London (UCL). The UCL Data Protection Office provides oversight of UCL activities involving the processing of personal data, and can be contacted at [data-protection@ucl.ac.uk](mailto:data-protection@ucl.ac.uk).

UCL's Data Protection Officer is Lee Shailer and he can also be contacted at [data-protection@ucl.ac.uk](mailto:data-protection@ucl.ac.uk).

Your personal data will be processed for the purposes outlined in this notice. The legal basis that would be used to process your personal data will be the provision of your consent. You can provide your consent for the use of your personal data in this project by completing the consent form that has been provided to you.

***Your personal data will be processed so long as it is required for the research project.*** If Anissa Moeini is able to anonymise or pseudonymise the personal data you provide and will undertake this, and will endeavour to minimise the processing of personal data wherever possible.

If you are concerned about how your personal data is being processed, please contact UCL in the first instance at [data-protection@ucl.ac.uk](mailto:data-protection@ucl.ac.uk). If you remain unsatisfied, you may wish to contact the Information Commissioner's Office (ICO). Contact details, and details of data subject rights, are available on the ICO website at: <https://ico.org.uk/for-organisations/data-protection-reform/overview-of-the-gdpr/individuals-rights/>

### 14. Who is organising and funding the research?

This research is being self-funded by Anissa Moeini as a part of her Doctoral Dissertation at UCL Knowledge Lab, UCL Institute of Education.

### 16. Contact for further information

Anissa Moeini      [anissa.moeini.17@ucl.ac.uk](mailto:anissa.moeini.17@ucl.ac.uk)

**You will be given a copy of the information sheet and a signed consent form to keep.**

**Thank you for reading this information sheet and for considering to take part in this research study.**

## Doctoral Student Ethics Application Form

Anyone conducting research under the auspices of the Institute of Education (staff, students or visitors) where the research involves human participants or the use of data collected from human participants, is required to gain ethical approval before starting. This includes preliminary and pilot studies. Please answer all relevant questions in simple terms that can be understood by a lay person and note that your form may be returned if incomplete.

### Registering your study with the UCL Data Protection Officer as part of the UCL Research Ethics Review Process

If you are proposing to collect personal data i.e. data from which a living individual can be identified **you must be registered with the UCL Data Protection Office before you submit your ethics application for review.** To do this, email the complete ethics form to [data-protection@ucl.ac.uk](mailto:data-protection@ucl.ac.uk). Once your registration number is received, add it to the form\* and submit it to your supervisor for approval. If the Data Protection Office advises you to make changes to the way in which you propose to collect and store the data this should be reflected in your ethics application form.

**Please note that the completion of the UCL GDPR online training is mandatory for all PhD students. The link is here: <https://www.ucl.ac.uk/legal-services/ucl-general-data-protection-regulation-gdpr/gdpr-online-training>**

Section 1 Project details		
a.	Project title	Developing a Research Mindset in Educational Technology Founders in the EDUCATE Programme
b.	Student name and ID number (e.g. ABC12345678)	Anissa Moeini 17122992
c.	<b>*UCL Data Protection Registration Number</b>	Reference No Z6364106/2019/03/35 Date Issued March 5, 2019
c.	Supervisor/Personal Tutor	Primary: Professor Rose Luckin Secondary: Dr Alison Clark-Wilson
d.	Department	CCM (UCL Knowledge Lab)
e.	Course category (Tick one)	PhD <input checked="" type="checkbox"/> EdD <input type="checkbox"/>
		DEdPsy <input type="checkbox"/>
f.	<b>If applicable</b> , state who the funder is and if funding has been confirmed.	
g.	Intended research start date	March 2019
h.	Intended research end date	September 2020
i.	Country fieldwork will be conducted in <i>If research to be conducted abroad please check <a href="http://www.fco.gov.uk">www.fco.gov.uk</a> and submit a completed travel risk assessment form (see guidelines). If the FCO advice is</i>	UK

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<i>against travel this will be <b>required</b> before ethical approval can be granted:</i>	
<a href="http://ioenet.inst.ioe.ac.uk/about/profservices/international/Pages/default.aspx">http://ioenet.inst.ioe.ac.uk/about/profservices/international/Pages/default.aspx</a>	
j.	Has this project been considered by another (external) Research Ethics Committee?
	Yes <input type="checkbox"/>
	External Committee Name:
	No <input checked="" type="checkbox"/> ⇒ go to Section 2
	Date of Approval:
<b>If yes:</b>	
<ul style="list-style-type: none"> <li>- Submit a copy of the approval letter with this application.</li> <li>- Proceed to Section 10 Attachments.</li> </ul>	
<b>Note:</b> Ensure that you check the guidelines carefully as research with some participants will require ethical approval from a different ethics committee such as the <a href="#">National Research Ethics Service (NRES)</a> or <a href="#">Social Care Research Ethics Committee (SCREC)</a> . In addition, if your research is based in another institution then you may be required to apply to their research ethics committee.	

## Section 2 Research methods summary (tick all that apply)

- |   |   |
|---|---|
| <input checked="" type="checkbox"/> Interviews        | <input type="checkbox"/> Controlled trial/other intervention study                                    |
| <input checked="" type="checkbox"/> Focus groups      | <input type="checkbox"/> Use of personal records  |
| <input checked="" type="checkbox"/> Questionnaires    | <input type="checkbox"/> Systematic review ⇒ <i>if only method used go to Section 5.</i>              |
| <input checked="" type="checkbox"/> Action research   | <input type="checkbox"/> Secondary data analysis ⇒ <i>if secondary analysis used go to Section 6.</i> |
| <input checked="" type="checkbox"/> Observation       | <input type="checkbox"/> Advisory/consultation/collaborative groups                                   |
| <input checked="" type="checkbox"/> Literature review | <input type="checkbox"/> Other, give details:   |

Please provide an overview of the project, focusing on your methodology. This should include some or all of the following: purpose of the research, aims, main research questions, research design, participants, sampling, data collection (including justifications for methods chosen and description of topics/questions to be asked), reporting and dissemination. Please focus on your methodology; the theory, policy, or literary background of your work can be provided in an attached document (i.e. a full research proposal or case for support document). *Minimum 150 words required.*

Below are ethical issues that have been approved for the EDUCATE project. There are no new issues with my dissertation research. Please find EDUCATE Ethical Review Form and Ethical Review Approval Letter attached.

EDUCATE is a unique project bringing together entrepreneurs and innovators, with academics, researchers and educators, to deliver world-class EdTech products and services.

Based at UCL Knowledge Lab, UCL Institute of Education, EDUCATE is match-funded by the European Regional Development Fund and UCL's partners: UCL Engineering, the British Educational Suppliers Association (BESA), Nesta and F6S. This collaboration brings together all the strands of knowledge, experience and expertise needed to produce world-class EdTech.

The UCL Knowledge Lab research team (led by Dr Alison Clark-Wilson) is developing and delivering a rigorous and comprehensive research training programme that is designed to help start-ups, SMEs, entrepreneurs and educators to develop, evaluate and improve their products and services with the use of research evidence.

The aim is that entrepreneurs and innovators can be confident that access to reputable evidence will assist them in developing world-class products and services that are effective and marketable, and fit for purpose.

The parallel UCL KL research is focused on the evaluation of participants' progress through the research training programme and its impact on the development of their products, services and processes. Most of this research evidence is already captured through the participants' responses to tasks and activities on the programme. The EDUCATE project itself has sought and received Ethical approval to collect the following additional data from the participants:

- audio recordings of face-to-face research mentoring sessions;
- screen recordings of online research mentoring sessions;

- audio/video recording of small group discussions;
- audio/video recording of company presentations to the project.

online questionnaires to evaluate participants' experiences of the programme.  
Please see full ethical approval acceptance letter attached.

In addition, I will be:

- conducting audio-recorded interviews
- conducting observation within companies and in the community

**Section 3 Research Participants (tick all that apply)**

<input type="checkbox"/> Early years/pre-school <input type="checkbox"/> Ages 5-11 <input type="checkbox"/> Ages 12-16 <input type="checkbox"/> Young people aged 17-18	<input checked="" type="checkbox"/> Adults <i>please specify below</i> <input type="checkbox"/> Unknown – specify below <input type="checkbox"/> No participants Adults who are small business entrepreneurs or their employees participating in the EDUCATE project.
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**NB:** Ensure that you check the guidelines carefully as research with some participants will require ethical approval from a different ethics committee such as the [National Research Ethics Service](#) (NRES) or [Social Care Research Ethics Committee](#) (SCREC).

**Section 4 Security-sensitive material (only complete if applicable)**

Security sensitive research includes: commissioned by the military; commissioned under an EU security call; involves the acquisition of security clearances; concerns terrorist or extreme groups.

a.	Will your project consider or encounter security-sensitive material?	Yes <input type="checkbox"/> *	No <input checked="" type="checkbox"/>
b.	Will you be visiting websites associated with extreme or terrorist organisations?	Yes <input type="checkbox"/> *	No <input checked="" type="checkbox"/>
c.	Will you be storing or transmitting any materials that could be interpreted as promoting or endorsing terrorist acts?	Yes <input type="checkbox"/> *	No <input checked="" type="checkbox"/>

\* Give further details in **Section 8 Ethical Issues**

**Section 5 Systematic reviews of research (only complete if applicable)**

a.	Will you be collecting any new data from participants?	Yes <input type="checkbox"/> *	No <input type="checkbox"/>
b.	Will you be analysing any secondary data?	Yes <input type="checkbox"/> *	No <input type="checkbox"/>

\* Give further details in **Section 8 Ethical Issues**

*If your methods do not involve engagement with participants (e.g. systematic review, literature review) and if you have answered **No** to both questions, please go to **Section 8 Attachments**.*

**Section 6 Secondary data analysis (only complete if applicable)**

a.	Name of dataset/s	
b.	Owner of dataset/s	



c.	Are the data in the public domain?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
			<b>If no, do you have the owner's permission/license?</b> Yes <input type="checkbox"/> No* <input type="checkbox"/>
d.	Are the data special category personal data (i.e. personal data revealing racial or ethnic origin, political opinions, religious or philosophical beliefs, or trade union membership, and the processing of genetic data, biometric data for the purpose of uniquely identifying a natural person, data concerning health or data concerning a natural person's sex life or sexual orientation)?	Yes* <input type="checkbox"/>	No <input type="checkbox"/>
e.	Will you be conducting analysis within the remit it was originally collected for?	Yes <input type="checkbox"/>	No* <input type="checkbox"/>
f.	<b>If no</b> , was consent gained from participants for subsequent/future analysis?	Yes <input type="checkbox"/>	No* <input type="checkbox"/>
g.	<b>If no</b> , was data collected prior to ethics approval process?	Yes <input type="checkbox"/>	No* <input type="checkbox"/>
* Give further details in <b>Section 8 Ethical Issues</b>			
If secondary analysis is only method used <b>and</b> no answers with asterisks are ticked, go to <b>Section 9 Attachments</b> .			
<b>Section 7 Data Storage and Security</b>			
Please ensure that you include all hard and electronic data when completing this section.			
a.	<b>Data subjects - Who will the data be collected from?</b>	Adults who are participating in the EDUCATE project	
b.	<b>What data will be collected?</b> Please provide details of the type of personal data to be collected	<ul style="list-style-type: none"> <li>- the 'theory of change' for the participants' educational technology product or service.</li> <li>- the draft research proposal for the participants' educational technology product or service.</li> <li>- participants' perceptions of their experiences on the EDUCATE programme.</li> <li>- Psychometric data regarding personality and mindset of participants</li> <li>- In-office observations and in-depth interviews regarding their perspective on research</li> <li>- Contextual data about companies and products</li> </ul>	
c.	<b>Is the data anonymised?</b>	Yes <input checked="" type="checkbox"/>	No* <input type="checkbox"/>
	Do you plan to anonymise the data?	Yes* <input checked="" type="checkbox"/>	No <input type="checkbox"/>
	Do you plan to use individual level data?	Yes* <input checked="" type="checkbox"/>	No <input type="checkbox"/>
	Do you plan to pseudonymise the data?	Yes* <input checked="" type="checkbox"/>	No <input type="checkbox"/>
* Give further details in <b>Section 8 Ethical Issues</b>			
e.	<b>i. Disclosure – Who will the results of your project be disclosed to?</b>		

	<p>The data collected will be used to inform the design of the technology, the project deliverables as well as academic publications and dissemination materials, but this will all be published in an anonymised form. Some of the data may be transferred to other project partners outside of the UK, but in these cases e.g. teacher interviews, anonymised written transcripts will be shared and not the original recordings.</p> <p><b>ii. Disclosure – Will personal data be disclosed as part of your project?</b></p> <p>All personal data will be anonymized. Consent will be sought from company founder/CEO to name the company, if necessary.</p>
f.	<p><b>Data storage – Please provide details on how and where the data will be stored i.e. UCL network, encrypted USB stick**, encrypted laptop** etc.</b> The dataset will be stored on the UCL network. Data being analysed will be stored on an encrypted laptop. Any transfers of data from colleagues on the EDUCATE project (who are all UCL researchers) will be done via an encrypted USB Stick.</p> <p>** Advanced Encryption Standard 256 bit encryption which has been made a security standard within the NHS</p>
g..	<p><b>Data Safe Haven (Identifiable Data Handling Solution) – Will the personal identifiable data collected and processed as part of this research be stored in the UCL Data Safe Haven (mainly used by SLMS divisions, institutes and departments)?</b></p> <p>Yes <input type="checkbox"/> No <input checked="" type="checkbox"/></p>
h.	<p><b>How long will the data and records be kept for and in what format?</b> EDUCATE data has been approved to be held for 10 years (See attached staff ethics application form) after the end of the project in the form of anonymised written transcripts/notes/original data (for video recordings). Any additional data acquired through this dissertation will follow the same procedure.</p> <p><b>Will personal data be processed or be sent outside the European Economic Area? (If yes, please confirm that there are adequate levels of protections in compliance with GDPR and state what these arrangements are)</b> No</p> <p><b>Will data be archived for use by other researchers? (If yes, please provide details.)</b> Yes- researchers working on the EDUCATE project.</p>
i.	<p>If personal data is used as part of your project, describe what measures you have in place to ensure that the data is only used for the research purpose e.g. pseudonymisation and short retention period of data'</p> <p>To ensure that the data is only used for the research purpose, I will pseudonymize content.</p> <p><b>* Give further details in Section 8 Ethical Issues</b></p>

### Section 8 Ethical issues

Please state clearly the ethical issues which may arise in the course of this research and how will they be addressed.

All issues that may apply should be addressed. Some examples are given below, further information can be found in the guidelines. *Minimum 150 words required.*

<ul style="list-style-type: none"> <li>- Methods</li> <li>- Sampling</li> <li>- Recruitment</li> <li>- Gatekeepers</li> <li>- Informed consent</li> <li>- Potentially vulnerable participants</li> <li>- Safeguarding/child protection</li> <li>- Sensitive topics</li> </ul>	<ul style="list-style-type: none"> <li>- International research</li> <li>- Risks to participants and/or researchers</li> <li>- Confidentiality/Anonymity</li> <li>- Disclosures/limits to confidentiality</li> <li>- Data storage and security both during and after the research (including transfer, sharing, encryption, protection)</li> <li>- Reporting</li> <li>- Dissemination and use of findings</li> </ul>
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Below are ethical issues that have been approved for the EDUCATE project. There are no new issues with my dissertation research. Please find EDUCATE Ethical Review Form and Ethical Review Approval Letter attached. **Any additional statements for the terms of this dissertation are bolded.**

**Informed consent**

- Adults: All participants in EDUCATE project that will participate in research training sessions, mentoring sessions, interviews and dissemination events will be given an information sheet and consent form (see appendix A), either as:
  - part of the registration process for the programme
  - and/or prior to the start of the session.

The information sheet explains their involvement, and also asks for separate permission for them to be video or audio-recorded during interviews. They will also be advised that they can withdraw from the study at any point without giving a reason and ask for their data to be deleted.

**Confidentiality/Anonymity**

We will not require that any of the participants to disclose any personal information about themselves and any information that they share with us (e.g. quotes) and is published will be done so anonymously.

**Some companies may wish to give consent to be named in the dissertation. These companies will be asked to sign a separate consent form – attached.**

**Data storage and security**

All original audio and video recordings will be stored during the course of the research on password-protected and encrypted laptops. They will be transcribed, anonymised and the transcripts as well as original video recording stored in a centralized repository on the UCL network with any original audio recordings destroyed after transcription. All other information that is collected (i.e. through written notes) will be stored anonymously in a centralized repository on the UCL network. Any data that is shared with other partners on the project (including those outside of the UK) will be shared in an anonymised format, with the original recordings not shared.

**Reporting**

**Results of this project will be written in a dissertation.**

The results of this project may be written up for conference and/or journal publications as well as for the project deliverables but no identifiable information will be included that can link the research with the participants. However, we will give participants the opportunity to be recognized within/give input to any publications if they wish to. All publications that result from the research will be made publicly available on the project website.

**Dissemination and use of findings**

We will produce project updates in the form of News and BLOG entries on the EDUCATE website, which will be shared with our mailing list which participants will be provided with the information with about how to join. We will also include photographs of some research activities where consent has been given, for dissemination purposes, but individual participants will not be named within these photographs.

Please confirm that the processing of the data is not likely to cause substantial damage or distress to an individual Yes

**Section 9 Attachments** Please attach the following items to this form, or explain if not attached

a.	Information sheets, consent forms and other materials to be used to inform potential participants about the research ( <i>List attachments below</i> )	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
Note: all forms except the new consent form "Anissa_Moeini_Dissertation_Participant_Consent_Form.doc" and "Anissa_Moeini_Dissertation_Information_Sheet.doc" have already been approved under the EDUCATE project Ethical Application form. All forms are attached.			
<b>If applicable/appropriate:</b>			
b.	Approval letter from external Research Ethics Committee		Yes <input type="checkbox"/>
c.	The proposal ('case for support') for the project		Yes <input type="checkbox"/>
d.	Full risk assessment		Yes <input type="checkbox"/>

**Section 10 Declaration**

I confirm that to the best of my knowledge the information in this form is correct and that this is a full description of the ethical issues that may arise in the course of this project.

I have discussed the ethical issues relating to my research with my supervisor.

I have attended the appropriate ethics training provided by my course.

**I confirm that to the best of my knowledge:**

The above information is correct and that this is a full description of the ethics issues that may arise in the course of this project.

Name	Anissa Moeini
Date	30 <sup>th</sup> January, 2019

Please submit your completed ethics forms to your supervisor for review.

**Notes and references**



### Professional code of ethics

You should read and understand relevant ethics guidelines, for example:

[British Psychological Society](#) (2018) *Code of Ethics and Conduct*

or

[British Educational Research Association](#) (2018) *Ethical Guidelines*

or

[British Sociological Association](#) (2017) *Statement of Ethical Practice*

Please see the respective websites for these or later versions; direct links to the latest versions are available on the Institute of Education <http://www.ucl.ac.uk/ioe/research/research-ethics>

### Disclosure and Barring Service checks

If you are planning to carry out research in regulated Education environments such as Schools, or if your research will bring you into contact with children and young people (under the age of 18), you will need to have a Disclosure and Barring Service (DBS) CHECK, before you start. The DBS was previously known as the Criminal Records Bureau (CRB) . If you do not already hold a current DBS check, and have not registered with the DBS update service, you will need to obtain one through at IOE.

Ensure that you apply for the DBS check in plenty of time as will take around 4 weeks, though can take longer depending on the circumstances.

### Further references

The [www.ethicsguidebook.ac.uk](http://www.ethicsguidebook.ac.uk) website is very useful for assisting you to think through the ethical issues arising from your project.

Robson, Colin (2011). *Real world research: a resource for social scientists and practitioner researchers* (3rd edition). Oxford: Blackwell.

This text has a helpful section on ethical considerations.

Alderson, P. and Morrow, V. (2011) *The Ethics of Research with Children and Young People: A Practical Handbook*. London: Sage.

This text has useful suggestions if you are conducting research with children and young people.

Wiles, R. (2013) *What are Qualitative Research Ethics?* Bloomsbury.

A useful and short text covering areas including informed consent, approaches to research ethics including examples of ethical dilemmas.

### Departmental use

If a project raises particularly challenging ethics issues, or a more detailed review would be appropriate, the supervisor **must** refer the application to the Research Development Administrator (via [ioe.researchethics@ucl.ac.uk](mailto:ioe.researchethics@ucl.ac.uk)) so that it can be submitted to the IOE Research Ethics Committee for consideration. A departmental research ethics coordinator or representative can advise you, either to support your review process, or help decide whether an application should be referred to the REC. If unsure please refer to the guidelines explaining when to refer the ethics application to the IOE Research Ethics Committee, posted on the committee's website.

Student name	
Student department	
Course	
Project title	

## Appendix E: Cycle 2 – Programme Engagement Numbers

Ref.	Company Number	Cohort	Dedicated Research Mentor	Company Name	Category of Activity	Description of activity	Time (Hr/Min)	Adjusted Total Engagement Hours				
ANON	ANON	B6	P4	C1	Research	1:1 Research Mentoring – M4	00:45					
					Research	1:1 Research Mentoring – M4	00:45					
					Research	C26, Logic Model	00:00					
					Research	C28	00:00					
					<b>Total Research</b>						01:30	<b>01:30</b>
					EdTech	Induction	08:00					
					EdTech	Getting to Know You Session	01:00					
					EdTech	1:1 Business Mentoring – M11	01:00					
					EdTech	Accounting Webinar	01:30					
					EdTech	Data is Beautiful Presentation	02:00					
					EdTech	C6/B6 Business Workshop 2	02:00					
					EdTech	Impact Investment Workshop 2	07:00					
					EdTech	Global EdTech Superleague Semi-final	02:00					
					<b>Total EdTech</b>						00:30	<b>24:30:00</b>
<b>Total Support</b>						02:00	<b>26:30:00</b>					
ANON	ANON	B4	P14	C2	Research	1:1 Research Mentoring – M3	00:30					
					Research	1:1 Research Mentoring – M3	00:30					
					Research	1:1 Research Mentoring – M16	00:30					
					Research	1:1 Research Mentoring – M14	00:30					
					Research	C26, Logic Model	00:00					
					<b>Total Research</b>						02:00	<b>02:00</b>
					EdTech	Lean Training	01:45					
					EdTech	F6S Showcase	02:00					
					EdTech	GDPR Seminar	02:15					
					EdTech	Cohort 4 Speed Mentoring	03:00					
					EdTech	1:1 Business Mentoring – M17	00:30					
					EdTech	GDPR Seminar	04:00					
					EdTech	1:1 Business Mentoring – M17	00:30					
					EdTech	Nesta Impact Investment Workshop	05:00					
EdTech	Spring Show & Tell	03:00										
EdTech	Selling to Schools	00:40										
<b>Total EdTech</b>						22:40	<b>22:40</b>					
<b>Total Support</b>						00:40	<b>24:40:00</b>					
ANON	ANON	Lab 2	P2	C3	Research	EDUCATE Research Training 1	02:00					
					Research	EDUCATE Research Training 2	02:00					
					Research	1:1 Research Mentoring – M16	01:00					
					Research	EDUCATE Research Training 3	02:00					
					Research	C26, Logic Model, Research Proposal	00:00					
					Research	EDUCATE Research Training 4	02:00					

					Research	C28	00:00		
						<b>Total Research</b>	<b>09:00</b>		<b>09:00</b>
					EdTech	F6S Workshop	01:30		
					EdTech	BESA Launchpad	07:00		
					EdTech	EdTech Exchange Networking	01:00		
					EdTech	London EdTech Week: EDUCATE & Education	02:30		
					EdTech	GBER Declaration	00:00		
						<b>Total EdTech</b>	<b>12:00</b>		<b>12:00</b>
						<b>Total Support</b>	<b>21:00</b>		<b>21:00</b>
ANON	ANON	Lab 2	P1	<b>C4</b>	Research	EDUCATE Research Training 1	02:00		
					Research	EDUCATE Research Training 2	02:00		
					Research	EDUCATE Research Training 4	02:00		
					Research	C26	00:00		
					Research	C28	00:00		
						<b>Total Research</b>	<b>06:00</b>		<b>06:00</b>
					EdTech	F6S Workshop	01:30		
					EdTech	Lean Training	02:00		
					EdTech	1:1 Business Mentoring – M1	01:15		
					EdTech	EDUCATE Clinic 2	02:00		
					EdTech	1:1 Business Mentoring – M17	02:00		
					EdTech	GDPR Seminar	04:00		
					EdTech	Christmas Show & Tell & Demo Day	08:00		
					EdTech	Marketing Workshop 2	03:00		
						<b>Total EdTech</b>	<b>23:45</b>		<b>23:45</b>
						<b>Total Support</b>	<b>05:45</b>		<b>29:45:00</b>
ANON	ANON	Lab 2	P6	<b>C5</b>	Research	EDUCATE Research Training 1	02:00		
					Research	EDUCATE Research Training 2	02:00		
					Research	1:1 Research Mentoring – M16	00:50		
					Research	EDUCATE Research Training 3	02:00		
					Research	EDUCATE Research Training 4	02:00		
					Research	1:1 Research Mentoring – M16	00:50		
					Research	C26	00:00		
					Research	C28	00:00		
						<b>Total Research</b>	<b>09:40</b>		<b>09:40</b>
					EdTech	F6S Workshop	01:30		
					EdTech	Lean Training	02:00		
					EdTech	EDUCATE Clinic 1	02:00		
					EdTech	EDUCATE Clinic 2	02:00		
					EdTech	BESA Launchpad	07:30		
					EdTech	Narativ Workshop	07:15		
					EdTech	GDPR Seminar	04:00		
					EdTech	Festival of Culture: EDUCATE	02:00		
						<b>Total EdTech</b>	<b>04:15</b>		<b>28:15:00</b>
						<b>Total Support</b>	<b>13:55</b>		<b>37:55:00</b>

ANON	ANON	B6	P3	<b>C6</b>	Research	1:1 Research Mentoring – M3	01:00	
					Research	1:1 Research Mentoring – M3	01:00	
					Research	C26, Logic Model, Research Proposal	00:00	
						<b>Total Research</b>	02:00	<b>00:20</b>
					EdTech	Induction	08:00	
					EdTech	Curriculum Fund Briefing	01:30	
					EdTech	1:1 Business Mentoring – M10	01:15	
					EdTech	1:1 Business Mentoring – M17	01:00	
					EdTech	Nesta Impact Investment Workshop 2	07:00	
					EdTech	C6/B6 Business Workshop 2	02:00	
					EdTech	Christmas Show & Tell & Demo Day	08:00	
					EdTech	Global EdTech Superleague Semi-final	02:00	
						<b>Total EdTech</b>	06:45	<b>30:45:00</b>
						<b>Total Support</b>	08:45	<b>38:45:00</b>
ANON	ANON	B5	P3	<b>C7</b>	Research	Lunch & Learn Introduction to Virtual Hub	01:00	
					Research	Clinics, 13.06.2018 – M3	00:40	
					Research	1:1 Research Mentoring – M3	00:45	
					Research	1:1 Research Mentoring – M3	00:50	
					Research	C26, Logic Model, Research Proposal	00:00	
						<b>Total Research</b>	03:15	<b>03:15</b>
					EdTech	User Journey, F6S Showcase, Lean Training	07:30	
					EdTech	1:1 Business Mentoring – M17	00:30	
					EdTech	Getting to Know You Session	01:30	
					EdTech	C5/B5 Product Workshop 2	02:00	
					EdTech	EDUCATE: FOL Narativ Workshop	04:00	
					EdTech	Festival of Learning Showcase Marcomms & Support	08:00	
					EdTech	1:1 Business Mentoring – M10	00:50	
					EdTech	Demo Day Pitching	02:00	
					EdTech	Christmas Show & Tell & Demo Day	08:00	
						<b>Total EdTech</b>	10:20	<b>34:20:00</b>
						<b>Total Support</b>	13:35	<b>37:35:00</b>
ANON	ANON	Lab 2	P2	<b>C8</b>	Research	EDUCATE Research Training 1	02:00	
					Research	EDUCATE Research Training 2	02:00	
					Research	1:1 Research Mentoring – M6	01:00	
					Research	1:1 Research Mentoring – M16	01:00	
					Research	EDUCATE Research Training 3	02:00	
					Research	EDUCATE Research Training 4	02:00	
					Research	1:1 Research Mentoring – M16	01:00	
					Research	1:1 Research Mentoring – M16	01:00	
					Research	C26	00:00	
					Research	C28	00:00	
						<b>Total Research</b>	12:00	<b>12:00</b>
					EdTech	EDUCATE Clinic 2	02:00	
					EdTech	EDUCATE: FOL Narativ Workshop	04:00	
					EdTech	Festival of Learning Showcase Marcomms & Support	07:00	

					EdTech	GBER Declaration	00:00		
						<b>Total EdTech</b>	13:00		<b>13:00</b>
						<b>Total Support</b>	01:00		<b>25:00:00</b>
ANON	ANON	B7	P3	<b>C9</b>	Research	1:1 Research Mentoring – M3	01:00		
					Research	1:1 Research Mentoring – M3	00:30		
					Research	C26 v2, Logic Model, Research Proposal	00:00		
						<b>Total Research</b>	01:30		<b>01:30</b>
					Edtech	Induction	08:00		
					Edtech	Getting to Know You Session	01:30		
					Edtech	1:1 Business Mentoring – M17	02:00		
					Edtech	Christmas Show & Tell & Demo Day	08:00		
					Edtech	BESA Open Day	03:30		
					EdTech	C7/B7 Business Workshop 1	02:00		
					EdTech	Product Workshop 2	02:00		
					EdTech	C8/B8 Business Workshop 2	02:00		
					EdTech	Global EdTech Superleague Semi-final	02:00		
					Edtech	Barclay's Ventures Expo	06:00		
					EdTech	C7/C8 Show & Tell	03:00		
						<b>Total EdTech</b>	16:00		<b>40:00:00</b>
						<b>Total Support</b>	17:30		<b>41:30:00</b>
ANON	ANON	Lab 5	P4	<b>C10</b>	Research	Research Training 2	02:00		
					Research	1:1 Research Mentoring – M4	00:45		
					Research	1:1 Research Mentoring – M4	00:32		
					Research	C26, Logic Model, Research Proposal	00:00		
					Research	Research Training 3	02:00		
					Research	Research Training 4	02:00		
					Research	Clinics, 07.08.2018 – M4	00:45		
					Research	Clinics, 05.09.2018 – M4	00:40		
					Research	C28	00:00		
						<b>Total Research</b>	08:42		<b>08:42</b>
					EdTech	User Journey, F6S Showcase, Lean Training	08:00		
					EdTech	Clinics, 17.07.2018 – M11 + M17	01:00		
					EdTech	Applying for Awards	02:00		
					EdTech	C5/B5 Business Workshop 1	02:00		
					EdTech	Christmas Show & Tell & Demo Day	08:00		
					EdTech	Writing Workshop	05:30		
						<b>Total EdTech</b>	02:30		<b>26:30:00</b>
						<b>Total Support</b>	11:12		<b>35:12:00</b>
ANON	ANON	Lab 4	P3	<b>C11</b>	Research	Getting to Know You Session – M3	01:00		
					Research	Research Training 1	02:00		
					Research	1:1 Research Mentoring – M3	00:30		
					Research	Research Training 2	02:00		
					Research	Research Training 3	02:00		
					Research	1:1 Research Mentoring – M5	00:40		

Research	Research Training 4	02:00	
Research	Clinics, 14.05.2018 – M3	00:30	
Research	C26, Logic Model	00:00	
	<b>Total Research</b>	<b>10:40</b>	<b>10:40</b>
EdTech	F6S Showcase/BESA Presentation	01:45	
EdTech	Lean Training	02:00	
EdTech	1:1 Business Mentoring – HF	00:30	
EdTech	Cohort 4 Speed Mentoring	03:00	
EdTech	GDPR Seminar	04:00	
EdTech	1:1 Business Mentoring – CA	00:40	
EdTech	C28	00:00	
EdTech	Impact Investment Workshop	07:00	
EdTech	EdTech Exchange Networking	02:00	
EdTech	Spring Show & Tell	03:00	
EdTech	BESA/Mango Social Media Seminar	02:00	
EdTech	London EdTech Week: EDUCATE & Education	02:30	
EdTech	EDUCATE: FOL Narativ Workshop	04:00	
EdTech	Festival of Learning Showcase Marcomms & Support	07:00	
EdTech	Applying for Awards	02:00	
EdTech	BESA Open Day	02:00	
EdTech	Curriculum Fund Briefing	01:30	
EdTech	BESA Seminar	02:00	
EdTech	Demo Day Pitching	02:00	
EdTech	BESA Spring Networking Evening	02:30	
EdTech	Data is Beautiful Workshop	02:00	
EdTech	Marketing Workshop 1	03:00	
Edtech	Social Media Workshop	04:00	
	<b>Total EdTech</b>	<b>12:25</b>	<b>36:25:00</b>
	<b>Total Support</b>	<b>23:05</b>	<b>47:05:00</b>

ANON	ANON	Lab 2	P15	<b>C12</b>	Research	EDUCATE Research Training 1	02:00	
					Research	1:1 Research Mentoring – M16	01:00	
					Research	EDUCATE Research Training 3	02:00	
					Research	Research Proposal Analysis – M5	00:45	
					Research	EDUCATE Research Training 4	02:00	
					Research	C26	00:00	
					Research	C28	00:00	
						<b>Total Research</b>	<b>07:45</b>	<b>07:45</b>
					EdTech	F6S Workshop	00:00	
					EdTech	Lean Training	02:00	
					EdTech	EDUCATE Clinic 1	02:00	
					EdTech	BESA Launchpad	07:30	
					EdTech	Media Training	05:00	
					EdTech	Christmas Show & Tell	03:00	
					EdTech	GDPR Seminar	04:00	
					EdTech	EdTech Exchange Networking	02:30	
					EdTech	Demo Day Pitching	02:00	

							<b>Total EdTech</b>	04:00	<b>28:00:00</b>
							<b>Total Support</b>	11:45	<b>35:45:00</b>
ANON	ANON	Lab 4	P5	<b>C13</b>	Research	Research Training 1	02:00		
					Research	Research Training 2	02:00		
					Research	1:1 Research Mentoring – M5	00:30		
					Research	Research Training 4	02:00		
					Research	1:1 Research Mentoring – M5	00:30		
					Research	C26, Logic Model	00:00		
					Research	1:1 Research Mentoring – M5	00:30		
							<b>Total Research</b>	07:30	<b>07:30</b>
					EdTech	F6S Showcase/BESA Presentation	01:45		
					EdTech	Lean Training	02:00		
					EdTech	High-Performing Team Workshop	02:00		
							<b>Total EdTech</b>	05:45	<b>13:15:00</b>
							<b>Total Support</b>	13:15	<b>20:45:00</b>
ANON	ANON	Lab 4	P2	<b>C14</b>	Research	Getting to Know You Session	01:00		
					Research	Research Training 1	02:00		
					Research	Research Training 2	02:00		
					Research	1:1 Research Mentoring – M2	00:20		
					Research	Research Training 3	02:00		
					Research	1:1 Research Mentoring – M2/M6	00:36		
					Research	C28	00:00		
					Research	Research Training 4	02:00		
					Research	1:1 Research Mentoring – M2	00:30		
					Research	C26, Logic Model	00:00		
							<b>Total Research</b>	10:26	<b>10:26</b>
					EdTech	F6S Showcase/BESA Presentation	01:45		
					EdTech	1:1 Business Mentoring	00:30		
					EdTech	Cohort 4 Speed Mentoring	03:00		
					EdTech	EdTech Exchange Networking	02:00		
							<b>Total EdTech</b>	07:15	<b>7:15:00</b>
							<b>Total Support</b>	17:41	<b>20:45:00</b>

## Appendix F: Cycle 2 Construct Development Workshop

### RMETE Validation Survey (Workshop 2)

Wednesday, November 13, 2019

Many thanks for participating in this session, the goal of which is to validate the facets of Research Minded Educational Technology Enterprises (RMETEs) which emerged from interviews with EDUCATE Edward Level 2 mentors.

#### Dissertation Goal

This dissertation is looking at emerging educational technology companies that are building learning technologies, as opposed to technologies for the education industry in general. Learning technologies are those where the user is vulnerable, and it is not as obvious to the user when the product is working – and thus this dissertation takes the position that it is unethical not to have an evidence base in such companies. The goal of this work is to uncover the facets that make up a RMETE in order to make it possible for more enterprises to develop such a capacity.

#### Workshop Goals

The goal of this cycle of research is to refine the construct of a research mindset in the context of an educational technology enterprise. This survey is a synthesis of data from semi-structured interviews with the mentors of Edward level two recipients. Edward level twos were chosen as they are the companies deemed to have the most exemplary research mindset on the EDUCATE programme. Data from interviews was synthesized and categorised into sub-constructs which were then put into survey form for validation. This synthesis was validated with the group on November 4, 2019. The surveys that you will see before you include the revisions from the validation workshop on November 4, 2019. Today's goal is to continue validation of the sub-constructs of a RMETE.

#### Assumptions

1. Please note that all statements in sub-constructs should be seen as guidelines rather than rules as it is not realistic to expect these statements to be absolute due to contextual factors arising in the enterprise. Statements should be read as 'to the best of the ability of the RMETE' or 'as much as is reasonably feasible and possible'.
2. Keep in mind that as the construct of a RMETE is being developed through the EDUCATE programme, it currently only applies to emerging edtech companies that have fewer than 250 employees or £50 million in turnover. Further research would need to be conducted to validate the construct for larger enterprise.



## Vocabulary

Please note that a Research Minded Educational Technology Enterprise is abbreviated as a RMETE. *Enterprise* may be used interchangeably with *business*, *company* and *corporation*. The *CEO*, *founder* and *leadership* are used interchangeably to refer to the head of the enterprise.

## Ethics Forms

Kindly ensure you've signed the ethics approval forms before we begin.

## **Appendix G: Cycles 3 and 4 Construct Evaluation Workshop**

*Content available upon request.*

## **Appendix H: Cycle 5 Construct Validation Workshop**

*Content available upon request.*

## **Appendix I: Final ELTE Survey**

*Content available upon request.*

## **Appendix J: Cycle 6 Construct Validation SurveyMonkey Results**

*Content available upon request.*

## Appendix K: Cycle 6 EETN Presentation

ELTE Workshop  
Wednesday February 19, 2020



### Agenda

1. Introduction
2. ELTE Diagnostic Survey
3. Purpose
4. Methodology
5. Framework Relevance
6. Stakeholders



# Research mindset for responsible edtech

Does it work?

**If so...**

When?

Where?

Why?

How?

Critically: How do you know?



## EdTech Stakeholders

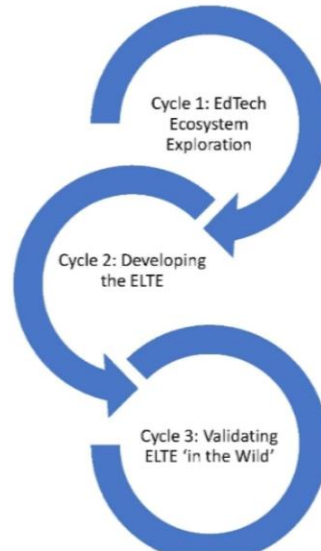


## Fast Facts!

- 252 small to medium sized enterprises
- 2 ½ years
- Cohort 1: June 2017
- Cohort 12: October 2019
- **Master's level research training (non-accredited)**
- 14 expert edtech research mentors



ELTE  
Development  
Methodology:  
Design  
Based  
Research





## Activity 1: ELTE Survey

<https://www.surveymonkey.co.uk/r/ELTE>

Individual activity or groupwork.



## Activity 1: ELTE Workshop

Wednesday 19 Feb 2020  
10 – 11:30 am

BusinessOulu  
Business Asema  
Hallituskatu 36

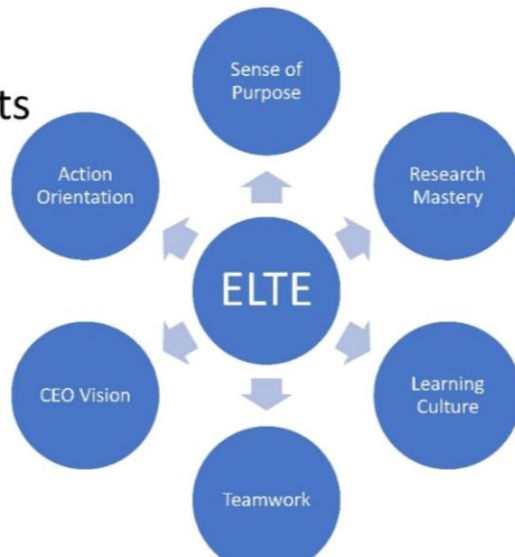
<https://www.surveymonkey.co.uk/r/ELTE>



So, what does an Evidence-informed Learning Technology Company (ELTE) look like?



## ELTE Sub-Constructs



## Sense of Purpose

Why are you doing research?

Why are you building the product in the company?

What is the vision and mission of the company- is it clear how research fits into it?



## Research Mastery

- Does the company have the knowledge/expertise to design appropriate research initiatives to assess the efficacy and impact of their products?
- Is there an awareness of the appropriateness of different research methods?
- Is there an understanding of what sound evidence is, and how it should be generated and used?



## Learning Culture

Is the company always learning?

Is there a culture of openness to knowledge?

Are there systems in place to share knowledge inside the company?



## Teamwork

Are research initiatives done in teams?

Does the research team have a connection to the other teams in the company?

What systems are in place for individuals to work together on research initiatives?



## CEO Vision



Does the CEO have a vision for how research fits into their greater organisational goals?

Does the research vision match the vision of the company?

Does the CEO make the research vision explicit?



## Action Orientation

Was the research plan acted upon?

Is the evidence that is generated acted upon?

How do you balance business goals with educational goals when implementing research findings?



## How can ELTE be used?

- ✓ Diagnostic- is the edtech in the position to be evidence-informed?
- ✓ Capacity building- what capacities do we need to build out in the company to adopt an evidence-informed approach?
- ✓ Trust building- which companies should we invest in to help meet our education goals for our kids, for our schools, for our countries?



## Activity 2: How could you use the ELTE?

Choose a group leader to present at the end.

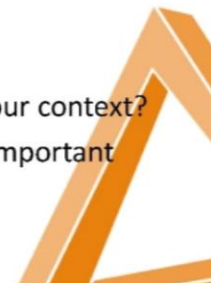
I will let you know when you have 10 and 5 minutes left.

Talking points:

Which one of your goals would ELTE help?

Where would you see challenges in implementing ELTE in your context?

Which one of the six sub-constructs do you think are most important and why?



### Activity 3: ELTE Reflection Activity



Stay in touch!

Anissa Moeini  
[anissa.moeini.17@ucl.ac.uk](mailto:anissa.moeini.17@ucl.ac.uk)

Alison Clark-Wilson  
a.clark-wilson:@ucl.ac.uk



## Appendix L: Cycle 6 EETN Workshop Handout

ELTE Framework  
February 19, 2020

### Sense of Purpose

Why is the enterprise doing research?  
Why is this particular product being built by this enterprise?  
What is the vision and mission of the enterprise- is it clear how research fits into it?

### Research Mastery

Does the enterprise have the knowledge/expertise to design appropriate research initiatives to assess the efficacy and impact of their products?  
Is there an awareness of the appropriateness of different research methods?  
Is there an understanding of what sound evidence is, and how it should be generated and used?

### Learning Culture

Is the enterprise always learning?  
Is there a culture of openness to knowledge?  
Are there systems in place to share knowledge inside the enterprise?

### Teamwork

Are research initiatives done in teams?  
Does the research team have a connection to the other teams in the enterprise?  
What systems are in place for individuals to work together on research initiatives?

### CEO Vision

Does the CEO have a vision for how research fits into their greater organisational goals?  
Does the research vision match the vision of the enterprise?  
Does the CEO make the research vision explicit?

### Action Orientation

Was the research plan acted upon?  
Is the evidence that is generated acted upon?  
How do you balance business goals with educational goals when implementing research findings?

Anissa Moeini ©