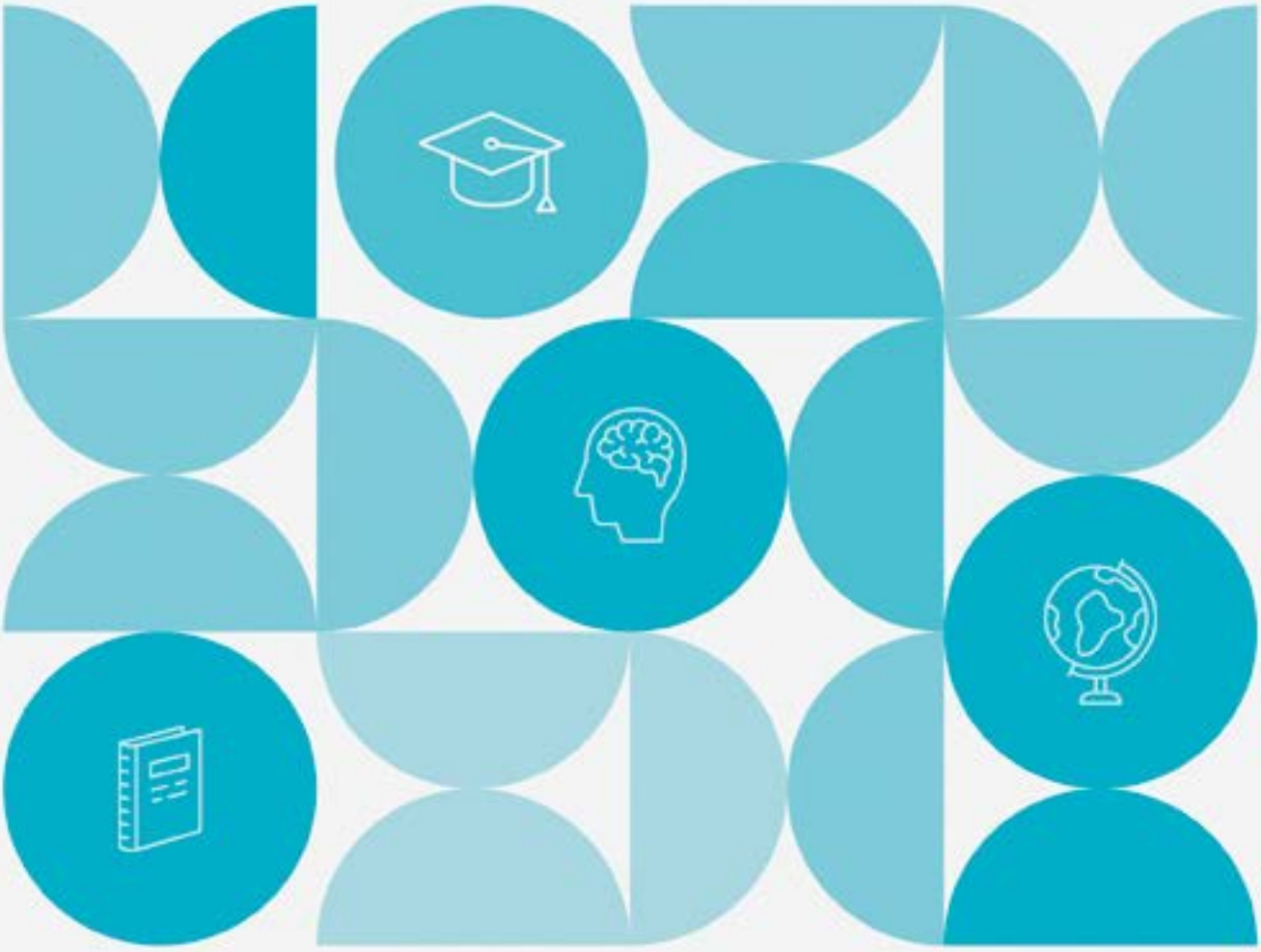
EMBEDDING INNOVATION LABS IN SCHOOLS AS A VEHICLE FOR TRANSFORMATION IN EDUCATION



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FOREWORD

There's an old Scottish story about a car driver approaching someone walking in the street, and asking how to get to Glasgow. The pedestrian pauses then replies 'Well, if I was going to Glasgow… I wouldn't start from here.' Perhaps there are similar challenges as we try to arrive at the kind of education we really want. Coming up with a target destination may be relatively easy. Taking practical steps is more difficult. Each student and each teacher will have his or her own starting points. Suggested solutions based on 'average circumstances' are likely to enjoy limited success.

Bringing research and analysis closer to learning and building understanding on real-life practice is a great place to start doing things better. Working directly with the teachers, pupils and schools, not only to draw big conclusions but to make continuous small adjustments to a direction of travel, together, seem like wise ways to proceed. Indeed, proceeding in such a way provides opportunities to build trust and confidence, and for fellow travellers to learn together.

The WISE report 'Embedding Innovation Labs in Schools as a Vehicle for Transformation in Education' addresses the challenge of changing education and provides valuable practical insight into the practices and policies that can support and enhance the impact of providing innovation labs in schools. Built on real practice in real schools, and collaborative working, the report reflects the important contributions of schools, labs and hubs in generating understanding and how collaboration between teachers, researchers and leaders helps. The report concludes with implications for practice, research and policy and highlights lessons and approaches that may provide a key to the door of successful and sustained innovation.

'Embedding Innovation Labs in Schools as a Vehicle for Transformation in Education' provides excellent guidance for educators seeking to build their own innovation lab. It helpfully points towards tools and practices that might just make the innovation hub journey easier.

Whatever your education destination, I'm pleased to suggest you start the next part of your learning journey here, with the WISE Innovation Labs report. I hope you find friends to travel with you on your way, and that one day you will share your reflections on your journey to help others innovate and improve education too.

Gavin Dykes

Gavin Dykes is Program Director of the Education World Forum (2004 -2021) and the Asian Summit on Education and Skills (2015 -2021). He contributes to advisory boards including University of the People, Lyfta and Karanga, and was a judge for the Empathy Week Awards in 2021. He has worked closely with governments, corporations and foundations in many countries. His writing includes co-authorship of "Building and sustaining national education technologies agencies: Lessons, models and case studies from around the world" (The World Bank 2017) and "Aspire High – Imagining Tomorrow's School Today" (Corwin Press 2017). He has also moderated and chaired many international discussions including OECD Skills Summits, Virtual TIESS, and Education Fast Forward debates.

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GLOSSARY OF TERMS

Below is a list of terms used in this document, which are more fully described in the text.

Agile Methodology

an iterative and dynamic approach to tackling a project or task, based on design and quick feedback informing the next steps to take in the process.

Design-Based Research (DBR)

a type of research methodology commonly used by researchers in the learning sciences and education, which involves conducting research on interventions and innovations to understand where, when, and how they best work.

Design Thinking

a set of cognitive, strategic and practical processes by which design strategies are applied to a problem or goal in order to design the best possible solution.

Human-Centered Design

a design-based approach to problem solving that considers users needs and experiences at the center of the designed solution.

Innovation Cycles

a continuous and iterative process of solution discovery, development, and implementation.

Innovation Lab

a unit inside an organization that employs agile and design-based methods, with the goal of devising novel ideas that can disrupt or complement the overall organization.

Innovation Hub

the organization at WISE supporting schools to implement their own embedded Innovation Lab.

Learning Environments

any organization or environment designed to support learning (the term is used in this document to refer to but not limited to schools)

Mindset

the attitues and perspectives about approaching a problem, in life and in the world, held by an individual.

Prototypes

a simulation or sample version of a product, used for testing and the improvement of the overall design.

EXECUTIVE SUMMARY

Today, schools and education systems globally face critical and complex questions about how to organize themselves to most effectively support learning and overall learner development for an increasingly challenging world. While some guidance is provided by research, data trends and frameworks provided by organizations such as the OECD, perhaps the most challenging task is helping learning environments understand how to shift to more future-oriented models. This leads to the guiding questions for the work described in this report: *How can learning environments be supported to tackle these challenges and navigate to their preferred futures?*

While deep, meaningful and lasting change has been elusive in systems of education, more recently we have seen an increased shift from reform efforts to *redesign*—moving away from trying to 'fix' parts of education that are not working well, to a design mindset of creating and driving towards the learning futures we desire. Such an approach takes inputs on modern and emerging learning technologies, research on learning, and global trends as the foundation for designing new directions for the school or learning environment to move into in a coherent way.

In February 2020, WISE launched the WISE Innovation Hub as a platform and research initiative to support schools in embedding their own innovation and design practices as a mechanism to address critical learning issues they are facing, including those related to design and implementation (curriculum and teaching), and impact (assessment and learner outcomes). Although this initiative was established before the COVID-19 pandemic, it became a timely mechanism for understanding rapid transformation and innovation in practices at a time requiring this of most schools globally.

During this pilot phase (February 2020 - June 2021) WISE supported three schools of varying demographics with varying challenges and goals, to establish what we referred to as an "Innovation Lab" — an embedded structure and process to drive forward innovation within a school. Each school created their own Innovation Lab, which included a designated team of teachers and leaders within the school to identify core goals and future directions for the school (such as personalized learning, competency-based learning, etc.). In partnership with the WISE Innovation Hub team, each school's Innovation Lab team worked together to create practices and processes to design, test and implement their innovative solutions.

An Innovation Lab (as framed by this initiative) is a research, development and innovation unit embedded inside a learning environment in order to design and implement the future-focused structures of that learning environment, and propel it effectively forward. An Innovation Lab in a school is characterized by a number of key factors:

- serves as an "engine" of innovation, research and design practices inside a school, to drive forward new practices and model design, helping the learning environment transform itself into a contextually relevant and innovation model of twenty-first century learning;
- embraces key strategies, including conducting rapid research and evidence-collecting as needed; leveraging innovation cycles; designing, developing and testing prototypes and innovations; developing distributed leadership; enabling champions of innovations; and embedding teacher learning in design;
- operates as a team of people owning and overseeing the research on what is working in the learning environment, identifying what is needed, and exploring how new approaches might be designed, adjusted and implemented to meet the needs of its contexts and its learners;
- looks at the critical aspects of how learning is being supported in the school, what needs new innovative designs to support current and future objectives, and what tools and solutions will work effectively for its context to meet those needs;
- is capable of utilizing a mix of core practices in research, design, and innovation;

- integrates centrally into the core practices (pedagogy) of the school;
- builds capacity in individuals — skills, capabilities and mindsets — in school teachers, leaders and broader community stakeholders;
- serves as the key driver of deep changes to the learning environment, through strong and well-defined tools and methods;
- connects to a broader, global education research and innovation community.

Together, this empowers a learning environment to:

- → set a vision for their preferred future;
- → research, design, and support their community to innovate towards that vision in a way that is evidence-based; and
- → be able to dynamically adjust course as needed with the ongoing global shifts that we will continue to see over the coming decades.

The WISE Innovation Hub provided support and capacity-building for schools to implement their own Innovation Lab, while implementing a design-based research (DBR) approach to both support each school's efforts and to understand (1) what conditions and supports provided for the most successful outcomes of the model in each school, and (2) what outcomes were possible when these conditions were met and optimized.

Outcomes

The general intention and purpose of embedding an Innovation Lab in the three participating schools was the same, but each school had its own unique and distinct journey. Furthermore, since each school's shape, size, goals, context, demands and variables were different and specific to that school, each Innovation Lab's structure and activities were equally unique and continued to evolve dynamically over the course of the project. For example, School 1 came to the project looking for ways to deepen and extend their already progressive educational model. They sought to support their framework with further learning sciences research and evidence, and develop a set of associated tools to deepen their measurement and documentation of learner growth. By contrast, Schools 2 and 3 can be categorized as very classically 'traditional' by common standards, with rigorous and highly focused academic curricula and structures. Their aim for joining the project was to seek ways to integrate twenty-first century skills and competencies into their learning frameworks. School 2's aims were a bit bigger than School 3's in that they were interested in completely transforming their model with a robust competency-based framework developed by their Innovation Lab. By contrast, School 3 was looking to begin the journey to start to build into the existing school structure more integrated, project-based learning where possible—without disrupting the existing model very much.

Each school's size, structure and resources devoted to this work varied as well. Whereas School 1 had already fully committed to the vision of having an embedded Innovation Lab for years to come and, as such, already had full-time staff devoted to it, Schools 2 and 3 at the start of this initiative largely did not allocate any additional human capital or financial resources to the work and initially perceived this as means to an end.

Core findings include:

I. Adaptable Design: For success, the Innovation Lab structure needed to adapt according to the unique needs, goals and variables of each school.

At the start of this initiative, with each school we explained the purpose of this work and what was intended by the term "Innovation Lab". Part of the challenge was explaining this somewhat intangible concept which had not been implemented or defined extensively yet in the field. As such, and understandably, each school construed and interpreted what they felt an Innovation Lab could mean or do for their context, and how it would look in practice in their school. This was of course a central part of the hypothesis of this work: that the reason

change, transformation and reform largely has not had much success in education is because too often top-down, standardized structures are pushed on schools with little to no way of of accounting and accommodating for localized needs and dynamics, as well as lack of infrastructure to support the teachers and leaders implementing the changes.

II. Adaptive Change: The journey IS the work.

Each school's pathway showed that the journey was perhaps more important than the destination itself. While each school had clear vision and goals for growth and change, the journey itself was critical in collectively enrolling the whole school community in reaching that destination. In each school's journey, the very nature of the vision and the goals evolved through the work itself. Data collection, research, or piloting a prototype, elucidated new insights and understandings that helped direct the work in the right direction. Such insights would not have been as readily available by just planning a new school change or program outright and implementing it fully at the start of the next school year. Similarly, as the schools achieved certain outcomes, new desired outcomes became clear. For example, as School 2 worked to move to a mastery-based model, they felt that PBL (project-based learning) was not a priority and something the school was already adept at. Yet as they began piloting competency-based rubrics and new instructional methods for supporting them, it became clear that in fact many of the teachers at the school needed much more support in this area.

III. The Power of a Third Party: Having an external sense-making resource helped to shape innovation in the school and catalyse a range of benefits.

A consistent refrain heard when discussing this initiative at the conclusion of this year was the value and impact of having a 'neutral' third party provide clarity, expertise and focus which helped the school move forward towards their goals in a much quicker fashion.

IV. The Heart of Change: To be effective, the Innovation Hub's work must be embedded at the core of practice and spearheaded by school leadership.

Innovation work can easily get tossed aside if it is not built-in, protected and prioritized amongst other initiatives in the school. By definition, innovation is going 'against the grain' of what is, pushing against much of the status quo inertia; in a busy school year it can easily be cut off as "something extra we don't have time for." Collaborative development of the work through an external support or intermediatiary, such as the WISE Innovation Hub, providing expertise, coaching and co-design, was a key catalyst in pushing beyond this inertia. But it's not always enough. Unless the work is also embedded in the foundation of the school's practice and led visibly by the school leadership through an internal mechanism like an Innovation Lab, the work will likely not be sustained. We observed this to varying degrees and in varying ways across all three schools. While all good innovation work can and should have champions or change leaders at the helm, it cannot ride on one person's shoulders alone. Similarly, if it is not embraced as a fundamental practice to the school's 'work' now, then it is easily considered superfluous, peripheral, and not necessary when things get challenging. This is one of the reasons this work was framed at the beginning of the initiative as an "embedded engine" inside the school. The initiative was tied to fundamentally designing the future of core school structures for two reasons: first, so that it was embedded at the heart of the school's practices and not seen as extra or easily discarded; and second, because we are pursuing innovation in the core structure of the school for deep transformation.

Implications for Research, Policy and Practice:

Research is a crucial aspect of developing ideas applicable to the Innovation Labs. Investing in educational research and evaluation is fundamental to the education ecosystem's success. The rapid development of Innovation Labs will encourage educators to update and change their teaching methods through research. Implementing Innovation Labs will require new tools and resources, and further investment of resources. Likewise, more research is needed to understand the impact of directly cultivating these skills in educators and school professionals as they become more active and participatory co-designers of learning environments going forward, and the impact/value of creating time and space to cultivate these skills directly. Finally, the Innovation Hub model brings together contributions formulated from differentiated theoretical or methodological approaches that enable educators and learners to advance in understanding the complexity of the education system. The integrated, design-based methods used to drive forward innovation and transformation at the school level is also helping us to collectively expand our understanding of innovation, change, and redesign for modern education—and how the successful design and implementation of those innovations across varying contexts might look. This is an essential knowledge base for the field of education, in both our understanding of effective change and in the design of modern learning environments for a wide variety of contexts and learners.

As dynamic, embedded R&D labs inside schools, Innovation Labs create the context to elucidate key insights on effects of current policies in inhibiting innovation and change. These labs also create a structured space to trial new policies through risk-mitigated structures that scaffold change processes in schools. Key insights on the nature of change and innovative learning designs can be brought forth from these contexts in order to inform (and test) future policy development. Such insights are also needed as we seek to understand how to develop policies that effectively adapt to the global and societal shifts today. Such policies should prioritize and protect the ability for educators to cultivate these new competencies, and would facilitate the introduction of alternative methods and environments to do this. Finally, to implement Innovation Labs effectively, we need to identify and remove barriers to such innovating, and invest in supporting schools to build this capacity. A resilient system is open to demonstrating performance in various ways, including articulation of what is working and what is not with the system structures, and allows the flexibility and 'space' for this type of innovation work. Such a system is open to the users iterating and adjusting plans even halfway through a school improvement cycle. Policies (and their design) play a critical role in either enabling that kind of dynamic innovation and transformation, or in stifling it. As such, policy-makers participating in the capacity-building that is a part of the Innovation Hub model is also advised.

In regards to practice, additional resources must be allocated to schools to support the implementation of Innovation Labs. Resources like additional human capital and financial resources are necessary to rebuild learning environments. Schools that have undertaken transformational journeys and invested in a new operating system model require a school community to design the destination and the pathway. Central to this approach is collective capacity building. Schools need to create a culture that is open to more risk-taking, where teachers and learners can try new ideas and test new models. Teachers and other key stakeholders in the school need a safe space to share perspectives about effective practice, and they need to feel safe, broadly speaking, to take on such work. At the same time, school leaders must be supported in building their own capacity to lead transformative innovation—this includes supporting teachers to build their own capacity for flexible and reflective teaching practices, as well as design and innovation. The role of the school needs to be shifted from that of simply an 'enacting organization' to a 'learning organization' that seeks to achieve maximum growth capacity.

The school-embedded Innovation Lab model affords a mechanism for the 'change infrastructure' for innovation, coherent co-design, and a possible pathway to achieving the school's goals and vision. Innovation Hubs offer a model of education systems that can support school networks in catalyzing innovation and collective, evidence-based transformation for modern learning ecosystems. The authors hope this work will inspire educators, school leaders, parents, administrators and policymakers to explore innovation in their systems, identify existing barriers, and consider how they can play key roles in supporting, regularizing and embodying the design of modern learning so critically needed for our complex world.

I. INTRODUCTION

How must we be educating our learners today to prepare for the complex world of tomorrow?

How can we ensure learners are prepared for acceptance to competitive universities, and attain a robust foundation in critical skills and competencies to thrive in the modern workforce?

How must schools be prepared to shift their learning environment in light of a global pandemic—in a way that ensures equity and positive outcomes?

What of these shifts should we keep going forward, and how must we continue to design our learning environments and educational models for an AI-enabled future?

These are just some of the critical and complex questions facing schools, learning environments,[1] and education systems today. Understanding the most effective and meaningful answers to these questions is not a simple or even short-term task. Yet perhaps an even more challenging task is helping learning environment communities understand how to shift to future-oriented models in a sustainable way that maximizes learning at all levels of the school ecosystem. *How, then, can learning environments be supported to tackle these challenges of change and transformation while successfully navigating to their preferred futures?*

While deep, meaningful and lasting change has been elusive in systems of education (Darling-Hammond, 2004; Payne 2008), more recently we have seen an increased trend away from reform efforts toward *redesign* (Fullan, 2020, 2021; Groff, 2009, 2018a). Redesign signals shifting from efforts to 'fix' parts of education that are not working well, to a mindset of designing, creating and driving towards the learning futures we desire (Groff, 2018b). Such an approach takes inputs on modern and emerging learning technologies, research on learning, and global trends as the foundation for designing new directions for the school or learning environment to move into in a coherent way.

In February 2020, WISE launched the WISE Innovation Hub as a capacity-building platform and research initiative to support schools in embedding their own innovation and design practices as a mechanism to address critical learning issues they are facing, including those related to design and implementation (curriculum and teaching), and impact (assessment and learner outcomes). Although this initiative was established before the COVID-19 pandemic, it became a timely mechanism for understanding and supporting the rapid transformation and innovation in education practices that were being advanced during the pandemic at unprecedented speed by many schools around the world as they adjusted to remote and hybrid learning models. During this pilot phase (February 2020 to June 2021) the WISE Innovation Hub supported three schools of varying demographics with varying challenges and goals to establish their own "Innovation Lab." The lab is an embedded structure and set of intentionally designed processes meant to drive forward innovation within a school (discussed more fully in section III). The WISE Innovation Hub provided support and capacity-building for these schools to do this work, while implementing a design-based research (DBR) approach to both support their efforts and to understand (1) what conditions and supports provided for the most success of such a model in each school, and (2) what outcomes were possible when these conditions were met and optimized.

In this report, we unpack the Innovation Lab model leveraged by the WISE Innovation Hub, share the journey and experiences of the three participating schools, and discuss the critical themes and recommendations on how to support deep innovation in schools to help them transform their approaches and environments to their preferred futures of learning.

1- The authors intentionally use the term 'learning environments' as used in the OECD Innovative Learning Environments project, to serve as a broader term than 'schools' as traditionally conceived and to mean any environment dedicated to the learning and education of young people.

II. THE CALL FOR DEEP INNOVATION

What do we mean by deep innovation, and why is it so important today?

Education has been in the midst of a global transformation effort for quite some time, in part due to a long-standing call for significant transformation in education systems on a number of levels, and as learning environments themselves have sought more effective and meaningful personalized learning (Fullan, 2020; Basham et al, 2016). The drivers for this deep change include global shifts in workforce skills and societal demands, mounting evidence on the science of learning and what environmental factors most effectively support learning, as well as the impact of emerging technologies which are revolutionizing the field with their ability to offer more personalized approaches to teaching and learning in alignment with learning sciences research (OECD, 2020a). Taken together, these convergent factors create the context, the conditions and the call for the redesign of learning environments into a coherent and effective modern model of learning (Groff, 2013, 2018a, 2018b).

The COVID-19 pandemic shone a critical spotlight on the pain points of education systems globally, including exposing deep equity gaps between education delivery in rich and poor nations, as well as raising questions about the content, delivery and purpose of education and its ability to support learning and learners in the modern world (Kirby, 2020). At the same time, we also have some very promising practices and new innovation in how to support learners more holistically in a variety of ways, including learning in non-traditional community settings, a redefinition of seat time, hybrid learning structures, and more. Indeed, in addition to renewed global emphasis on "skills and competencies as the new currency" in education and an emerging global infrastructure to support much more dynamic pathways of learning and skills development (T3 Initiative), the shifting landscape has never made the call for system transformation louder or more clear.

A rapidly-shifting global landscape

While education reform has been a central focus for decades, especially in the last five years the conversation has shifted from reform to redesign—to transforming our fundamental model of teaching and learning from the "sage on the stage" model that emphasizes the acquiring of knowledge, to learner-driven personalized learning. Significant, positive outcomes over recent decades of research in the learning sciences has given us a robust picture of how children, adolescents and adults learn (Bransford, Brown, & Cocking, 2000; Dumont, Istance & Benavides, 2010; Fischer, Hmelo-Silver, Goldman & Reimann, 2018). Unfortunately, many of these research findings are in direct contrast to how most traditional learning environments and schools are designed today (Dumont, Istance & Benavides, 2010). We now fundamentally understand that learners are not buckets to be filled with knowledge, but rather are unique constructs with their own understandings and ability to master over time. This research and understanding of the science of how people learn, however, is still not supported by most schools, which by and large maintain set, linear curricula that are aligned to a predetermined set of standards and assessments that largely favor the rote memorization of facts (OECD, 2020b). Broadly speaking, the attempt to redesign this misalignment for modern, effective educational systems is the driver behind the global movement towards personalized learning (Sturgis & Casey, 2018).

In our radically changing world, where such knowledge is easily, effortlessly and nearly ubiquitously at our fingertips, it is not the collection of knowledge but rather the mastery of broad skills and competencies – particularly those that are not easily automated – that are critically essential for thriving in our modern world, and the complex, interconnected world our young learners today will inherit (Wagner, 2010). As a result, there has been a growing global conversation and movement to competencies over content standards (OECD, 2018). This is exemplified in Brazil's new national curriculum emphasizing broader competencies, and in Finland's elimination of a national curriculum altogether, replacing

traditional structures with transformative new ways of supporting teaching and learning. Yet too often in most national frameworks, these competencies have little space in an already overpacked traditional curriculum (OECD, 2020b).

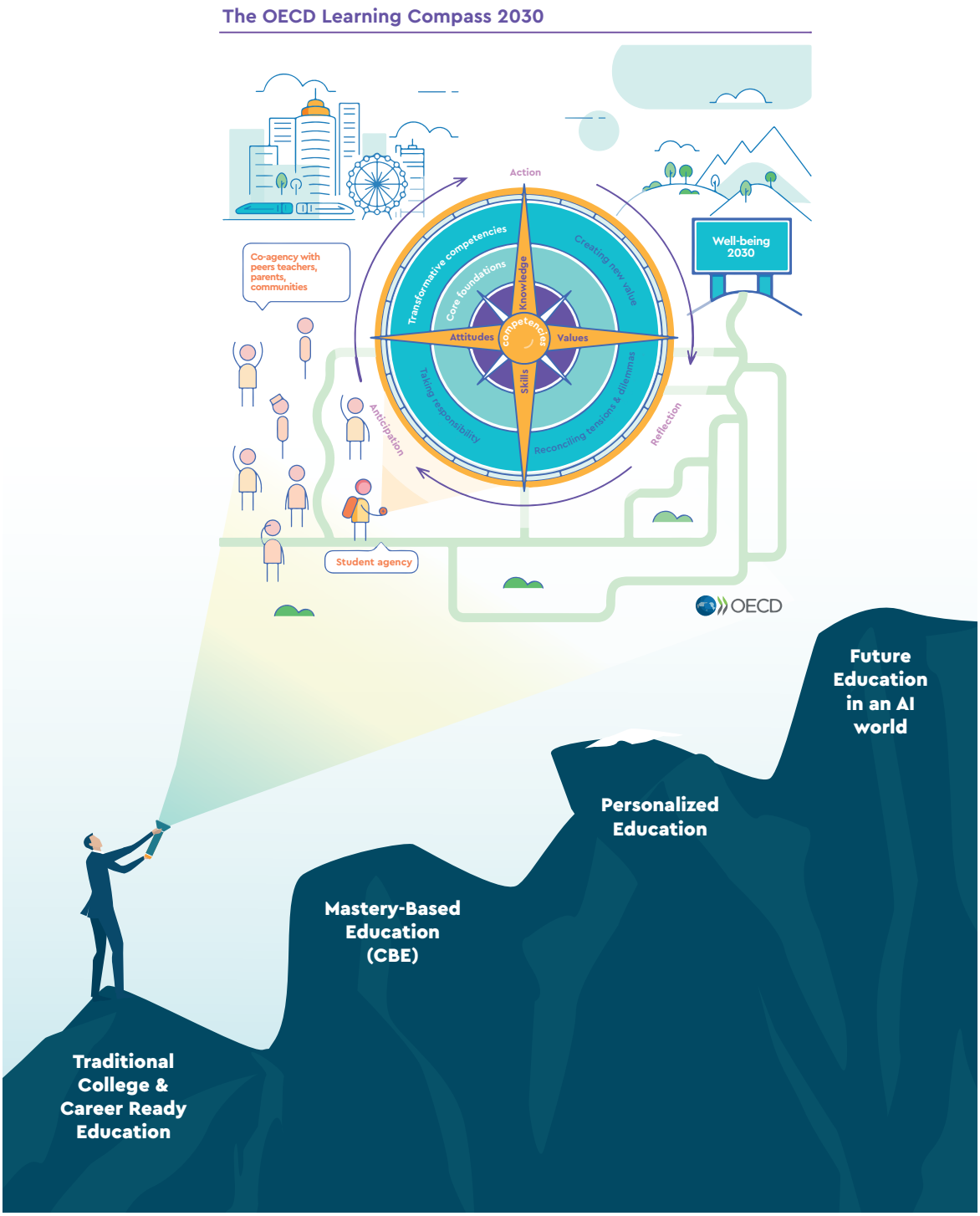
In understanding the critical significance of such a shift, in 2015 the OECD commissioned the Future of Education and Skills 2030 project to redefine a modern educational framework that is not just focused on traditional curricular disciplines, but the broader mastery of competencies needed for the modern world and supported by the learning sciences. In 2018, the project released their new "Learning 2030 Compass", outlining an integrated framework of skills, competencies and knowledge embedded in pedagogical pillars of learner agency and well-being (OECD, 2018). Such a compass sets a new 'north star' for most learning environments and educational systems, far beyond where they currently sit today. These models and arguments for such deep transformation are warranted, as they align with our research on how children learn best and what competencies are most needed in the modern world. While the OECD Learning 2030 Compass helped to pull together the global conversation on the need to shift to competencies and modern pedagogies and framed useful directions for schools, it critically left open how to progress. Now at a time when schools are increasingly finding themselves trying to navigate deep structural and curricular changes in the wake of the COVID-19 pandemic, they are seeking new ways to develop the internal and external infrastructure to support and navigate such changes in a way that makes sense for their contexts. Indeed, the pandemic pressed global educational transformation forward in early 2020, resulting in mass school closures worldwide. Overnight, three quarters of the world's learners found themselves learning remotely, and millions of schools and systems were forced to quickly and radically redesign how they delivered teaching and learning.

Schools across the spectrum – from those considering deep transformation to those who were not yet on this pathway – were forced into rapid innovation, largely having to support their learners in ways they had never considered before.

These changes all point to a long-standing challenge in both business and industry as well as the social sector: for innovation to be able to effectively cross the 'chasm' between promising ideas to mainstream implementation and products/services (Mulgan et al., 2007). While education has been challenged with this gap, the call has never been greater to find the way to make the leap to modern models of learner-directed, personalized, mastery-based learning.

Figure 1

Crossing the Chasm of Innovation to Implementation



Note. The call and challenge for learning environments today to be able to successfully cross the 'innovation chasm".

An emerging [undefined] future

While it may be tempting to look at our current reality and consider changes needed now and in the near future to meet these shifts and to effectively pivot post-pandemic, there are significantly deeper shifts in process that will impact us globally (and therefore locally) over the coming decade. The pace of technology development and adoption (particularly AI-based technologies), will continue and even accelerate, resulting in considerable shifts in industries, the types of skills needed, and the jobs available (World Economic Forum, 2020). The skills gaps will drive demand for reskilling and training of workforces; these shifts will continue to have considerable impact on the role and nature of education, including how learning is organized at scale (OECD, 2020a). How might education need to evolve to keep up with these continual and fast-paced shifts in work, in the environment and in the needed skills in order to thrive in this complex and uncertain world? How must we support learners in order to be able to survive and thrive in work, in life and in society?

The OECD, amongst other global organizations, organized the data, research and analysis helping to answer some of these challenging questions and ultimately called for the transformation of learning environments (OECD, 2019, p. 6):

> *...relevant changes in education are urgently needed to achieve more inclusive and sustainable development for all, not just for the privileged few...To shorten the period of 'social pain' and maximize the period of 'prosperity' for all, education systems need to undergo transformative change too.*

The educational change spectrum

Looking back, education has been in a "reform crisis" since the 1980s (Adamson, Astrand & Darling-Hammond, 2016; Salzburg, 2016). Van Den Berg and Sleegers (1996) describe that in traditional education reform or change processes, the school's role has often been simply to function as an "enacting organization," whereby schools enact that which has been externally specified by districts and governments, who are often far removed from the day-to-day practice of the classroom (Van Den Berg & Sleegers, 1996, p. 655). In this model an innovation may be developed by a group of visionary policymakers at the central government or district level, but then it is left to others to implement at the school-level, including school directors, principals and teachers. Once the policy reaches the school-level it is then filtered, translated, and even reconceptualized based on the internal and external contextual factors of the school environment. Such factors include the norms, values, visions and personal experiences of the school's leaders and teachers; the characteristics of the student population and community, including familial influences; and sometimes even external political or cultural factors that impact the operation of school (Leithwood et al., 2019; Van Den Berg & Sleegers, 1996). This can create a significant gap between the original policy vision and the actual practice of innovation and change.

Decades of work and research on how to support deep, meaningful and lasting change in education systems has shown that most systems are impervious to most efforts until significant and systemic changes are made—what Fullan refers to as "Tri-level reform", where strategic change must be supported simultaneously at the 1) school, 2) district or regional, and 3) state levels (Fullan, 2005). In recent years, a growing number of educational innovators and pioneers have embraced progressive models of learning, where learners are at the center of the environment, driving forward their own unique learning pathway and organic cultivation of skills, competencies and aptitudes (OECD, 2013a). Such models are steeped in evidence of how they support learning; yet they are still in the early phases of exploring how best to deliver and support learners in a world where much of the digital tools, technologies and processes needed at scale remain to be fully conceptualized and invented. These pioneers are indeed "flying the plane as they are building it", and in the process giving us all insights and inspiration of how a modern, meaningful and effective educational system might look.

While many of these progressive schools and learning environments are impressive – and there are many successful examples of progressive schools that have been established in recent years – they often require significant help in establishing their foundations, especially because their approaches often go against the grain of traditional schooling. In successful schools of this type, support is often provided by a dynamic and entrepreneurial group of innovators committed to finding the best way to support the school both internally in establishing their framework of learning and externally as a collective movement. Moreover, in some cases schools are innovative learning environments with one foot in the old model and one foot trying to step into the new—an approach that helps mitigate some of the risk but can also make the work of moving into the future difficult and cumbersome.

Challenges and opportunities for innovation

Throughout the years, experts have critiqued the sustainability of traditional approaches to educational change and reform. Some have even called for a complete redesign of educational policy approaches, as well as the redesign of schools and educator preparation programs, so as to provide the necessary infrastructure – both administrative and human – to better enable educational change, improvement and innovation at all levels. For example, Linda Darling-Hammond, in her 1996 summary of the Report of the National Commission on Teaching and America's Future, critiqued reform measures in U.S. schools, stating (Leithwood et al. 1998, p. 243):

> *Children can reap the benefits of current knowledge about teaching and learning only if schools and schools of education are dramatically redesigned… It is now clear that most schools and teachers cannot produce the kind of learning demanded by the new reforms – not because they do not want to, but because they do not know how, and the systems they work in do not support their efforts to do so.*

More than two decades later, Darling-Hammond's comments remain relevant, as there persists a deep disconnect between the ideation and implementation stages of educational policy innovation. Much of this stems from the fact that individual actors of innovation implementation – school leaders, teachers, and even parents, etc. – are not equipped with the necessary resources, including learning and growth opportunities, to support and enable the work necessary to transform schools into the twenty-first century centers of learning called for by the OECD and other global leaders (OECD, 2013b). If the learners of today are to reap the benefits of what the current evidence

from learning science research shows about how humans best learn, then approaches to learning at all levels – *including for educators themselves* – must be not only reconceptualized but revolutionized. Indeed, a large body of work agrees that the role of the school needs to be shifted from that of simply an 'enacting organization' to a 'learning organization,' where the capacity for growth, learning and change is not only nurtured in students, but continuously and systematically in school leaders, teachers, parents and the surrounding community (Van Den Berg & Sleegers, 1996; Leithwood et al., 1998; MacCharen et al., 2011; Rikkerink, 2016).

The role of the school as a 'learning organization' to empower innovation

There is a long history of literature demonstrating the connection between the capacity for innovation and change, and organizational learning (Leithwood et al. 1998; Fullan 2006; Kurland et al. 2010; Jones & Harris, 2014). Prioritizing the development of organizational learning as a primary function of any modern organization has been argued for quite some time:

> *A supportive learning culture and continuous, collaborative organizational learning process are considered to be pivotal in driving long-term, innovative education reform initiatives (MacCharen et al., 2011, p. 677).*

Organizational learning is commonly defined as a collective and collaborative learning process within an organization to respond to change, including the internal and external demands of the surrounding environment, and to ultimately improve organizational effectiveness. In short, to be a 'learning organization' one must prioritize systematic and continuous collaborative learning for staff at all levels, with the aim of building individual and organizational capacity to adapt to change, detect and correct errors, engage in dynamic knowledge creation, and improving overall effectiveness (Kurland et al., 2010; MacCharen et al., 2011). Central to this concept is *collective capacity building*; studies have concluded that without some infrastructure to enable continuous collective capacity building, school and system improvement of any type – including innovation – is unlikely to occur (Jones & Harris, 2014; Fullan, 2006; McCharen et al., 2011).

Indeed, in many industries, companies that have thrived and innovated in changing and challenging circumstances have done so primarily by building collective capacity (Jones & Harris, 2014). Capacity building itself is a highly dynamic process that is both skill oriented and process oriented. Michael Fullan, a world leader in education systems change, describes capacity building as a core "strategy that increases the collective effectiveness of a group to raise the bar and close the gap of student learning" (2006, p. 9). In education, capacity building is a complex endeavor, since it must include policymakers as well, and must facilitate relevant learning and skill-building experiences and opportunities for teachers, leaders and staff—ensuring positive synergy between and among all the component parts of the organization (Stoll, 2009) .

Capacity building, particularly when it is oriented toward the change of practices or the introduction of new practices or processes, also requires psychological motivation and a willingness on the part of staff to learn collaboratively and to shift behaviors and mindsets to focus on a common goal (Jones & Harris, 2014; Sharrat & Fullan, 2009). It is a shifting from a "this is how we do things here" mindset, to a cultural ethos of the school that uses data to modify, adapt, or change on behalf of the learners' most effective experience. Rikkerink (2016, p. 225) argues that the importance of flexible mindsets in innovation and change processes cannot be underestimated:

> *Educational innovation depends on what teachers think, feel and do. Any form of spontaneous innovation in the classroom or planned change of educational practices calls for the reconstruction of cognitive maps or personal interpretative frameworks (such as mindsets). Furthermore, the acquisition of new skills and, especially, the unlearning of old habits are important conditions for successfully implementing educational changes.*

In schools and elsewhere, such a willingness to learn collaboratively, unlearn old habits and engage in mutual support and accountability is not always forthcoming; this is when the role of the leader becomes ever more important in creating the right conditions to enable change and innovation (Jones & Harris, 2014). Indeed, the central role of the leader as a key mediator of organizational learning and an enabler of innovation is central to the research and literature on both business innovation and school innovation (Leithwood et al., 1998).

Supporting schools as collaborative learning organizations to build capacity at all levels to enact and implement deep change and innovation is at the core of this research initiative and the Innovation Lab and Hub model as a whole. More specifically, this research explored the effectiveness of creating dual infrastructure supports for innovation and change in schools: an embedded Innovation Lab that supports and enables dynamic and self-driven transformation processes within a school, coupled with an external Innovation Hub that serves as a sense-making resource to a school while facilitating capacity building for the staff and ecosystem – inclusive of leaders, teachers, parents and students – to manage both internal and external derived innovation and change.

In this intense and unprecedented time for education systems, when many learning environments are now in the grip of accelerating, radical change within their systems, the key question is: How can schools be supported to harness the opportunity for innovation and leverage evidence and research-based design decisions in order to effectively navigate their way to the future?

Our research specifically addresses the following questions:

What tools (practices and approaches), infrastructure and supports can help schools to make these significant transformations?

How can an Innovation Lab model support the ability of schools to make these significant transformations?

How does a networked Innovation Hub support schools in doing this work?

III. INNOVATION LABS

To explore these questions, in February 2020 WISE launched the WISE Innovation Hub, a research and development initiative established to support schools in implementing their own embedded Innovation Lab, and to specifically understand in what ways an embedded Innovation Lab model can support learning environments to drive forward and manage their own innovation, transformation, and improvement processes.

What is an Innovation Lab?

An Innovation Lab (as framed by this initiative) is a research, development and innovation unit embedded inside a learning environment in order to design and implement the future-focused structures of that learning environment in order to help propel it in a positive, and effective direction forward (Groff, 2015; Groff, 2009; Sutch, Rudd & Facer, 2008).

An Innovation Lab in a school is characterized by key factors:

- serves as an "engine" of innovation, research and design practices to propell the school forward in practices and model design, helping the school arrive at that innovative model of transformative twenty-first century learning;
- embraces a number of key strategies, including conducting rapid research and evidence-collecting as needed; leveraging innovation cycles; designing, developing and testing prototypes and innovations; developing distributed leadership; enabling champions of innovations; and embedding teacher learning in design;
- operates as a team of people owning and overseeing the research on what is working, what is needed, and how new approaches might be designed, adjusted and implemented;
- includes coaching, advising and training as needed to achieve the Lab's goals;
- looks at the critical aspects of how learning is being supported in the school, what needs new innovative designs to support modern needs, and what tools and solutions will work effectively for this context to meet those needs;
- is capable of utilizing a mix of core practices in research, design, and innovation;
- integrates centrally into the core practices (pedagogy) of the school;
- builds capacity in individuals – skills, capabilities and mindsets – in school teachers, leaders and broader community stakeholders;
- serves as the key driver of deep changes to the learning environment, through strong and well-defined tools and methods;
- is connected to a broader, global education research and innovation community.

Put plainly, an Innovation Lab is a generative and embedded aspect of the learning environment that both designs and implements transformative change as needed to navigate towards its future model. As such, research, design, innovation and implementation capacities are woven together to generate the most effective design for the school's path forward, and creates the structure to support the learning community in the design, adoption and implementation of a future-focused way of organizing learning. This empowers a learning environment to:

I. set a vision for their preferred future;

II. research, design, and support their community to innovate towards that vision in a way that is evidence-based; and

III. be able to dynamically adjust course as needed with the ongoing global shifts that we will continue to see over the coming decades.

A deeper discussion of the embedded Innovation Lab concept is best captured in the Futurelab Handbook, *Promoting Transformative Innovation in Schools* (Sutch, Rudd & Facer, 2008).

What an Innovation Lab is not

- a side project
- just capturing the story of what is happening at the school
- only doing research
- focused on just making sure that everyone is 'happy' with what the school is doing
- focused on a single challenge or short-term problem

It is worth noting the distinction between a Lab School and an Innovation Lab. Lab Schools are often based on the original Laboratory School run by John Dewey at the University of Chicago, with the intention of serving as a progressive model of how a teaching and learning environment could look for the purpose of training future educators. Many Lab Schools also conduct research on learning and thus on progressive or innovative methods to support learning. As such, they are positioned as emphasizing research and demonstration or teaching of new methods. An Innovation Hub, however, is a structure that can be embedded in any school as a mechanism to help that learning environment become a dynamic, generative one that designs its way to a unique, preferred future. In this way, an Innovation Lab is seen more as a mechanism rather than a school model, where the primary function is for the school to innovate, redesign and evolve or transform to modern, future-focused structures of learning (Groff, 2015).

Figure 2

The Objectives of the WISE Innovation Hub and a School's Innovation Lab

THE WISE INNOVATION HUB...

is a platform and a collaborative of experts that supports and empowers schools to make the shifts they seek to make as they advance into the future of education.

The Hub serves in a range of key functions and practices:

- **Understand** the needs, goals, and innovative processes related to modern learning environments journey to personalized, 21st century learning;
- **Support and empower** learning environments to do this work, with extended resources, expertise and a collaborative network so that they are successful in their journey;
- Support through **thought-leadership and expertise** in **research** and data collection/ analysis, **design**, and **innovation tools**—as well as domain expertise in innovative pedagogical and educational practices, learning technologies, and modern learning innovations;
- **Deliver materials, trainings, coaching and partnerships** as needed to successfully meet the goals of the Innovation Lab;
- Participate fully as a **partner** and **lead on the development** of the embedded Innovation Lab at a partner school;
- **Disseminate and advocate** the insights, findings, and innovations, so that the global education community may benefit from their knowledge and work.

A SCHOOL'S INNOVATION LAB is...

an R&D unit embedded inside a learning environment in order to conduct research and design innovations that help propel the learning environment in a positive, and effective direction forward.

- An **"engine" of innovation, research and design** practices inside a school, to drive them forward in their practices and model design—helping them arrive at that innovative model of transformative 21st century learning.
- A **team of people** owning and overseeing the research on what is working, what is needed, and how new approaches might be designed, adjusted and implemented.
- Looking at the critical aspects of **HOW learning is being supported** in the school, **WHAT needs new innovative designs** to support modern needs, and **WHAT tools and solutions** will work effectively for this context to meet those needs.
- Capable of **utilizing a mix of core practices** in research, design, and innovation.
- **Centrally integrated** to the core practices (pedagogy) of the school.
- The **key driver of deep changes** to the learning environment, through strong and well-defined tools and methods.
- **Connected to a broader, global education innovation community.**

Innovation is a multi-dimensional concept that can be described as the quest for finding new ways of doing things to attain a better result. In business and industry, it is often referred to as 'change' that involves 'the creation and implementation of new knowledge or improvement of something that already exists' (Oke et al., 2009, p. 64). For this research, we specifically use the term 'innovation' to refer to a new method, process or experience, as the term is used by the OECD Innovative Learning Environments project: "innovative ways of organising learning for young people with the view to positively influence the contemporary education reform agenda with forward-looking insights about learning and innovation" (OECD, 2013a). It is important to note, however, that in any definition of innovation it is not sufficient simply to be creative and come up with new ideas; implementation is a key and, in many respects, a defining feature of the innovation process (Oke et al., 2009)

In education, both individual school innovation and system innovation have most often been considered within the context of school improvement and education reform. Similar to business innovation, where change can be categorized into two levels – technical product innovation and administrative process change – innovation in school settings can also be considered in two interconnected levels: the development of improved educational practice and the development of improved administrative process (Le & Lei, 2019; McCharen et al., 2011).

The innovation or change process is often more complex and challenging in educational settings, compared to business settings, because the pathway from ideation to implementation is far from linear, and can involve an intricate web of internal and external actors with varying needs and practices that ultimately all influence the end design and adoption of innovation. These include central and district government officials, school leaders, teachers, parents, community members and the learners themselves. Each group possesses a unique set of norms and values and, depending on the context, asserts varying degrees of influence over what type of change is pursued and how and in what form it is implemented.

Embedding innovation practices in any organization or business has long been shown to be a powerful tool for enabling vastly different outcomes (Senge, 1990; Kotter, 2012; Brown & Katz, 2019; Kanter, 2020). In industry, for some time there has been a movement towards design-based methods such as human-centered design and design thinking (Kelley, 2001; Beckman & Barry, 2007). Similarly organizational management and innovation has moved more towards agile methods (Ries, 2011; Gobillot, 2007). In educational research, design-based approaches such as *design-based research* (DBR) and *design-based innovation research* (DBIR) are increasingly popular due to their ability to more effectively understand and support learning in real-world contexts (Fishman et al., 2013). More recently, there has been the increased use and demonstration of the power of design thinking and design-oriented methods for the innovation and transformation of schools (Diefenthaler et al., 2017).

Perhaps more than ever, the urgent demands of today's world are passed along to learning environments, and they are pressed to undergo deep change. Rebuilding learning environments as fundamentally learner-centered, aligned with learner needs and unique pathways, and delivered – including by remote participation – is a daunting challenge. Innovation practices are not only a mechanism for leveraging new technologies, or for improving practice, but for fully transforming learning environments in every dimension as a coherent new model of learning (OECD, 2014). Schools that have achieved new models of teaching and learning around competencies, personalized and mastery-based learning, have done so effectively by redesigning all components of their model to work together coherently to support this new operating system (Colby, Hess & Joseph, 2020). Making this kind of transition or transformation, is indeed a journey, ultimately requiring a school community to design the destination as well as the pathway to it.

The overarching objective of this initiative and research is to understand how learning environments, schools, and educational systems can be best supported to navigate into this transformed future, and in what ways an embedded innovation structure can be supportive in this work. That means not only being able to adapt to and successfully implement modern models of teaching and learning, but to be able to continue to adapt and adopt changes as needed, as our global environment continues to transform as well.

The project structure

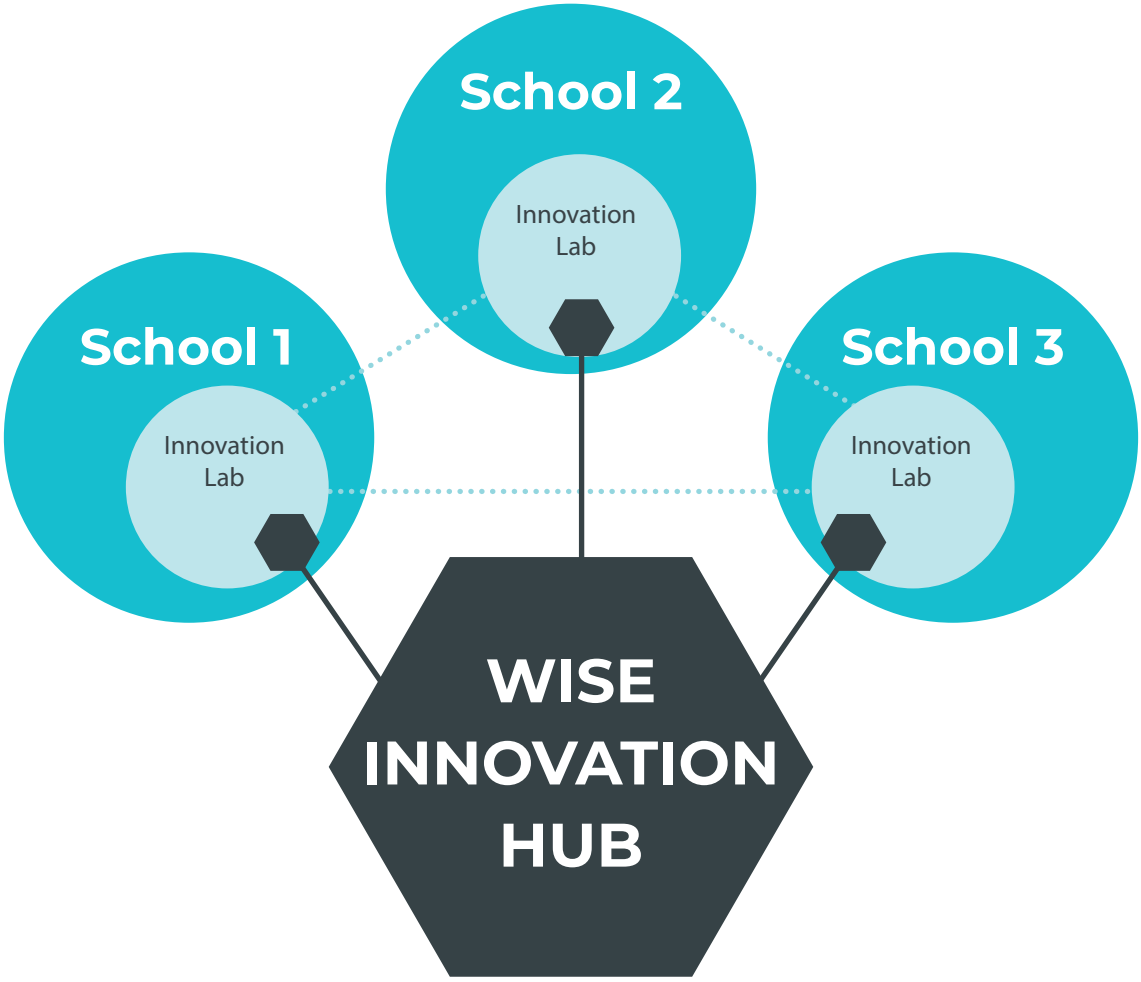
In February 2020, WISE launched the Innovation Hub, and over the course of the following year supported three schools in the process of implementing and leveraging their own Innovation Lab as a mechanism to drive forward their school design. These schools are described more fully in the next section.

Each participating school collaboratively worked in partnership with WISE to establish their own Innovation Lab, an engine for developing, testing and scaling innovation within the learning environment. With support from the WISE Innovation Hub, each school worked to identify key needs, challenges, or ways in which they wanted to evolve or transform, and worked closely with the Hub team to pull from best practices, research and existing innovations to build prototypes[2] and pilot innovative solutions, collect data on what was working and what was not, refine those prototypes and scale innovations across the learning environment. In this way, the WISE Innovation HUB team served as a collaborative of experts that served in a range of key functions and practices:

- Understand the needs, goals, and innovative processes related to modern learning environments journey to personalized, twenty-first century relevant learning;
- Support and empower learning environments to do this work, with extended resources, expertise and a collaborative network so that they are successful in their journey;
- Support through thought-leadership and expertise in research and data collection and analysis, design, and innovation tools, as well as domain expertise in innovative pedagogical and educational practices, learning technologies, and modern learning innovations;
- Deliver materials, trainings, coaching and partnerships as needed to successfully meet the goals of the Innovation Lab;
- Participate fully as a partner and lead on the development of the embedded Innovation Lab at a partner school;
- Serve as a sense-making resource for schools, to support capacity-building for change and innovation;
- Disseminate and advocate the insights, findings, and innovations, so that the global education community may benefit from their knowledge and work.

Figure 3

The Coordination of the Work of the Wise Innovation Hub with the Participating Schools



Together, the WISE HUB team engaged with each school to conduct the core functions of an embedded Innovation Lab:

- ***Explore, research and identify*** key challenges or goals for the learning environment, and areas to build out new practices and innovation;
- ***Design*** new tools, practices and innovations that answer the call across the chasm to mastery- and competency-based, personalized learning;
- ***Implement innovation cycles*** to prototype, test and review new innovations that come from the research and design, and to help scale what is working to the rest of the school, resulting in whole school transformation;
- ***Build capacity*** with the entire school community, to build their skills and their ability to help co-design and drive forward the practices of the school.

Figure 4

The Shared Goals and Areas of Focus of the WISE Innovation Hub and a School's Innovation Lab

THE WISE INNOVATION HUB...

A SCHOOL'S INNOVATION LAB is...

TOGETHER we...

√ **EXPLORE, RESEARCH** and **IDENTIFY** key challenges or goals for the learning environment, and areas to build out new practices and innovation

√ **DESIGN** new tools, practices and innovations that answer the call cross the chasm to mastery- and competency-based, personalized learning

√ **Implement INNOVATION CYCLES** to protoype, test and review new innovations that come from the research and design, and to help scale what is working to the rest of the school, resulting in whole school transformation

√ **BUILD CAPACITY** with the entire school community, to build their skills on driving forward the practice of the school, and their ability to help co-design and drive forward the practices of the school.

...and explore such driving questions as:

- …how to design a curriculum that includes modern competencies?
- …how to transition to mastery-based, competency-based education?
- …how to empower learners with agency over their learning?
- …how to integrate modern, formative assessment models?
- …how to embed well-being and social-emotional learning (SEL) at the center of a learning environment?
- ...and many more…

With each school the Innovation Hub project was implemented through weekly meetings that involved a mix of coaching, strategy design, data review, and co-design of tools and practices. Although each school set a general course or focus of work at the beginning of the year, pursuing the work was very much week-to-week, "riding the waves" of what we were finding, what was showing up in practice, and considering the next iteration. That dynamism and adaptive design work is at the heart of the hypothesis of why embedded Innovation Labs can be a powerful mechanism for driving change.

To guide this work and answer the mentioned research questions, we used a design-based innovation research (DBIR) methodological approach, as this framework considers the subject of study to be a complex system involving emergent properties, and is a methodology purposefully established to address the issue of designing innovations in complex environments and how those innovations are adopted in and across educational systems (Fishman et al., 2013).

IV. CASE STUDIES

This section provides a brief overview of three schools that participated in this initiative from March 2020 to June 2021. The schools are of varying size and demographics discussed further below; two of the schools are in Asia and one is in North America. Note: as research participants in this initiative, the authors have intentionally kept some details such as the names and locations of the participating schools anonymous.

School 1

The first school participating in this initiative launched their Innovation Lab in February 2020.

BACKGROUND

School 1 opened its doors in September 2019, having spent several years designing its model as a transformative future school. The school wishes to stand as a model for how modern, innovative education can look in an otherwise traditional, conservative cultural context. The environment is entirely learner-centered, with no prescribed curriculum or assessments; it currently serves approximately 60 children between three and eight years old. In lieu of traditional structures of curriculum and assessments, the school uses a guiding "5Cs" document which outlines core competencies and dimensions of growth in each learner, and broadly documents this learning in journals called "Floor Books". These frameworks and tools are part of the original design of the school, but require continuous development, revision and refinement as the school grows and establishes itself.

CONTEXT and GOALS

As this school considers itself as innovative and transformative, their philosophy of learning differs considerably from most traditional schools. In light of this, the school community is focused on how to understand and document the success and impact of the learning model, and on how to design for the ongoing sustainability and expansion of the school to support older age students. Broadly, these became the primary focal points in choosing to build in the school a permanent, embedded Innovation Lab to grow the scale of the school and drive its vision.

INNOVATION LAB FRAMING

Since the school had already pre-planned to create and embed an Innovation Lab in their school, staff resources were already dedicated to building their Lab. The school's head of research became their Lab's lead, and later the school brought in additional full-time support staff. In February 2020, the WISE Innovation Hub conducted an initial review on the school's progress and context to identify gaps and priorities for their work together going forward. The first set of priorities and objectives for their Lab's work included:

I. Supporting school staff ability to identify, capture and understand where each learner is on their individual learning journey;

II. Understanding how learner agency and engagement is currently supported at the school;

III. Expanding the school's ability to identify and support levels of well-being and Social-Emotional Learning (SEL) across the learning community, including among learners as well as staff;

IV. Identifying the extent to which parents understand and are able to articulate the school's philosophy, and to understand ways to deepen that understanding;

V. Understanding how the COVID19-impromptu distance-learning program was and was not supporting learners and families, and ways this could be adjusted.

KEY MILESTONES

Date	Milestone
Feb 2020	- Initial review of the school's current progress and gaps completed
March 2020	- Lab launch; exploratory phase begins, creating the priorities and goals for the Innovation Hub in the upcoming school year
April 2020	- Rapid analysis done on how impromptu remote-learning is supporting learners and families
Sept-Dec 2020	- Full scope of Innovation Lab work begins - Research, design, prototyping work begins on core objectives - School-wide survey and data collection implemented
Jan 2021	- Lab lead departs on maternity leave - Full-time data analyst / research assistant joins the initiative
Feb-June 2021	- Well-being data collection tools piloted - Engagement data collection tools piloted - Learner competencies framework redesign work begins - Prototype 2.0 of competency framework completed for testing in the Fall

DISCUSSION and OUTCOMES

Despite the challenges of the COVID-19 pandemic, School 1 was engaged and committed to the Innovation Lab work. The school's head of research led the project from launch in March 2020 until December 2020, when she went on maternity leave. A data analyst team member joined in December 2020 and largely took over this work from January 2021. Weekly meetings were held to unpack objectives and priorities, identify resources needed and next steps whether for data collection, researching existing tools, prototyping new tools to be piloted, and/or engaging teachers in co-design and discussion.

Over the course of the development of its Innovation Lab from February 2020 to June 2021, the school made continued progress on:

(1) understanding community stakeholders' needs, concerns, and desires;

(2) identifying core needs and objectives for the school's onward design journey;

(3) collecting data on the core objectives;

(4) researching and prototyping new tools and methods in relation to the core objectives; *and*

(5) building capacity for the school's Innovation Lab team to continue to carry out this research, design, and innovation work.

Across these broad outcomes, there were a number of project-specific outcomes:

- COVID-19 response surveys for staff and parents intended to engage the community, understand their needs and their experiences with distance-learning;
- The design and prototype or pilot of well-being and engagement measurement tools;
- The redesign of school floorbooks (portfolios);
- Analysis, research and redesign of the school's "5 Cs" (competency dimensions).

School 2

The second school participating in this initiative launched their Innovation Lab in May of 2020.

BACKGROUND

School 2, an urban, specialized secondary school was established in August 2018. It focuses on modern education in science and technology as well as global citizenship. As an international private school with a diverse community of national and expatriate families, the school holds to high academic standards and a range of international curricula and offerings including the US Diploma with Advancement Placement Courses, IB diploma, and UK A Levels certification. The school serves approximately 60 learners aged 13 to 17 years, through three course curricula in Biomedical Sciences, Computer Science and Engineering.

CONTEXT and GOALS

A primary aim of the school is to develop talented students to become pioneers, innovators, and future leaders in STEM. By fostering an entrepreneurial and innovative mindset alongside a strong foundation in science and technology, the school seeks to cultivate leaders in business, research and development and the sciences. Additionally, while beholden to traditional academic outcomes, the school also focuses on cultvating modern competencies and supporting mastery-based, integrated learning. The goal is to be a high-performing school in traditional academics, while being an exemplary model of how to also cultivate broader skills and competencies that are critical to today's world.

INNOVATION HUB FRAMING

The leadership team had a clear vision for this new school since its inception. Understanding how to fully implement all aspects of that vision in practice, however, was still in development. The school's Innovation Lab was led by the school director, principal, and curriculum coordinator; they work with WISE to establish priorities and objectives for the 2020-21 academic year. Weekly meetings were held from May 2020 until April 2021, initially with the school leadership in the summer of 2020 to identify and frame the Hub objectives for the school year, and then including a range of teachers who were collaborating on the co-design and piloting of prototypes.

The prime objective of the school was to expand, deepen and refine the implementation of a pedagogical model to support both complex traditional curricula and the broader integration of mastery or competency-based learning. Within this, there were four outlined objectives for this work:

1. **Develop a learner/graduate profile** which articulates a comprehensive and complimentary set of dimensions, dispositions, and competencies as the ultimate, targeted outcome for learns at this school. Such a document is often used by schools moving to competency-based learning to paint a coherent picture of the aspects of development to be pursued, and framing a more learner-centered approach beyond curricula and assessment.
2. **Identify the structure of skills and competencies** that relate to all aspects of the Learner Profile, organized in a functional way that supports classroom instruction.
3. Prototype and refine **rubrics** that map learner growth of these competencies, while supporting educators to refine their practice with regards to their use.
4. Identify a viable **digital learning platform** to support the management of curricula, competencies, and learner growth.

Later in the year, two additional objectives were added:

5. Cultivate the use and integration of **performance assessments.**
6. Explore how to more effectively integrate **service learning** into learners' experiences.

KEY MILESTONES

Date	Milestone
June 2020	- Launch of Innovation Lab exploration conversations
July 2020	- Initial set of Lab objectives identified - Preliminary review of digital platform options
August 2020	- Project details for Learner Profile created - Launch of Learner Profile development
September 2020	- Coaching on rubrics, mastery learning and distance learning project-based learning delivered - Continued, collaborative development of Learner Profile prototypes with teachers
October - November 2020	- Learner Profile prototype 1.0 piloted, reviewed and refined - Core competencies identified - Design, prototyping and piloting of rubrics by teachers begins
January 2021	- Learner Profile prototype 2.0 piloted with the entire school community - Began exploration of performance assessment and how best to support school staff in taking this deeper
March 2021	- Full set of skills and competencies written to ensure clarity and consistency - Much of the work paused due to school closure (quarantine) and move to remote learning
May 2021	- Full competency framework development begins to support the Learner Profile

DISCUSSION and OUTCOMES

Despite frequent school closings and reopenings due to the COVID-19 pandemic over the course of the school year, School 2 made significant progress in achieving its objectives toward integrating competencies and mastery-based learning into the school culture and structure. The Lab work conducted by School 2 as outlined above created a structure to support the school in that work.

It is worth noting that, together, the leadership and the participating teacher had broad and varying ranges of prior knowledge and experience when it came to competency-based, mastery learning. Each individual was truly on their own unique journey of understanding this pedagogical method. Indeed, the entire school community was on a collective journey to design and collaboratively implement a vision and an outcome for the school. The collaborative nature of the work produced, at times, led to a fluid leadership vision across the group.

At the start of the work, the school director was excited about the project, but allowed the school principal to lead given his strong background and passion for mastery-based, competency-based learning. As the director later reflected, "I let it go so that [the principal] and the WISE Hub team could formulate additional directions that I didn't conceptualize." In June 2021 the outcomes of School 2's Lab work included:

- Developing a complete Learner Profile (to be refined over the next two years as it is implemented in alignment with the new competency frameworks);
- Designing a structure of competencies and skills that support the five core areas outlined in the Learner Profile;
- Implementing a new digital learning platform to support competency-based learning;
- Developing and piloting of a range of rubric prototypes by various teachers at the school.

School 3

The third school participating in this initiative launched their Innovation Lab in November 2020.

BACKGROUND

School 3 is a large, private, independent school in North America with more than 1,200 students ages 3 to 17. The school has a strong history, founded more than 125 years ago, and is consistently one of the top performing schools in traditional academics in its region.

CONTEXT and GOALS

Although largely a conservative and traditional school focused on classic academic skill development, school leaders understand that there are modern, innovative pedagogies that have demonstrated powerful methods which were largely not used at the school. These include approaches such as PBL, integrated learning, place-based and community-based learning, as well as the shift towards competencies and skills not reflected in the school curriculum or practice. As such, the school was focused on identifying and structuring ways to embed these pedagogies and practices to create more integrated learning that generally maintained the existing school structures and practices.

INNOVATION LAB FRAMING

The driver of this initiative was the dean of innovation and pedagogy, who saw it as the next logical step for the pedagogical and curricular redesign work already under way over the previous year. The intention was to build an integrated learning space on campus where more interdisciplinary, integrated, project-based, and connected learning could take place. The initiative was launched through a collaborative effort to define the goals, scope, and timeline of implementation by the school leadership team. After approximately seven weeks of meetings, the work unfolded more directly through working with teams of teachers to design, pilot and test new practices and approaches.

The core objectives identified for this work included:

- Establish what the integrated learning model would look like in practice;
- Expand the curriculum to outline the skills and competencies to be developed by learners;
- Develop a structure by which community-based learning and internships could be integrated into the learners overall learning pathway;
- Design the physical space that would be used to support this learning approach;
- Support educators in co-designing these aspects while also growing their ability to support this type of learning.

KEY MILESTONES

Date	Milestone
October 2020	- WISE Innovation Hub team met with school leaders to establish the partnership with WISE
November 2020	- Official launch of the initiative
January 2021	- Leadership team design and strategy sessions conclude, resulting in identified objectives and work plan - Design and prototyping work begins with educators - Outside design firm engaged to support the design of the physical integrated-learning space
February 2021	- Curriculum competency analysis completed; competency prototypes developed for testing
Mar 2021	- Dean of innovation and pedagogy departs the school - Work narrows to focus solely on educator design and implementation of integrated learning projects
April 2021	- Initiative concludes

DISCUSSION and OUTCOMES

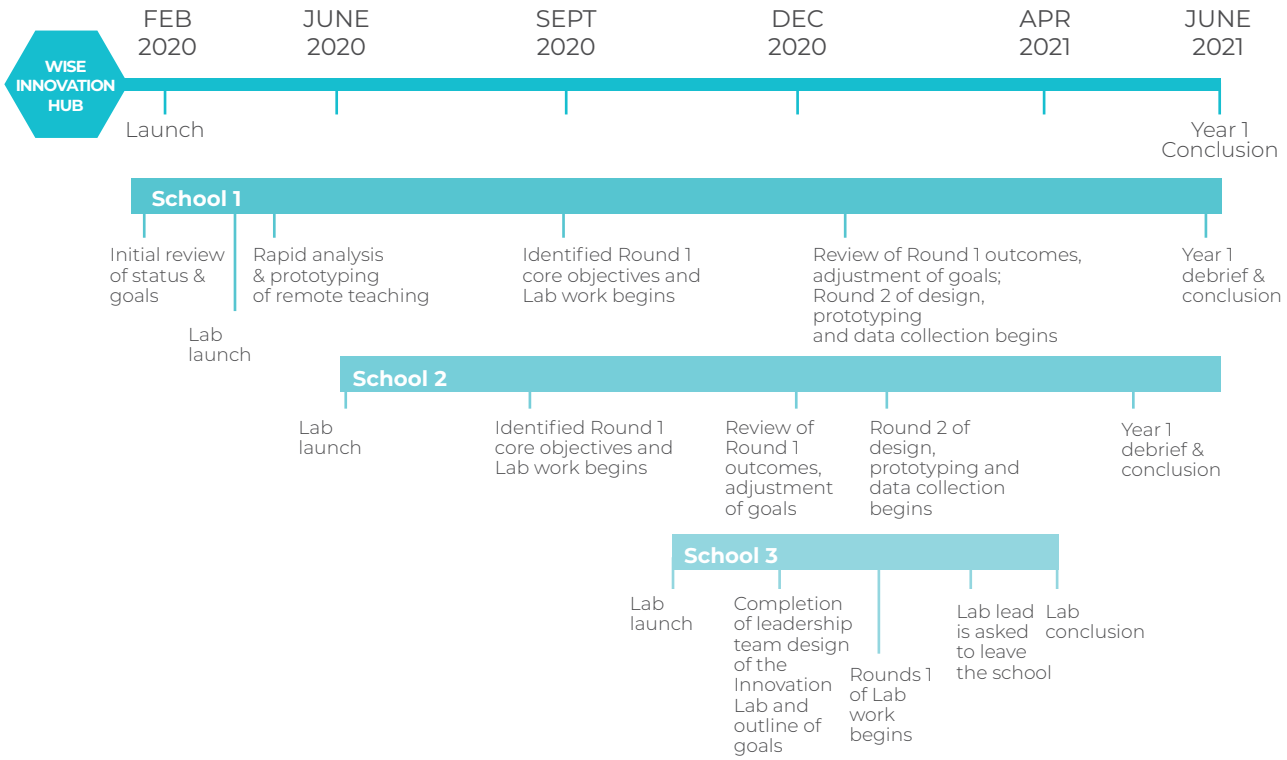
The Innovation Lab at School 3 began with considerable momentum, largely due to its champion, the dean of innovation and pedagogy, who had previously led innovation initiatives at three schools prior. Before the launch of this Innovation Lab, he had spent over a year leading the development of the school's pedagogical strategy and future-focused framework. Over the course of seven weeks during the initial phase before the formal launch of the Innovation Lab, meetings were held to build collective buy-in and alignment within the school's leadership team. This work was critical for a shared understanding of the approach across the team, and for securing collective support for the next phase of implementation. The team identified the core objectives needed to explore, prototype, and implement an integrated learning space at the school.

The school director ultimately approved of proceeding with the Innovation Lab work, and subsequently published the school vision document outlining many of the ideas and goals put forth by the Innovation Lab. There remained, however, considerable concern and constriction on how the work proceeded. As will be discussed further in the next section, change work has a 'messy middle', where new organizational learning is happening. School staff and teachers are often not familiar with new ways of growing and exploring through design-oriented practices.

Six months into the project, the school director fired the Lab leader (note, the director clarified that the termination was unrelated to the Lab work). Although the director wished to continue the project following the Lab leader's departure, she removed much of the structure and goals, reducing the work to supporting teacher training and coaching in project-based learning, that was delivered in a familiar format used by the school. As the work no longer took the form of the Innovation Lab structure, WISE concluded this pilot in April 2021.

Figure 5

The Timeline of Activities of the WISE Innovation Hub and Participating Schools



V. THEMES AND OUTCOMES

Although the general intention and purpose of embedding an Innovation Lab in the school was the same, each of the schools participating in this project had a unique and distinct journey. Each Innovation Lab's structure, implementation, and shape evolved dynamically according to the specific character of each school—its shape, size, goals, context, demands and other variables. For this reason we used DBIR as our guiding methodology, as discussed in the previous section.

Although all three schools aimed to move pedagogy and practice to modern education and "deeper learning"[3] goalposts and the mechanisms for achieving those goals varied considerably. Whereas School 1 was seeking ways to deepen and extend their already progressive model, and support it with further evidence and tools, Schools 2 and 3 were very much traditional and rigorously academic schools wishing to integrate learning with contemporary skills and competencies. School 2 was interested in fully transforming its model and developing a robust set of competencies to support all learners for high academic achievement. School 3, by contrast, wished to begin building more integrated, project-based learning into the existing school structure with minimal disruption of the existing model.

Each school's size, structure and resources devoted to this work varied. Whereas School 1 had already fully committed to the vision of having an embedded Innovation Lab for years to come, and already had full-time staff devoted to it, Schools 2 and 3 at the start of the initiative largely did not allocate any additional human capital or financial resources to the work, and initially perceived this as means to an end.

Despite the uniqueness of each school, clear common themes emerged across them, discussed below.

I. Adaptable design: For success, the Innovation Lab structure needed to be adaptable to each school's own unique and distinct mixture of needs, goals, and variables

At the start of this initiative the WISE Innovation Hub team explained the purpose of the work to each school, and introduced the term Innovation Lab. The concept had not been implemented extensively in the field; understandably, each school construed and interpreted what they felt it meant in their context, and how they wished to put it into practice. This was a central part of the hypothesis of this work: that the reason change, transformation and reform largely has not had much success is because of the tendency to push top-down, standardized structures, which have no way of accounting for, and accommodating, localized needs and dynamics.

3- 'Modern education' is used here to describe many of the pedagogical shifts advocated for by the OECD and the trend we see globally in moving towards learner-centered, competency-based, personalized learning.

Several parameters were constant across all of the Innovation Lab schools; they all:

- led their own Innovation Lab, with considerable support from the WISE Innovation Hub team;
- set their own structure and goals;
- received support in the form of:
  - weekly meetings and coaching with the WISE Innovation Hub, who helped to co-navigate the direction of the work;
  - specific training, coaching and professional development of teachers where and when needed;
  - co-design and refinement of prototypes;
  - support with data analysis and prototype testing and implementation;
  - communication with key stakeholders in the school community about the work;
- determined when and how to modulate and adjust the pace and depth of the work, depending on conditions at the school;
- continued steady and ongoing development of their intended goals, and adjusted those goals when needed during the journey.

Each school's Innovation Lab varied in their implementation and innovation pathways. In addition to the differences noted above, each school had unique needs and situations that required dynamic alterations through the year. While this text cannot fully capture all those journeys, the authors wanted to highlight a few specific dynamics:

School 1:

- Adjusted some of their data collection goals mid-Fall 2020 when the school no longer was fully remote learning.
- Brought in an additional full-time staff member who took the helm of the Hub not long after the original leaded went on maternity leave; this considerably impacted the nature of the work, as the leaders took different approaches.
- The schools went into lockdown again in April 2021, impacting what was originally intended for implementation and the goals needed to be adapted.

School 2:

- About two months into the project, after numerous discussions amongst the leadership team about the goals for the work, everyone had a better collective awareness of mastery-based learning and therefore what the goals and priorities of the work should be. This became an excellent example of how the journey is the work (discussed more below).
- One of the initial goals of the school was to identify a strong and viable digital platform that could support their pedagogical needs. After lengthy discussion with administration on requirements and constraints, however, it became clear that the school was largely inhibited in this space due to those barriers, and thus chose a simple viable tool that they could get approved. While disappointing, this became an outcome that helped to focus the next steps of the work.
- The initial group of teachers selected to be the 'early innovators' for this work, did not take well to it, for reasons related to existing requirements, personalities, and lack of aligned mindsets within the leadership team. Ultimately, they were removed from the project and a new group of collaborating teachers were brought onboard. This was a considerable setback and a tangible example of how local dynamics can inhibit effective innovation.
- The school made swift and steady progress on the community-wide co-design of their Learner Profile. When it came to the next stage of creating the coherent set of competency frameworks to be used in practice to support the development of the profile for each learner, however, it became apparent that this was too resource and time intensive for the school to support on its own. As a result, this goal was pushed to the summer and outsourced to a learning design firm.

School 3:

- The original intended timeline had to be considerably altered when it became clear that additional time for co-design and foundation setting across the leadership team was needed more deeply in order for it to be effectively launched.
- The leadership realized that the competencies in the curriculum were not developed enough to support the pedagogical shifts sought. This created a significant gap needing to be addressed to pull the pieces together that would truly enable the teachers to move in the new direction. At first, this created a messy and uncomfortable sidebar as we negotiated exactly what this meant for the school and the work, and what needed to be accomplished to help move ahead effectively.
- The departure of the Lab lead from the school in March 2021 had a considerable impact on the work. The school director handed off this initiative to another person on the team who did not have the expertise to lead the work. The director closed down most of the original objectives of work that were collaboratively scoped in the first two months together.

II. Adaptive change: The journey is the work.

Each school's experience suggested that the journey was more important than the destination itself. While each school had a clear vision and goals for growth and change, the journey itself was the critical venue for enrolling and encouraging the school community collectively toward that destination.

> Director of School 1: "Having the space to reflect and that being built into the [teachers'] day, into their practice, definitely improves what they do and how they move forward."

> Principal of School 2: "I just knew the end goal was the process—empowerment, learning and growing as a school. I saw it as a huge potential for change, growth and adaptability."

In each school's journey, the nature of the vision and the goals evolved through doing the work. Data collection, research, or piloting a prototype elucidated new insights and understandings that helped direct the work in the right direction. Such insights would not have been as readily available by planning a change or program outright and implementing it at the start of the next school year. Similarly, as the schools achieved certain outcomes, new desired outcomes became clear. For example, as School 2 worked to move to a mastery-based model, they felt that PBL (project-based learning) was not a priority and something the school was already adept at. Yet as they began piloting competency-based rubrics and new instructional methods for supporting them, it became clear that many teachers needed more support in this area.

III. The power of a third party: Having an external resource helped shape innovation in the school and catalyse a range of benefits

A consistent refrain heard when discussing this initiative at the end of the year was the value and impact of having a 'neutral' third party provide clarity, expertise and focus to help the school move forward more quickly toward their goals.

On the surface, external expertise and resources brought depth to the work that might not otherwise have been available. As one school director noted, "[The WISE Innovation Hub] provided resources and expertise that we otherwise never could have had access to, or even known about."

The director of School 2 remarked: "Our school was able to accelerate the creation of its student learner profile and developmental progressions through [this initiative's] help. We wouldn't be where we are today without [this] expert help and continued efforts. "

The external vantage point helped the team elucidate needs and opportunities for innovation which were already present in the school. This was an aspect noted by the leadership at each school:

> "I wanted to engage in this work because I know that… a third party, not invested, sees things differently and has access to different resources, [and] will ultimately lead to what is better for kids."

> "I think a third party is required for true innovation…I'm so close to, and emotionally invested in the school, that I'm blind to things."

"Having a resource base supporting us, and a research base and expertise on what other schools and other major research institutions have done to move practice forward, it was hard for people to argue that teaching to the test was the right way to go. Having that outside voice of expertise saying that this is what is happening in the rest of the world, really challenged us to think 'hey we've got to change our practice'".

The innovation process brought into the schools through the Innovation lab format helped to create some space and structure to guide deeper inquiry. One participant noted that the hub provides the support to "accelerate and project manage the aspects that we don't have the capacity for here". This was a common theme in all the participating schools, where innovation was valued, yet often was edged out by existing timetables and practices. Leaders from all three schools emphasized that having an outside individual and/or team supporting the innovation work had a big impact in progressing the work.

"Just having the school reflect on one thing makes a huge difference, and how the educators see themselves, how they move forward in their classroom with their students. It changes the way they think, and I think that's very important."

"This helped us get to the place of working to embed competencies in our program, rather than just in the content. That's a massive step for the school, and incredibly successful.

"Our school was able to accelerate the creation of its student learner profile and developmental progressions through [this initiative's] help. We wouldn't be where we are today without [this] expert help and your continued efforts. We anticipate launching the profiles and developmental progressions in the Fall."

Finally, embedding an Innovation Lab and these practices, particularly when in partnership with an outside party, created a structure or mirror, reflecting what the school was doing, and willing to do, in innovation and change.

"The Innovation Lab for me is a place where we identify those boundaries that stop us from being able to innovate. And if we identify them clearly, then we can chart a better path."

"Institutions need to know where they lack capacity and resources and be able to find the right people to provide that support — fill those gaps."

IV. The heart of change: To be effective, the Innovation Hub's work must be embedded at the core of practice and spearheaded by school leadership.

Innovation work can easily get tossed aside if it is not built-in, protected and prioritized amongst other initiatives in the school. By definition, innovation is going 'against the grain' of what is, pushing against much of the status quo inertia; in a busy school year it can easily be cut off as "something extra we don't have time for." Collaborative development of the work through an external support or intermediary, such as the WISE Innovation Hub, providing expertise, coaching and co-design, was a key catalyst in pushing beyond this inertia. But it's not always enough. Unless the work is embedded in the foundation of the school's practice and led visibly by the school leadership. This is something we observed to varying degrees and in varying ways across all three schools.

While all good innovation work can and should have champions or change leaders at the helm, it can not ride on one person's shoulders alone. They become the lone voice shouting into a canyon. Similarly, if it is not seen as a fundamental practice to the school's 'work' now, then it easily is seen as superfluous or peripheral, and not necessary when things get challenging. This is one of the reasons this work was framed at the beginning of the initiative as an "embedded engine" inside the school. The initiative was tied to fundamentally designing the future of core school structures. This was for two reasons: first, so that it was embedded at the heart of the school's practices and not seen as extra or easily discarded; and second, because we are pursuing innovation in the core structure of the school for deep transformation. Otherwise it becomes 'innovating at the edges', which is much less likely to produce results or impact learner's overall learning experience, and become much less likely to stick (Groff & Mouza, 2008).

Similarly, school leadership became the most important 'signal', indicating whether or not an activity was effective, meaningful innovation or not.

> *"When the top leadership is involved, in the classrooms, promoted the program, hands-on involved – when the principal is seen as leading the way – the driving force comes from the top and that's a real incentive for teachers to do something and is a necessary thing for this to be successful."*

> *"Ultimately for this work to succeed there needs to be a decision made at the upper levels that innovation does cost money, and those additional funds create more support and flexibility to enable innovation—such as allowing for an additional staff member or more flexible use of money so that it can be used to create more flexibility in the school and school model to create the space for innovation."*

V. Leadership for change: Vulnerable, courageous leadership is critical.

The nature and quality of school leadership, and its role and impact, emerged as the most important aspect to this work. All three schools chose to engage in this work enthusiastically. Yet the ultimate effectiveness and depth of implementation varied considerably across the three schools, and in all cases the school's leadership became the most dominant factor in outcomes.

As noted previously, by definition 'innovation' is pushing boundaries and challenging the status quo. The Innovation Hub structure served as a mirror, reflecting what the school was actually doing, and willing to do in innovation and change. The structure revealed the comfort level in the school with the collaborative co-design process the Innovation Lab was offering as a driver for action and progress. Challenges emerged just as they might when your new roof is first tested in a storm. Actively engaging in the innovation journey helped reveal barriers to innovation in school, and perhaps more critically, the gaps between the intention or perceived action toward innovation, and what was actually happening in practice.

These thresholds varied across the participating schools. Whereas School 1 was very comfortable with the messiness of change, distributed leadership and co-design as the process to achieve their goals, School 3 very much was not in practice once the work began, even though the discussions leading up to the implementation indicated endorsement of the planned path.

As one participant at School 3 noted:

> *Because of being a high performing school, especially at the upper school level there is a sense of 'why risk trying something new and risk being judged on how test performance may be impacted because of trying something new...I think it takes courageous leadership, to be leading a traditionally high-performing school and to constantly try new ideas.*

Some leaders will bow to the pressure of the existing system: 'I've just beaten my brother school for the first time in a long time, I'm not going to risk changing that because that will reflect poorly on my leadership.' As such, the leader's focus is on their own performance rather on the true nature of teaching and learning in a school.

To be taking that risk in your own school rather than watching another innovate, is not easy and not comfortable for many people. [School leadership] said yes all along the way, but then changed it all in the end and closed down many of the objectives because it was too scary to make that final leap.
It's that commitment in actually making the link between theory and practice, they understood that – 'that's great, I can market that and write about that in my newsletters and talk about that to the board' – versus thinking deeply about how do we change practice to actually make that happen. They were thinking up, not down. Had they been thinking down they would been saying, 'OK, what are the steps we need to make this happen and how can we get that happening.'

This kind of deep innovation and transformation work at the heart of the school's model can create challenging dynamics. Factors common to many organizations such as power and control, hidden agendas, and ownership can become critical barriers to success. As one participant stated directly:

This work requires the head of the school to be sure enough in themselves and their ability to cultivate a learning culture in the organization so that the ideas can come from anywhere. If you're not OK with that, innovation really can not happen because you're basically saying 'innovation has to come from me' — 'So you're the only one who can create the good ideas?'

This is a theme or direction found in business and industry as well. As Tim Brown, CEO of IDEO explains (Howard, 2018):

If you think as a leader you can and should have all the answers, then you're both wrong and significantly constraining the capacity of the organization to be creative. Even worse, if you're waiting for teams to come to you for answers and decisions, you're leading them down a path that's neither productive nor creative enough. Instead, it's your job to ask the right questions, to help teams frame the challenge they're designing for, and make sure they're considering the end user and their needs. Not only does it stop you from assuming you have to have the answer, it leaves the space for the individual or team you're working with to express their own creativity and their own innovation.

> *"The best leaders are not coming up with answers, they are coming up with great questions."*
>
> **TIM BROWN , Chair of IDEO**

The nature of leadership for transformation can be distilled down to the culture that is being cultivated in the school: a fragmented, critical culture versus a culture of exploration and collaboration. The latter really is a culture of learning, play, design, collaboration, which of course are many of the skills that are framed as critical for our kids, and those cited as being central to good learning environments (Dumont, Istance & Benavides, 2010).

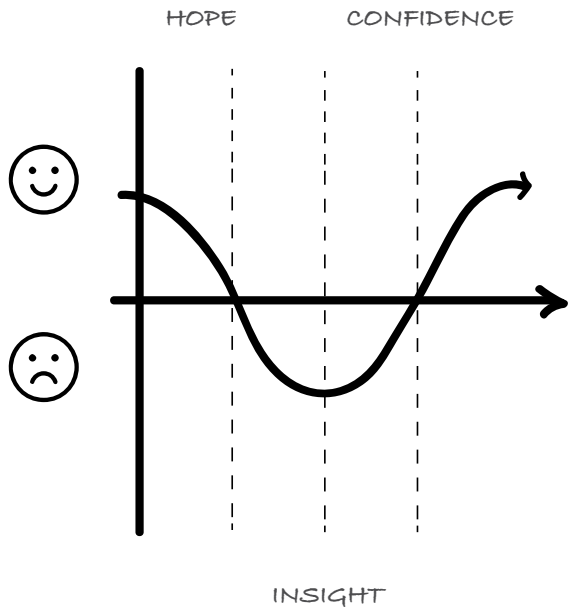
It is important to note, however, that this is not a dichotomy but a spectrum; importantly, no leader or organization is fixed at one extreme or another. School 2, for example, faced some philosophical and collaboration challenges, which the Innovation Hub work helped uncover and highlight and evolve. As the director of School 2 reflected:

> *At the start I let it go so that [the principal] and the WISE team could formulate additional directions that I didn't conceptualize. It was me letting go saying, 'I can't have all the answers', and it turned out to be something really helpful because it awakened this need for moving to mastery.*

Innovation and transformation is non-linear and unpredictable. It can be really difficult for an organization that is traditionally top-down and directive or control-oriented. In change work, there is the 'messy middle' where existing practices and tools are deconstructed and new ones begin to messily take shape (Brown & Katz, 2019). This can be really uncomfortable and unfamiliar for some individuals and organizations who have not previously approached organizational change this way. Even for seasoned innovation veterans, the messiness can be tricky. This is familiar in innovation projects; the famous IDEO design firm even created the "Product Mood Chart" which reflects the persistent bad feelings that come when structures or processes are disassembled, before insight and breakthrough ocurrs and the momentum comes. It takes creative and confident leadership to push through the low points.

Figure 6

IDEO's Project Mood Chart - "How the Journey of a Project Feels"



Note. A visual created by the innovation design firm, IDEO, to demonstrate the often disarfirming feelings about a project between the hopeful launch and the ultimate breakthrough to new ground.
Source: https://designthinking.ideo.com

We can pursue our innovation work in much the same way we coach our learners to persist when they're not getting it. In their book *Switch*, Chip and Dan Heath explain that,

> *To create and sustain change, you've got to act more like a coach and less like a scorekeeper. You've got to embrace a growth mindset and instill it in your team. Why is that so critical? Because, as Harvard Business School professor Rosabeth Moss Kanter observes in studying large organizations, 'Everything can look like a failure in the middle.' A similar sentiment is expressed by marriage therapist Michele Weiner-Davis, who says that 'real change, the kind that sticks, is often three steps forward and two steps back.'* (2011, p. 168)

This kind of journey can be especially uncomfortable and unfamiliar in schools, which often can be risk-averse (Aslan et al., 2018). Yet in our modern, complex world, not taking risks to provide the modern, complex education our children need is no longer an option. This is also why the Innovation Lab/Hub structure specifically helps to mitigate this tension by providing tools, structures and methods to innovate purposefully and in a well-managed way to the desired destination.

Unpacking leadership for Innovation: Empowering innovation in schools

Leadership is widely recognized as one of the key enablers for companies and organizations to foster innovation, and there is an emerging, shared set of leadership capabilities that are the hallmark of leading for innovation (Le & Lei 2019; Oke et al. 2008).

Transformational vs. Instructional Leadership

Among different leadership styles, transformational leadership has been most often associated with innovation and change (Oke et al., 2008; Le & Lei, 2019; Hoch, 2013). Transformational leadership is a term first coined by the presidential biographer James MacGregor Burns (1978) to describe a process in which "leaders and followers help each other to advance to a higher level of morale and motivation." It has come to mean a type of visionary or motivational leadership that involves binding people around a common goal or purpose (Oke et al., 2008). Bernard Bass and Avolio (1993) extended this work into a more comprehensive theoretical framework for transformational leadership centered around the 'four Is': (i) idealized influence, (ii) inspirational motivation, (iii) intellectual stimulation, and (iv) individualized consideration. Bass and Avolio (1993, p. 113) were also the first to connect this style of leadership with organizational learning and innovation:

> *In a highly innovative and satisfying organizational culture we are likely to see transformational leaders who build on assumptions such as: people are trustworthy and purposeful; everyone has a unique contribution to make; and complex problems are handled at the lowest possible level. Leaders who build such cultures and articulate them to followers typically exhibit a sense of vision and purpose. They align others around the vision and empower others to take great responsibility for achieving the vision. Such leaders facilitate and teach followers. They foster a culture of creative change and growth rather than one which maintains the status quo. They take personal responsibility for the development of their followers. Their followers operate under the assumption that all organizational members should be developed to their full potential.*

In education, transformational leadership also emerged as the preferred theoretical construct for school leaders managing innovation and change processes, including large-scale reform (Leithwood & Jantzi, 2006; Shatzer et al., 2014). Van Den Berg and Sleegers (1996) define "innovative capacity" as the ability of schools to implement innovation initiatives, either prescribed internally by the school or externally by the government. In their study of Dutch secondary schools, they identified four interrelated components of a school's innovative capacity, including the presence of transformational school leadership, the functioning of the school as a learning organization, collaboration among teachers, and the internal and external context of a school (Van Den Berg & Sleegers, 1996, p. 673).

Similarly, work by Leithwood et al. (1998) and Kurland et al. (2010) showed a positive link between transformational leadership and organizational learning in schools, noting that where there is increased transformational leadership there is also increased teacher self-efficacy, increased teacher empowerment, and a more positive work culture, among other benefits. MacCharen and colleagues (2011, p. 688) observed that "a culture of continuous learning for both students and teachers is necessary to create a learning organization that constructs new knowledge, innovates and shares with the entire organization." Where

existing empirical evidence becomes weaker, however, is in relation to the link between transformational leadership practices and student academic outcomes (Leithwood & Jantzi 2006, Robinson et al. 2008, Shatzer et al. 2014). In their study of 665 primary schools in England, Leithwood and Jantzi (2006) found that while transformational leadership had strong direct effects on teachers' motivation and the school environment, it had little to no effect on student achievement gains on national literacy exams. Similarly, in data collected from elementary schools across Canada, Ross and Gray (2006) found that while transformational leadership had strong effects on teacher commitment and teacher self-efficacy, it had much weaker effects on student achievement (Shatzer et al., 2014).

Instructional leadership has some of the most direct effects on student outcomes (Robinson et al., 2008). Instructional leadership can be defined broadly as learning-centered leadership in which the main function of the school leader is to manage the instructional program of the school (Vaillant, 2015; Hallinger, 2005). While there are a number of overlaps between instructional and transformational theories of leadership, particularly in more recent revisions, the key difference is that in instructional leadership frameworks, the primary aim is the academic achievement of students. In order to achieve this, the instructional school leader is directly involved in the school's curriculum, including in supervising classroom teaching, managing the curriculum, and monitoring student progress (Shatzer et al., 2014). In this type of leadership, a principal or school leader will use a mix of more transactional forms of leadership, including rewards, and transformational approaches to motivate staff towards this common goal (Shatzer et al., 2014).

Leadership for deeper learning

More recent research has broadened the focus of school leadership to examine leadership mindsets, competencies and capabilities more deeply, including how various leadership roles, responsibilities and practices can be shared or distributed among school staff to create conditions for more successful change. This perspective of leadership stands in contrast to the heroic leadership model and considers leadership as a practice that occurs in "the interactions of leaders, followers, and their situation" (Spillane, 2005, p. 149). This construct also envisions a social distribution of leadership that is stretched over the work of many individuals and is characterized by collaborative decision-making and shared responsibility for outcomes (Spillane, 2005; Harris et al., 2007; Jones & Harris, 2014; Hoch, 2013).

A growing body of research globally suggests that highly effective school leaders emphasize leadership by expertise rather than by role or responsibility in order to enable collective capacity and capability for productive change (Jones & Harris, 2014). Such leadership draws on the collective talent of the team, allowing for various types of influence at all levels, including teachers and staff. This makes leadership particularly flexible in facing unique conditions or challenges found in various school settings. Collective leadership is consistent with newer, more progressive, multi-dimensional frameworks of leadership and learning promoted by the OECD and others (Jones & Harris, 2014; OECD, 2013b).

The paradigm of schooling has shifted toward learning frameworks that emphasize personalized, competency-based learning, and so have the frameworks for school leadership. These emerging paradigms allow for broader learning and change-centric leadership frameworks to emerge that are less focused on the role of the individual school leader, or principal, and more focused on the leadership of the school as a collective, wherein responsibility and expertise is exerted across the organization as well as the ecosystem surrounding it. The OECD (2013, p. 25) in its "Learning Leadership" framework identifies and intersects the several types of leadership considered above – transformational, instructional, organizational learning, and distributed – to describe the complex and inter-related leadership criteria required for so-called "twenty-first century learning," or "deeper learning," to occur:

[The leadership criteria result] from the intersection and accumulation of several leaderships (instructional, organization, etc.) to take them even further. This leadership continuously and sustainably teaches and creates learning, autonomy and empowerment in the learners and in the community. It aims to identify the transferable theories of change management, of shared, collaborative and team leadership strategies, and the organizations that provide learning, with value-creation chains which can "read" and interpret the reality – of the classroom in the school, or of the school in the classroom.

In *Preparing Leaders for Deeper Learning,* Cator and colleagues (2015) build on the idea of "learning leadership" but takes it one step further. They outline a practical framework of leadership competencies, skills, behaviors and practices needed to shift education toward creating and supporting deeper learning environments. Their framework, described below and presented in *Figure 7,* outlines ten leadership roles across four categories, both deeply rooted in transformational leadership practice and instructional leadership theory to create a holistic vision of the deeper learning leadership ecosystem.

1. ***Setting and conveying a vision for deeper learning:*** This includes roles of *vision builders, mission drivers and conversational leaders.* Like transformational leadership, these reflect strong commitment to deeper learning and propelling the community towards that mission.
2. ***Innovate and manage shifts to deeper learning:*** Similarly transformational roles such as *design thinker, smart innovator and change manager* include core competencies for leveraging trends, and building social and political constituencies through relationship building. Iteration, flexibility to ensure innovations scale, balancing day-to-day work of instruction with innovation are key features. Such leadership could underpin a purpose-built, visionary school or help a traditional or struggling school transform and navigate complex environments.
3. ***Lead for deeper learning outcomes:*** Roles in instructional and distributive leadership are *deeper learning instructional leaders, distributive leaders,* and *advocates for all students*. The framework enables the school to serve as a learning organization for teachers and leaders; opportunities are targeted for staff and community engagement in continuous deeper learning. Like distributive leadership perspectives, it calls for identifying and empowering leadership beyond principals to include in the classroom, harnessing the strengths and expertise of the staff and ecosystem.
4. ***Engage and scale deeper learning:*** *Civic* and *community catalysts* and *policy advocates* roles acknowledge school leadership beyond the boundaries of the schoolhouse.

Figure 7
How to Prepare Leaders for Deeper Learning

Note. The dimensions of leadership as related to supporting deeper learning, as framed by Cator et al., 2015.

> *"The role of a creative leader is not to have all the ideas; it's to create a culture where everyone can have ideas and feel that they're valued."*
>
> **SIR KEN ROBINSON**

Going forward: Emerging, transforming

On reflection, there was consensus among the three schools for continuing the work. With the initial experience of the work and its potential impact, the school leadership teams wished to explore more deeply.

School 1 leadership team:

> *It's not easy to identify what will help us move into the future, but I think we need to move away from being on the defense all the time to [defining] this is what will make your child successful in the future. And how do we communicate that in a better way.*
>
> *We need to do more prototyping, trying new things with the teachers, and less fear of the right and wrong.*

School 2 leadership team:

> *My intention now is to figure out how we can get more involved in this approach and expand it even further in our work.*
>
> *Going forward I am focused on two areas: one, taking further steps to set up a safer environment to do the work (a culture of trust); and two, creating more space for the work, the innovation is the work, and not an add-on or by-product of just teaching normally.*

School 3 leadership team:

> *We intend to pick this work up in the new school year, when we have more resources to devote to it.*

VI. IMPLICATIONS

The general intention and purpose of embedding an Innovation Lab were the same across the three paricipating schools, but each had a unique, distinctive journey. Each Innovation Lab›s structure, implementation, and ongoing shape evolved uniquely and dynamically according to the diverse character, context, goals, and variables of the schools. In this section we present suggestions for practitioners, researchers and policymakers on how the Innovation Hub could be implemented in schools, based on our findings and experience.

Implications for research:

1. Investing in educational research

Investing in educational research and evaluation is fundamental to the ecosystem's success (Serdyukov, 2017), and to developing ideas relevant to the Innovation Hub. The rapid development of Innovation Labs will encourage educators to improve their teaching methods through research. Implementing innovation labs will require new tools and resources. Therefore, there is a need to maintain the link between research and pedagogy so teachers receive timely capacity-building and professional development. Innovation Labs require a systematic method and process to identify effective practices.

2. The shifting teacher skillset

'Modern learning' suggests a range of pedagogical shifts in which competencies are emphasized over content knowledge, and learning is developed through personalized pathways. As discussed previously, leveraging an Innovation Lab creates a vehicle to support teachers in growing their understandings and skills for this type of learning. More research, however, is needed. Similarly, effectively implementing an Innovation Lab requires teachers and all education professionals to practice new, potentially unfamiliar skills such as design thinking, human-centered design, design-based research (DBR), and others. More research could support deeper understandings of the impact of creating time and space to directly cultivate such skills in educators as they become active co-designers of learning environments.

3. Building the knowledge base of bottom-up transformation

The Innovation Lab model brings together contributions formulated through differentiated theoretical and methodological approaches to enable educators and learners to advance their understanding of the complexity of the process of education (Pellegrino, Chudowsky & Glaser, 2001, p. 296). The integrated, design-based methods used to propel innovation and transformation at the school level help expand understanding and direct education for contemporary goals. In action, these methods can demonstrate outcomes of successful innovation and design implementation in various contexts. This is a valuable knowledge base toward understanding effective change and learning environment design for a wide variety of contexts and learners.

4. Ongoing research on impact and design of the Innovation Hub and lab model

As the Innovation Lab and Hub models are more widely adopted, further research could identify and understand needs in other contexts, to effectively sustain and scale the model, and other aspects. Analysis and synthesis across these contexts could, for example, elucidate the main skill sets and competencies needed in schools and through supportive organisations, the role of external players in supporting the school based labs, and what is needed to sustain the initiative over time.

Implications for policy:

1. Developing policies conducive to future change

As dynamic, R&D labs embedded in schools, Innovation Labs create context reflecting key insights on how current policies inhibit innovation and change. They also create a structured space to try new policies through risk-mitigated structures that scaffold change processes in schools. Key insights on the nature of change and innovative learning designs can emerge from these experiences to inform and test policy development.

2. Capacity-building for teachers

As considerable social shifts lead to change in education and learning environments, there is a need to develop policies that invest in educator competencies, capacity-building to improve research and design skills (Harris, 2011), as well as current pedagogical practices. Such policies should prioritize and protect the ability of educators to cultivate these new competencies, and would facilitate the introduction of alternative methods and environments to do this.

3. Policymakers play a vital role in the effective implementation of Innovation Labs

To implement Innovation Labs effectively, we need to identify and remove barriers to innovating in this way, and support schools in building capacity. A resilient system is open to demonstrating performance in various ways, including articulation of what is and isn't working with system structures. It should allow the flexibility and space for innovation work. Such a system would be open to the users to iterate and adjust plans even halfway through a school improvement cycle. Rather than sticking with an existing program, the stakeholders could update it based on learnings. Policies (and their design) play a critical role in either enabling or stifling such dynamic innovation and transformation. Thus, we advise that policy-makers participate in capacity-building that is part of the Innovation Hub model.

Implications for practice:

1. Resources allocated to the school to support the Innovation Lab

Additional human capital and financial resources are necessary to rebuild learning environments. Schools that have undertaken transformational journeys and have invested in new operating system models, require a school community to design the destination and the pathway. Upper level decision making is needed on funding for additional staff and increased flexibility to enable effective innovation.

2. The need to create a culture of trust

The overarching objective of this initiative is to understand how to best support learning environments, schools, and educational systems in navigating transformation. That means being able to adapt to and successfully implement contemporary models of teaching and learning, and continue to adapt to and adopt change as needed. Schools are complex organizations; teachers may resist newly introduced ideas and innovations. Schools need to create a culture that is open to more risk-taking, so that teachers and learners are encouraged and empowered to test new ideas and models. Teachers and other key stakeholders need a safe space to share perspectives about practice and to take on such work.

3. Learning from failure

Innovation agenda in schools need a fertile, enabling culture before they can be meaningfully implemented. Starting small, learning fast, and sometimes failing are all intrinsic to the process (Breakspear, Peterson, Alfadala & Khair, 2017). Some of the best effective learning comes from efforts, unsuccessful experiments, and unrealized plans. Such learning facilitates understanding and addressing barriers to innovation and deep learning. Each school›s pathway showed that the journey was perhaps more important than the destination itself. While each school had clear vision and goals for growth and change, the journey itself was critical in collectively enrolling the whole school community in reaching that destination.

4. Teacher learning

Recognizing that teachers can't work alone is part of implementing the Innovation Lab model successfully. Teacher learning is fundamentally about responsive teamwork; teachers need to work in teams bounded by shared values and a deep sense of psychological safety (Edmondson, 2012). The work of the Innovation Lab is complex. If it doesn't work the first time, it may not be from a lack of effort; it may be that the work is hard, nonlinear. Teachers may lack familiarity and experience with the tasks and process; they may not at first recognize success when it comes. Investing in adult learning by building organizations and processes focussing on adult learning is critical. As adults engage in continuous improvement they learn more deeply about their practice.

5. Collaborative work embedded in school practices

Innovation work can easily be neglected especially in a busy school without collaboration. There is a need to build partnerships to protect innovation in the classroom and prevent resistance. This work can be embedded in the foundation of the school's practice and led visibly by school leadership. Active, collaborative engagement in the innovation journey helps identify and address barriers to innovation. The process is advanced by identifying gaps between the intended or perceived innovative actions and what is actually happening in creative classroom practice, and then working to design and cultivate spaces for that innovation to expand.

6. School Leadership

The nature and quality of school leadership, and its role and impact, emerged as the most important aspect to this work. All three schools chose to engage in this work enthusiastically. Yet the ultimate effectiveness and depth of implementation varied considerably across the schools, and in all cases the school's leadership became the most dominant factor in outcomes. The nature of leadership for transformation can be distilled to the culture that is being cultivated: a fragmented, critical culture versus a culture of collaboration. The institution can foster a fear-based culture or a growth-oriented one of learning, play, design, with collaboration central to suitable learning environments (Dumont, Istance & Benavides, 2010). It is vital for teacher innovators and the leadership team to achieve similar mindsets to support practical innovation and profound change—collectively and collaboratively co-designing their future together.

7. Flexible and reflective teaching practices

Through active observation and reflection, and opening their practice to innovation, teachers can evolve their thinking around education, and apply new theories in unique ways. Teacher experience must be reflected in classroom practise and setting. Teachers can reflect more on the construction of their students› knowledge, allowing them to discuss and raise hypotheses rather than giving ready-made responses and answers. In such open, active environments, young people practice

drawing their conclusions and building their own meaningful learning (Tarr, 2013). The Innovation Lab encouraged educators to practice openness to change and innovation, embrace dynamic learning processes, and to anticipate the complexity of current realities. We need to change and deepen teachers› thinking about the process and meaning of their work. Teachers will benefit from more autonomy and opportunities to explore instructional practices, and reflect on their goals and objectives. Through the Innovation Lab embedded within existing models, they can assess and celebrate their successes.

8. Organizational learning as a continuous and collaborative process

The role of the school can be shifted from simply an 'enacting organization' to a ‹learning organization› that seeks to achieve maximum growth capacity (Van Den Berg & Sleegers, 1996). The process should be systematic and continuously fostered among students, school leaders, teachers, parents, and the surrounding community. The connection between the capacity for innovation and change, and organizational learning is well noted in the literature (Leithwood et al. 1998; Fullan, 2006; Kurland et al. 2010; Jones & Harris 2014). Prioritizing systematic and continuous collaborative learning plays a crucial role in successful innovation and change processes. The Innovation Lab model provides the embedded infrastructure needed as an enabler of continuous capacity building and ultimately school and system improvement of any type.

VII. RECOMMENDATIONS FOR ESTABLISHING AN INNOVATION LAB

Creating an Innovation Lab in your school may seem daunting, but getting started does not need to be complicated or difficult. We recommend embracing the same mindset cultivated in doing the work of the Lab: start simple, build and test something quickly, and design your next steps based on the outcome. Here are a few additional recommendations on to ensure success of your Innovation Lab:

Recommendations for Schools, Education System Administrators and Policymakers for Supporting the Implementation of Innovation Labs

Note. Recommendations on how to support the implementation of Innovation Labs.

Key tools and practices

There are a number of increasingly popular foundational tools used in Innovation Lab work that are easy to learn about.

→ ***Entrepreneurial mindset*** (creativity, design, innovation, risk-taking). Absolutely foundational to this work in the mindset of an innovator. In stark contrast to problem-solving and fixing or adjusting what is, this means dreaming up ideas and playing with possibility. The mindset is about playing with ideas, creating new pathways, testing prototypes, and recognising that failure, too, produces useful insight. At first risk taking and failure can be difficult to embrace in many learning environments where they are new. The Innovation Lab structure creates a protected space where work can happen purposefully; taking risks and trying new things can move the learning organization forward in understanding how to support learners. A great resource is Creative Confidence by IDEO founders Tom and David Kelley; additionally, Tony Wagner's book, Creating Innovators, is an excellent discussion on why this mindset is critical for learners today (a mindset critical for teachers and school leaders too!).

→ ***Design Thinking and Human-Centered Design.*** These are the core toolsets of organizations like IDEO who have shown us the critical power of empathy and designing for the user experience for transformative design. As a result, these tools have become increasingly popular over recent few years for their usefulness and applicability in our world. Some great resources include:

- https://www.wise-qatar.org/-2017wise-research-design thinking
- https://designthinking.ideo.com
- https://www.ideo.com/post/design-thinking-for-educators
- https://dschool.stanford.edu/resources/k-12lab-network-resource-guide
- https://www.ideo.com/post/design-kit

→ ***Agile practices.*** An agile approach to project and product development is increasingly popular (the learner's experience can be considered a 'product'). This approach is powerful because it encourages testing ideas early and quickly to learn about the needs or context, and adjusting as needed. This is far preferable and more effective than initiating a lengthy process with a team to create and implement a new tool or process only to learn (or not and ignore which is all too common in education!) what is not working about a design. Agile practices in education include attending to learner voices and needs early on, testing prototypes on how to meet those needs, and adjusting quickly and often for a refined and evidence-based design in the end.

→ ***OKRs.*** This framework – "Objectives / Key Results" – was popularized in John Doerr's book *Measure What Matters,* which describes how using this simple structure to outline objectives and key results that support achieving that objective; the structure has been leveraged by Intel, Google and other organizations to reach transformational goals.

Finally, we recommend taking the leap. As the principal of School 2 offers: "You have to trust that the outcome will be good—it won't be what you first thought it will be, or expected, but it will be good."

VIII. CONCLUSION

The change and challenges facing society today, coupled with the long overdue need for the redesign of our global education systems, serve to amplify the call for fast acting, deep innovation in schools to meet the needs of the modern world. The urgency and complexity of the moment, however, requires measures far beyond traditional top-down policy processes to drive the change required, and additional internal and external infrastructure to support schools and systems in implementing and sustaining deep innovation will be increasingly necessary for true transformation to occur.

In too many schools today the misalignment between existing structures and practices, and the deeper learning school teachers, leaders, communities, and educators all want, has created dysfunction. The pressurized dynamics constrain the ability and/or willingness by school leadership to make substantial changes. Negative impacts vary considerably from one school to another; the forces for change as well as the 'take-no-risk' forces are different according to school context. Clearly, the pathway to innovation and transformation is inherently unique to each school.

Dynamic, adaptive change has never been more critical in education. Foundational to adaptive change is a culture of adult learning and co-design of new solutions. Over the past year and a half, this was evidenced time and again by schools that were able to effectively respond to the COVID19- pandemic. The school-embedded Innovation Lab model provides a tangible 'change infrastructure' for innovation, adult learning, coherent co-design, and a pathway to achieving the school's goals and vision. Similarly, Innovation Hubs offer a model of education systems that can support school networks in catalyzing innovation and collective, evidence-based transformation for modern learning ecosystems.

The authors hope this work will inspire educators, school leaders, parents, administrators and policymakers to explore innovation in their systems, identify existing barriers, and consider how they can play key roles in supporting, regularizing and embodying the design of modern learning so critically needed for our complex world.

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ABOUT LEARNING FUTURES GLOBAL

Learning Futures Global is an international design and consulting group that helps learning environments, schools and education systems to transform to modern models of learning. Our work includes innovative designs and structures in curriculum, assessments, learning technologies, pedagogical strategies, and school model design, to support learning environments and education systems to move to personalized, mastery-based learning. Learning Futures has supported MIT, Harvard University, Futurelab, the OECD, TechFoundation, as well as schools in six continents around the world.
www.learningfutures.global

ABOUT WISE

The World Innovation Summit for Education was established by Qatar Foundation in 2009 under the leadership of its Chairperson, Her Highness Sheikha Moza bint Nasser. WISE is an international, multi-sectoral platform for creative, evidence-based thinking, debate, and purposeful action toward building the future of education. Through the biennial summit, collaborative research and a range of on-going programs, WISE is a global reference in new approaches to education.

The WISE Research series, produced in collaboration with experts from around the world, addresses key education issues that are globally relevant and reflect the priorities of the Qatar National Research Strategy. Presenting the latest knowledge, these comprehensive reports examine a range of education challenges faced in diverse contexts around the globe, offering action-oriented recommendations and policy guidance for all education stakeholders. Past WISE Research publications have addressed a wide range of issues including access, quality, financing, teacher training and motivation, school systems leadership, education in conflict areas, entrepreneurship, early-childhood education, twenty first century skills, design thinking, and apprenticeship, among others.

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DISCLAIMER

The views and opinions in this publication are solely those of the authors. Errors and omissions remain the responsibility of the authors.

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