Learning Environments for Flourishing: Spaces, Themes and Principles for Design

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INTRODUCTION

What are schools for? This disarmingly basic question is due for a dramatic rethink, according to the HPST (2023), because of the three challenges that we currently face. Firstly, the established trajectory of school as preparation for economic activity is now in question because of the wealth gaps produced and exacerbated by our current approach to organising economic activity; further, we are recognising that many of these activities are in excess of our planetary boundaries. Secondly, schools as an mechanism for meritocracy may not be functioning well in many countries. This principle may be the best approach in principle, but in practice does not take into account the different family backgrounds, and is narrowly focussed on cognitive measures and outcomes. Lastly, young people are increasingly reporting a loss of meaning in their lives.

In addition to these factors, Artificial Intelligence (AI) presents unique opportunities and threats to economies and societies alike. As discussed in the HPST report, AI, as a form of automation: can relieve us of boring tasks, but may corrode our individual sense of agency; may accelerate social mobility and reduce inequality, but may also be implicated in the interference of democratic process; and may increase economic productivity, but may cause a period of painful disruption.

In the light of these challenges to the status quo, the HPST has identified three competencies contributory to human flourishing: adaptive problem solving, important to forms of inventive thinking that may provide new responses to the problems we encounter; ethical decision making, central to issues of social justice and appropriate actions in interactions with other living things; and aesthetic perception, an educated ability to appreciate beauty, magnificence, and mystery.

In this document, we extend these considerations about education for human flourishing, and outline the characteristics of learning environments that support this form of education. A key extension of this paper is our contention that education is not reducible to learning; in the English language, learning is a verb that is not complete without specification of content, purpose, and relationships (Biesta, 2016). The choice of what to teach our children is intimately linked to questions of power and ideals of flourishing. Young people can acquire the same piece of knowledge with a purpose to either uphold its legitimacy, or to critique it with an intention to replace it. Relationships between teachers, students, and the lesson content also plays a significant role in the establishment of classroom cultures more or less amenable to learning about human flourishing.

At the same time, the manner in which one educates can dramatically change the content of what is learnt (Peters, 1959), hence it is not possible to separate considerations of curriculum and pedagogy—pedagogical questions are curriculum questions, too, and must

be given the same consideration as questions of what knowledge students need for flourishing.

Another significant extension of this paper is in its making space for the liberal account of human flourishing. While it does not seek to supplant the Aristotelian perspective adopted by the HPST, admitting the liberal account may be more effective in providing young people the possibility for discovering ways of flourishing in unforeseeable futures.

A core tension for the problem of flourishing is the choice between received wisdom and self determination. While the latter poses the risk of being too trivial, the former can be accused of unwanted imposition (Kitcher, 2022, p. 84).

This paper agrees with Kitcher (2022), that one's choice of life project must satisfy three conditions: it must be autonomously chosen, it must be at least in principle achievable, and it must not conflict with the achievement of another's project. While young people may not be of sufficient competence to make these decisions completely for themselves, it is nonetheless important to give them opportunities to develop their autonomous desires.

If the starting assumption is that young people are not competent, the risk will be that they will never be found competent; more tests can be found in which they will fail and autonomy is not 'given'. On the other hand, an alternative approach is to assume autonomy at the start, that they can be competent and responsible for their decisions, and that therefore the role of the educator is not as a gatekeeper, but as a coach instead.

Especially given the contemporary problems that we are confronted with, where paradigm shifting solutions are needed, an expansive set of value orientations may serve educators better in preparing young people to arrive at different answers.

The problem of AI and human flourishing may be attracting headlines because of its topical pertinence, but its treatment must be seen as a special case of the ideas developed in attending to the problems of Science, Technology, and Societies (STS). STS is a novel interdisciplinary field of study that emerged in the 1960s. While schools do not typically teach interdisciplinary subjects, let alone deal with STS, its findings are nonetheless significant. In this paper, the main principles adopted are the significance of technologies as intention amplifiers (so that a proper understanding of technology must begin to an analysis of intentions), and that artefacts are imbued with politics to begin with.

Combining these extensions to the existing HPST position affords expanded perspectives for the design of learning environments. Considering the role of teachers in the educational interaction (not just 'learning') opens up the space for how young people may emulate competent human behaviour. Teachers, as qualified adults in society, must have some insight on flourishing and must possess some practical wisdom about how to live in the world.

Thinking about the learning environment must extend beyond the physical infrastructure, to also thinking about the sociocultural patterns of being. While teachers are significant members of these collectives, students are not to be considered as mere recipients of knowledge. Especially for inventive behaviours, teachers face the difficult task

of heralding the intentions of young people, some of which may even stand in opposition to existing ideas. While the role played by teachers *and* students in creating, maintaining, and growing the learning environment is complex, it cannot be overlooked in preference for principles which appear to give a sense of control and predictability.

This is especially so, again, if we are to true to the project of attending to the problems of our time. Certainly, young people must inherit the significant cultural achievements of our hard won knowledge. But, in order to flourish, they must find a different way than what we now know will fail. They must transcend the limits of our current ways of thinking. Educating for such a goal is inherently risky, but it must be a risk that we have to take.

RETHINKING LEARNING ENVIRONMENTS FOR FLOURISHING

Various OECD projects have addressed the importance of designing innovative learning environments that operate at a micro level of the classroom and at the same time are networked or integrated in the wider eco-system so as to operate at a "meta" systemic level (OECD 2013, OECD 2015). In this paper, we define a learning environment to be a set of cognitive, social, psychological, technological and physical conditions created to support and enhance the learning process for students. The learning environment is conceptualised as consisting of seven simultaneously interacting *spaces* which constitute several well-developed ways of thinking about the educational interaction. These are the: (i) curriculum; (ii) pedagogy; (iii) aesthetics; (iv) social-emotional; (v) exploratory-imaginative (vi) digital-virtual; and (vii) physical spaces, as shown in Figure 1. Across all these spaces, we propose that three inter-linked *themes* that pose productive tensions for which to make design decisions in learning environments. These are: (a) Disciplinary forms of knowledge as constraints and enablers; (b) Student autonomy and the risk posed by educating for it; and (c) Learning with technology, learning about technology.

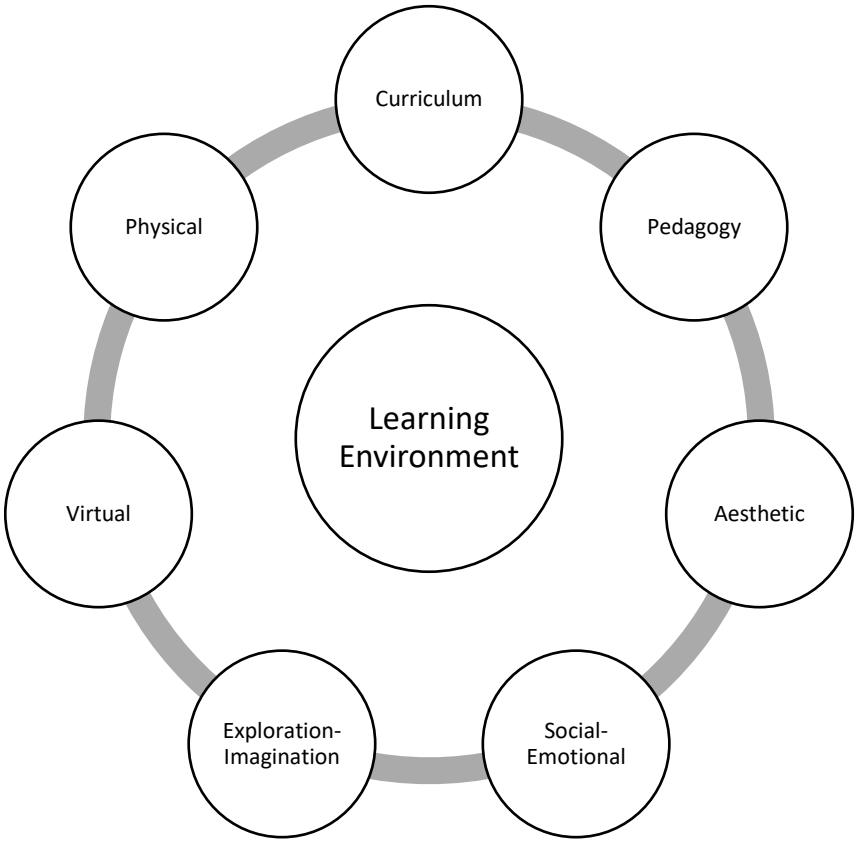

Figure 1 Tangible and Intangible Spaces of the Learning Environment.

SPACES

Learning environments are often conceived as tangible and observable spaces where learning takes place. Some examples include the classrooms, gymnasiums, science laboratories and even the school. While these physical spaces can cater to specific types of teaching and learning, they are only one aspect of learning environments we see them. We suggest that learning environments should instead be conceptualised as both tangible and intangible spaces, with the latter occurring as cognitive, social and affective processes within learners to support their learning, and ultimately their flourishing as individuals.

Learning environments are therefore not static but are the iterative outcomes of interacting tangible and intangible spaces which can be complex and unpredictable. Human learning is never an exact science. Curricular decisions that are made at the system level can produce effects in classrooms, and conversely teachers can modify the intentions of state policies in significant ways through their pedagogies and curriculum enactment. At the same time, students' internal learning processes that encompass an appreciation of the aesthetic, an exploration of ideas and the imagination, and the perception and management of emotions will interact with the tangible spaces. As educators, we should pay attention to these six spaces and consider ways to negotiate them so as to provide students with experiences to learn and grow. This should be the overarching principle for designing learning environments.

In the following sections, each of the seven spaces introduced earlier will be described to explain why they are crucial to the creation of learning environments.

The curriculum space

In every system, there are sets of written plans that focus on the academic content for the course of study at each level of schooling. This is the written or planned curriculum, which is the official document for teaching and consists of recommended plans for meeting specific learning goals and objectives. Curriculums in schools are based on subjects of study such as History, Mathematics and Art. Teachers and students are committed to this course of study which last several years. Each year is distinct in terms of its emphasis and includes the subject syllabus that contains specifications of topics that need to be taught and recommendations of how to teach them. A curriculum consists of clear learning goals for students, and these comprise knowledge and skills that the course of study will develop. In some curriculums, affective outcomes of attitudes and values are also included as learning goals.

Implementing a curriculum is never straightforward as the overall outcome will depend on factors such as the teachers' use of pedagogy, assessment practices, teaching material and learning experiences created in and outside a classroom. The written curriculums offer the space for creating learning environments in which students can potentially flourish in classrooms and schools. Written curriculums, however, remain static until they are enacted by teachers to create the kind of experiences that have been planned so that students can learn as the plan intended (Marsh & Willis, 2007). Education specialists with expertise in a subject and skills for developing a curriculum are the ones designing a curriculum. Apart from the academic content to be covered, the curriculum designers will also exercise their own judgments on what content or processes to exclude. This "excluded curriculum" can have an impact on students' development and shape their thinking, knowledge, values and attitudes as much as what is included.

The pedagogical space

Pedagogy refers to teaching methods for delivering the curriculum to the students. It is founded on one or more approaches to teaching which are based on theories about learning. Key pedagogical approaches include constructivist, collaborative, reflective, integrative, inquiry-based, problem-based, team-based and appreciative inquiry. The pedagogies that teacher employ to teach in a classroom can directly affect the things we want students to know and learn. A teachers' pedagogy reflects their knowledge of relevant theories about learners and learning as well as the depth of their own disciplinary knowledge of the academic subject. In the current drive towards using technology for teaching and learning, the pedagogical space will invariably include the use of e-pedagogies.

Teachers' pedagogy is the result of their pedagogical content knowledge, that is the integrated knowledge of how to teach a particular academic subject and the content or disciplinary knowledge of the subject (Shulman, 1987). This knowledge may have been acquired explicitly through training and education and strengthened over time, but they may also be implicit views developed and distilled over the course of the teachers' own professional experience. On balance, a teachers' general pedagogical knowledge, that is strategies for teaching and organising classroom experiences, is just as important because subject specific pedagogies are usually based on these broad principles and strategies that

a teacher possesses. It is in the use of appropriate pedagogies that students' learning is fostered.

The aesthetic space

Aesthetics is the study and practice of beauty. While it can be fairly common to think of aesthetics as an afterthought or as a form of luxury that can only be afforded once basic needs are met, we suggest that instead that aesthetic appreciation is central to a life of flourishing, along with truth, and goodness. Although aspects of aesthetic appreciation are culturally determined, there is likely to be a strong innate component. The features of the human body deemed of aesthetic merit across cultures, for instance, have been linked to reproductive fitness (Pflüger et al., 2012); aesthetic surroundings have been noticed to be central to the promotion of health in hospital settings (Caspari et al., 2011), and in urban landscapes (Root et al., 2017).

Learning environments that are designed with aesthetics in mind are not merely beautiful spaces in which teachers and students may feel at ease and be inspired for the educational interaction. Learning environments can also be designed for an education in aesthetics. For flourishing, such an education should help students connect their sensations of aesthetic experiences with culturally established understandings of what constitutes desirable aesthetics. A critical education in the aesthetic space would offer students opportunities to evaluate existing norms, propose meaningful shifts in cultural values, and where appropriate, usher in these shifts. While much of aesthetics may have become debased by capitalist influence in contemporary media industries, it is still important to appreciate the potential for aesthetics to point the way for critique, or more constructive visions of what flourishing may be. In this regard, an education in aesthetics should be essential for all.

The social-emotional space

Social-emotional learning (SEL) is the development of a combination of skills and dispositions that enable students to flourish as individuals. Although these skills are often referred to as "soft", they are as important as skills that are associated with academic content learning. When students develop social-emotional skills they develop more a positive image of themselves, strengthen their ability to manage negative emotions, motivate themselves in learning and improve inter-personal relationships with others. Relatedly, they also grow in confidence to collaborate with others and can in future contribute positively to society as they cultivate strong moral character and values. SEL remains one of the most powerful influences on children's learning. It improves academic achievements, increases pro-social behaviours and strengthens positive attitudes towards self and school (Durlak et al. 2011). Successful SEL training programmes can help students develop five key skills: self-awareness, self-management, social awareness, relationship skills and responsible decision making (Collaborative for Academic, Social, and Emotional Learning, (2015).

Learning environments should provide the space for social-emotional learning to take place. Avenues for this include the use of teaching pedagogies and activities that promote reflection and self-awareness, demonstrate humanity, offer explanations, encourage

collaboration, include perspectives sharing, acknowledge negative emotions, explore difficult issues, and grow interpersonal and social empathy. While SEL can be taught through the formal learning curriculum, it is best offered to students in the context of their lived experiences. This would naturally include lessons in the classrooms but should include the wider learning environment of extra/ co-curricular activities and the overall school culture.

The exploration and imagination space

In schools, the exploratory and imaginative space refers to the forms of 'magic' talented educators can do to bring their students along on a flight of fancy. For instance, in early literacy, teachers reading big books to their children can inspire their students to think along with them the scenarios presented in the book. This space is where literary (and other forms of) fiction exists and is also the space where creative speculation is developed. Exploration and imagination occur not only for fiction but can also be a useful means of instruction. For instance, using embodied cognition approaches to learning, teachers can use the physical space and students senses to teach mathematical concepts (e.g., Nemirovsky et al., 2012). Educational projects in creativity will utilise teachers' abilities to use and develop the space for students' participation. It is possible to design such a space to be more, or less, inviting, by manipulating the aesthetic or physical space, and by adjusting the parameters and 'rules' for participating in this space. While interactive forms of digital media (e.g. virtual/mixed/augmented reality systems) have been in the spotlight in recent years, far simpler and low-cost approaches could include the use of board games.

Exploration and imagination are not limited to creative and artistic forms of engagement. They can occur in talk – talk amongst students and talk with their teachers. Learning environments should provide a space for this other form of thinking through oracy to help students develop the skills and confidence to explore ideas with one another and imagine alternatives and possibilities. This space helps students recognise that they have something valuable to add to their collective learning through 'interthinking' or thinking together (Mercer, 2000). Learning environments that allow students to think collectively and reach outcomes through oracy not only contribute to their social and cognitive development, but also develop in students important oracy skills that are needed for acting upon the world they will enter upon leaving school.

The virtual space

The virtual space exists with the application of technological tools for teaching and learning in the classroom. It changes the pedagogical space by creating new experiences for students. It is also found as a hybrid environment of lessons conducted synchronously over the internet with video conferencing and teaching platforms. The virtual space also exists in asynchronous learning activities through tasks that teachers have prepared for students to attend to at their own time and pace.

The virtual space also exists quite literally in worlds and cyberspaces created by technology. Contemporary digital media technologies have become increasingly powerful in their abilities, to the point that it is becoming realistic for individuals to develop simulated avatars in interactions with other characters. Starting from text based forms of

communication and online fora in the later part of the 20th century, technological developments have continued apace; today participation in Massive Multiplayer Online Role Playing Games (MMORPGs) is routine, and digital technology companies are attempting prototype versions of the science fiction online agora of *Ready Player One* (Cline, 2012). Whether or not these efforts are effective, these spaces are an artefact of the human inclination toward social behaviour and the maintenance of social norms.

The educational use and design of these spaces can result in high degree of student engagement. However, this may not be sufficient for an education interested in human flourishing, as it is our lives, *in reality*, that matter. While there will always be cultural rules (which can be arbitrary) in the social worlds built atop nature (the 'real' world), or in the virtual world, it is still more likely that the real world is more consequential. In addition, the basic rules governing interactions in virtual worlds will never be completely neutral; the education task can be the discernment of these rules, and an ethical analysis, as a prototype analysis for rules in the real world.

The physical space

The physical space involved in the educational interaction is certainly a vital space to consider. While the recent pandemic has demonstrated that a limited form of education can occur online, it has also shown the importance of physical spaces for educational interactions. The design of physical spaces as part of the educational design is most strongly associated with the Reggio Emilia method of education originating from Italy. Space is considered the 'third teacher', after one's teachers and peers. Physical spaces are especially useful for collaboration, can hold artefacts which represent the societal values, and can be a canvas for exhibiting lasting representations of the ideas that are discussed in the aesthetic and imaginative/exploratory spaces. In addition, a well-designed space will be necessary for learning embodied forms of knowledge such as reading and literacy development in school libraries (Loh et al, 2021). The entire school can also be the physical space that promotes learning, as a documentation of children's voices have shown how built environments can influence their relearning experiences (Burke & Grosvenor, 2015).

The design of physical spaces such as a classroom must take into account the other spaces as discussed above. For example, digital spaces will require physical spaces to 'jack in', both in the electrical supply sense, and in the metaphorical sense of needing physical space to arrange computing machinery to participate in online communities. Curriculum and pedagogical considerations matter, too. If knowledge is tacit and requires apprenticeship to acquire, large classrooms with many students will not work. Nevertheless, this can be mitigated by the provision of suitable furniture for reconfiguration of large class teaching to small group interactions and explorations. The surroundings in a classroom can immerse students in aesthetic appreciation, knowledge enrichment and learning discoveries. The traditional notice boards and walls surrounding the room can be transformed to spaces of beauty, creativity and knowledge. They can also be partially transformed into virtual spaces. Whatever purposes these physical surroundings may serve, the physical space of a classroom should continue to be important places for learning and discovering the joy of learning.

THEMES

Three themes are presented for the creation of learning environments. Common across all these themes is the central problem of education, especially if we are interested in human flourishing as a goal. We cannot know for certain if what we aim to do will lead to flourishing; this is because we are unlikely to settle questions of what the good life constitutes (Harðarson, 2012). The appropriate educational response for this must be one where we enable and empower young people with abilities to transcend our current imaginations of what ought to be possible, while not simply discarding the cultural achievements that they will inherit.

In the next section, the themes and related principles shown in Table 1 will be developed more fully to explain how learning environments are affected by these themes, and how certain design principles emerge from a consideration of the three theme.

Table 1 Themes and Principles in Learning Environment Design and Development

Theme I: Disciplinary forms of knowledge as constraints and enablers.	**Theme II:** Student autonomy and the risk of educating for it.	**Theme III:** Learning with technology; learning about technology
• Learning design is determined by learning goal, which should be established first. • Learning environments need to make epistemic reasoning visible. • Tacit knowledge that cannot be represented exists; how it is acquired will continue to be through apprenticeship. • Design learning environments to allow students to practise solving complex real-world problems.	• Learning for flourishing cannot be understood only in cognitive, psychological, or individualistic terms. It is an embodied social act. • Educators must embrace and preserve the risks involved in the cultivation of the new generation, who must decide for themselves how best to live life. • Learning environments should create and support trust rather than enforce accountability.	• Technology should be utilised in the service of complex educational goals. • Technological education should be an education in the humanities as well as the technology itself. Students should learn about technology as much as they learn with technology. • Technological education should not be limited to technical know-how. It needs to take account of the use of technologies in social and cultural contexts and the intricacies of such use. .

Disciplinary forms of knowledge as constraints and enablers

Students go to school to acquire knowledge. Knowledge is organised in disciplinary forms and must continue to have a role in human flourishing. These forms of disciplinary organisation are social constructions but are often limited by non-negotiable boundaries in nature and culture. Learning environments need to be designed in ways that make these boundaries and organisational structures clear to students. Students should neither needlessly 'reinvent the wheel', nor be overly constrained by arbitrary conventions and be prevented from innovation.

The ancient Greeks divided knowledge into episteme, techne, and phronesis, corresponding to scientific, and technical knowledge, as well as practical wisdom. When we think about formal schooling, we far more often associate it with episteme and techne, and to a lesser extent, the practical wisdom of phronesis. Especially for developing contexts, and with relevance even for High Performing School systems, it can seem seductive to focus on the high-status episteme and techne for their centrality in contemporary forms of high value economic activity. However, education for flourishing requires young people, individually and collectively, to engage with questions about value and what ought one do with accessible resources. Responses to these questions are the knowledge of phronesis and have a peculiar patterning distinct from episteme and techne. While episteme and techne can provide exact responses, phronesis is highly context dependent and subject to individual interpretation.

The nature of these knowledges already suggests different learning environments for its acquisition. For knowledge which is amenable to decontextualised abstraction and is accessible to many, mass approaches to instruction such as lectures may suffice. On the other hand, for practical wisdom and other forms of knowledge which are open to subjective interpretation, apprenticeship methods may be more appropriate. In this section, the influence of the nature of knowledge on learning environments will be explored.

Considerations based on the nature of knowledge forms

Disciplinary forms of knowledge provide socially constructed descriptions of the patterning of their object of study: the natural sciences study the ordering of nature (scientific laws) and provides explanation for these patterns (scientific theories). The humanities study the patterning of human experience and provide us with wisdom on how to act well in circumstances that we might find ourselves in the future. While these patterns are accessible to most, the knowledge that results may not follow intuitively. Knowledge in the natural sciences is especially prone to this counterintuitive behaviour; but knowledge in the humanities also contains many exceptions and particular ways of 'seeing' phenomena (Bernstein, 2003). For instance, while an intuitive, untrained physics (Pinker, 1997) suggests that objects can only be in motion because a force is continuously acting on it, the disciplined perspective understands otherwise (Galili & Bar, 1992). Similarly, multiple concepts in sociology can simultaneously analyse the same phenomena to different results depending on the theorists' perspective.

In designing learning, it is important to keep in mind the nature of knowledge that is to be communicated; there is unlikely one universal method of instruction that is knowledge agnostic. For instance, digital storytelling may be a good approach to teach concepts in the humanities such as the golden rule, as the rule can be instantiated in multiple different contexts, demonstrating its productivity. On the other hand, for other concepts which only admit singular interpretations such as many of those in the natural sciences, digital storytelling may not work as well (Tan et al., 2013). While there can be considerations such as increasing engagement in learning, primarily designing for this goal can detract from insights from the nature of knowledge. For instance, the lecture as a pedagogical technique has acquired negative connotations, but that need not be necessary; good teachers can "use their voices to excite and explain, not simply to instruct, command, or drill." (Peters, 1959) Especially for knowledge which may be counterintuitive, that may not follow immediately from the everyday experiencing of phenomena, the expert lecturer can do as much, if not more, than other methods conventionally considered more engaging.

This is an argument for recognising a diversity of approaches to designing learning environments, based on the learning goals intended by the educators. The goal may not always be the efficiency of communication, as when teachers want students to develop for themselves their own autonomy and in(ter)dependence—vital preconditions for a life of flourishing. To do so may require students to confront difficult questions or experiences, which may not necessarily be pleasant experiences. This leads us to the first principle for the design of learning environments: the learning design is determined by the learning goal, which should be established first.

Powerful knowledges, knowledges of the powerful

Originating from the dictum of Marx's, that the ruling ideas of any time are the ideas of the ruling class, this idea primarily affects the design of the curriculum space. What students ought to learn in school has always been the subject of intense debates; the notion of education for human flourishing must also been seen as a curriculum project designed as an educational response to social conditions of our times. The matter for consideration here is, once again, the nature of knowledge, specifically, its epistemic aspects.

In the mid 20th century, postmodern philosophy gave us insights into the problem of knowledge and power. Knowledge is socially constructed, and apparently innocuous concepts in common circulation hold meanings which benefit certain groups over others. In education studies, this has resulted in productive lines of inquiry where latent biases in the school curriculum against powerless groups are revealed (see, e.g., Apple, 1979/2004; Giroux, 1983; Young, 1971). A productive response to these problems may be culturally relevant pedagogies (Ladson-Billings, 1995), where high status knowledge is translated into forms that are within the realm of students' experience. If we are concerned with human flourishing, we must be concerned with the flourishing of all, including those who may not have the resources to do so. The provision of high status knowledge claims to impoverished groups must not be done at the expense of deleting their cultural traditions and ways of thinking about what flourishing constitutes.

This leads us to the question of the status of the knowledge we intend for students to acquire. Are they high status because certain powerful groups say they are, or are they high status because they are superior descriptions of reality? A further advance to this epistemological debate occurred in the late 20th century, where researchers argued that even if we accept the fact of the social construction of knowledge, nature and other humans place obligatory boundaries on how we might construct knowledge (Collins & Evans, 2017; Moore & Muller, 1999; Niiniluoto, 1999). The educational value of this insight may be in providing us a means to escape the misinformation crisis we currently face. Contemporary misinformation campaigns can make use of epistemic reasoning strategies that resemble certain more progressive pedagogies (Russo & Blikstein, 2023). Crucially however, these campaigns overly weaken the connection between the truth and their referents in reality, choosing instead to only create internally coherent webs of knowledge.

What constitutes flourishing, and how might collective projects in flourishing receive enough widespread support needed for success are significant educational projects. While the history of the 20th century has shown us the hazards of totalitarian regimes which tolerated no opposition, the diametrical opposite of excessive individualism is also inadequate (Brooks, 2020). Designing learning environments given these epistemic considerations requires educators to provide opportunities for collective engagement with the foundational basis of truth claims, as well as an exploration of the range of reasonable truth claims given a certain empirical phenomenon. Such explorations may appear more likely for phenomena that are personally experienced, and is subjective, embodied, or require human interpretation. For instance, whether societies are just and non-discriminatory can vary depending on one's social location. How communities are supposed to make sense of data to arrive at conclusions can become contentious. Significantly, physical phenomena is not exempt from contention, as when careful study reveals complex behaviours that require extensive preparation to 'capture' how nature behaves (Pickering, 1995, 2008). The design principle which encapsulates these ideas is thus: learning environments need to make the epistemic dimensions of knowledge clear to students. It is not enough that they know; they need to know why they know.

Education as apprenticeship

Appreciating the nature of knowledge and education has implications for how learning ought to occur. If knowledge exists in representational forms (such as words on paper), and education is a process of communicating knowledge, then a mass approach such as an online lecture may work well. However, if knowledge takes more experiential, embodied forms; and education is a process through which students learn to *be*, then apprenticeship may be a better method instead.

Human flourishing requires knowledge of both the representational and experiential forms, as when, for instance, we may want students to develop the ability to delay gratification. Introductory lessons can do a good job of initiating students to the concept, but then it can be challenging to discern how one's actions ought to be determined according to this principle. At what point does delaying gratification become unnecessary deprivation or being miserly with oneself? Responses to these kinds of questions require artful responses,

and apprenticeship relations may be ideal for learning the nuances to these responses, leading to the notion that such aspects of character education are ‘caught, not taught’.

Experiential and embodied knowledge occurs especially in physical activities and in material processing practices such as working with one’s hands or with tools and technologies (Crawford, 2009; Ingold, 2004, 2013; Magnani, 2004; Spretnak, 1999; Wilson, 2002). To learn how to play rugby, ride a bicycle, or perform surgery, there is no good substitute to actually doing these activities. There is know-how (tacit knowledge) as well as know-that (propositional knowledge) (Ryle, 1946); and we can know more than we can tell (Polanyi, 1966/2009). It is appropriate to consider the whole body as an approach to education. While contemporary technologies can offer simulations, students should continue as far as possible to access these experiential forms of learning. The disciplined ways of knowing in these embodied forms of knowledge can be particularly inefficient to acquire. As with learning to ride a bicycle, one can only make these experiences accessible, and trust that students try their best as they inevitably fail in their early attempts. Learning environments must be particularly open to students’ learning from failure.

To achieve lives of flourishing, the education of the body must complement the education of the mind. Especially in contemporary school systems which tend to privilege cognitive preparation, learning environments should be set up to give young people opportunities to ‘work with their hands’, even if they do not go on to careers which use these skills. Beyond the joy and fulfilment that can arise from mastery of oneself in challenging physical activity, having access to a wide range of leisure activities may be considered a condition for a life of flourishing. With such activities, while excellence may be aimed at, there can be much fulfilment even if we may not perform them well (Brighouse, 2006). Being able to learn through the emulation of experts will continue to be important as an educational process, simply because not everything is reducible to representational forms. The principle here is that tacit knowledge that cannot be represented exists, and the method of its acquisition will continue to be apprenticeship in nature.

Disciplines and interdisciplinarity

From the time of the western scientific enlightenment from around the 1600s, universities began to develop into their departmental organisation as we know it today (Repko et al., 2016). While this form of disciplinary organisation seems natural now, there is no real reason why another method of organisation may not be superior. Certain disciplinary organisations can exclude vital forms of knowledge, as when, for example, engineering departments treat ethics as “not engineering” or merely as legal compliance (Slaton, 2015).

Contemporary problems are said to require new ways of working, necessitating either the development of interdisciplinary or transdisciplinary efforts (Graff, 2016; Thompson Klein, 2004). However, it may be important to distinguish between routine interdisciplinarity, which occurs as part of regular academic labour, and hyper-interdisciplinarity, which is better seen as a discourse strategy meant to seize power and resources (Moore, 2011).

Problems such as the climate crisis cannot be resolved by simplistic, reductionist approaches. Solutions to complex problems require not only technological insights, they also

need a good understanding of the human condition and how we may be motivated to change our collective intentions. As a means to prefigure a later argument, issues surrounding the social use of technology are deeply interdisciplinary, despite many schools' approaches of treating it as a form of applied science. Schools can use issues in the use of science and technology in societies as a means to access interdisciplinary learning.

Given the current interest in Science, Technology, Engineering, and Mathematics (STEM) in many countries, it is strange how the humanities are left out of the consideration. This is especially perplexing since design (Cross, 2006; Nelson & Stolterman, 2012; Papanek, 1972) is used as a method to organise STEM projects (Tan, 2022). Good designs have to take into account what its intended users may want, and the methods to understand user needs are essentially methods in anthropology and sociology. Good designs also have to deal with choosing the ideal intention to make real, involving designers in ethical considerations of what is good for others.

Given that every generation leaves behind difficult situations for its descendants to solve, young peoples' ability to flourish will be dependent on their ability to deal with large, complex, and multidimensional problems. We have had past successes with specialisation and organisational theories where only a limited number of individuals needed to know what the 'big picture' amounted to. However, we may be nearing the limits of such approaches, as problems change in their nature (from optimisation to creation of new ways of being), and information and communications technologies now amplify peoples' access to information and knowledge. A case could be made that overspecialisation may be "bad for our health" (Midgley, 1989), and that more people ought to be involved in questions of what the 'big picture' is to become.

The design of learning environments for interdisciplinarity will require many schools to move away from existing structures of disciplinary silos that may have become *de facto* intellectual tribes defined in opposition to one another. The design principle for interdisciplinarity is that learning environments should be oriented toward the solution of complex real world problems, in order to let students practise for the time when they will have to take over.

Principles:

- Learning design is determined by learning goal, which should be established first.
- Learning environments need to make epistemic reasoning visible.
- Tacit knowledge that cannot be represented exists; how it is acquired will continue to be through apprenticeship.
- Design learning environments to allow students to practise solving complex real-world problems.

Student autonomy and the risk of educating for it

Life projects of flourishing must be autonomously chosen by those who will live it. For young people, their capacity for making these decisions are necessarily limited. However, this cannot support the case for indefinitely deferring their practice of wisdom. Educating young people in this manner will be risky, as they may make decisions which may be mistaken. Learning environments need to be designed in such a way as to ensure a 'low cost' for failures in choosing and provide the means for the development of wisdom in learning from these failures.

Education must always have a reproductive aspect to it. There are cultural achievements of humanity which deserve reproduction, and young people can and should learn from the mistakes of the past. However, not all traditions are worthy of such treatment, and indeed, some traditions can be abhorrent, and societies would do better without them. If we are to think about education for human flourishing, we must notice that there cannot be individual flourishing at the expense of a flourishing society: the goal of education is not simply the perfection of individuals, but also the elimination of injustice and forms of oppression that prevent us from achieving lives of flourishing. Attempting to accomplish these sorts of changes through education poses a rather classical problem for education—that of attempting to secure the freedom of others through coercion, especially when taken-for-granted notions of existing social arrangements are widely accepted by those whom we wish to educate.

In situations like these, it is likely that teachers will adopt a deficit mindset; after all, teachers perceive themselves in possession of a superior form of knowledge which students are in lack, and much of our existing paradigm of education prioritises teaching as a form of telling, organising, or otherwise leading; and learning as a form of listening, following, or some variation of being the object to which education is being done to. Much less common may be the treatment of young people as democratic equals, and where education is an act that educators do with students. In opposition to the position that educators have knowledge to transmit to young people, education can perceived to be the nurturance or cultivation of certain already existing qualities that are likely to be innate in all humans—traits such as conscience, empathy, and curiosity. The act of education in this sense may be described by Dietrich Benner as *Aufforderung zur Selbsttätigkeit*, where educators are responsible for summoning the young person to be a self; by Jacques Rancierè as denying young people the comfort of *not* being a subject; and by Gert Biesta as the process of subjectification, arousing the desire in young people to exist as the subject of their own lives (Biesta, 2020).

Education, seen in this light, is not the training of young people, or the development of well defined competencies amenable to psychometric measurement, control, or international comparison. Just as there cannot be a well-defined version of human flourishing that is standardised around the world, there is unlikely to be a singular program to achieve it. Some educators and policymakers may complain that such a demand places great risk on the educational interaction: there cannot be any guarantees that we will get the outcomes that we desire. Yet, as Biesta asserts, that may precisely be the point—the moment we eliminate the risk, and institute a system to guarantee an outcome, will be the moment that the interaction stops being educational (Biesta, 2016). If we desire a diversity of responses to

the question of what flourishing means, we similarly must not close ourselves off from the possibility that young people may derive a better answer than whatever we have now.

Wuwei (无为) as a teaching disposition for flourishing

According to Lobel (2017), Confucian principles privileged techniques, rules, and rituals in order to develop and exhibit prized virtues. However, Daoist teaching asserts instead that it is only upon the breakdown of the natural principles that manifest themselves as intrinsically good behaviour that there needs to an institution of these rules to remind people of what to do. Our modern day equivalent observation of this phenomenon may be what has ever been dubbed as 'Campbell's law': "The more any quantitative social indicator is used for social decision-making, the more subject it will be to corruption pressures and the more apt it will be to distort and corrupt the social processes it is intended to monitor." (Campbell, 1979).

In contrast to Confucian rituals, the Daoist sage acts with effortless ease; in a philosophy closely aligned with Biesta's notion of the risks associated with subjectification, the Daoist concept of wuwei (无为) presents itself as a constructive paradox that might serve as a useful principle-to-think-with when it comes to the design of diverse learning environments. The literal meaning of wuwei is that of non-doing, inaction, inexertion; however its actual signification is closer to the concept of effortless action, a way of acting that avoids anxious, effortful striving in order to bring about a state of affairs which may not be ready to be manifested. Instead, and in recognition that nature has a particular order and trying to bring about change when it is not ready is not productive, wuwei recommends a careful study of the circumstances, and only acting when the time is right. Edward Slingerland (2000) suggests that significant parts of Chinese philosophy have been dedicated as responses to the paradox posed by wuwei: the state of effortless, perfected action is a desirable state to be achieved; if we are currently not practicing wuwei, inevitably, we encounter the question: "how is it possible to try not to try?" (p. 298)

Thinking with wuwei in education presents a different perspective for policymakers; just as plants are quietly nurtured by the nutrients of the field:

> A child is nurtured, sheltered, and protected by the parent who stands by and allows her to express her own individuality, in contrast to the one who pokes and prods—like the character in Mencius who pulls up sprouts to try to help the grain grow and inadvertently destroys them. Wu-wei is thus a way of being that supports and nurtures growth without being aggressive, intrusive, or overbearing. This is a way of teaching as well as ruling (Lobel, 2017)

If what we desire our young students to learn is precious in and of itself, it should not be too difficult for young people to see for themselves this value, and for teachers to simply emphasise the intrinsic value of these goals. Yet for many in schooling systems around the world, far too much effort is directed towards credentialism and the instrumental purposes of schooling. Young people need to find for themselves their own answers to the questions of meaning and purpose in life; these are precedents for human flourishing as one's life project should not be determined by another (Brighouse, 2006). Seen from the lens of *wuwei* it is clear that while schools do have a responsibility to provide opportunities for students to try different projects, it cannot coerce or constrain students' choices one way or another.

Our aims for education for flourishing must be open ended, because contained within all interpretations of what education ought to be about are visions of what values, competencies, and human excellences would be ideal for living the good life. As our quest for better answers to what the good life constitutes continues with no clear end in sight (Harðarson, 2012), so, too, must we continue to provide young people with the open ended-ness that they need to arrive at newer and better answers to these questions (Katz, 2011).

Principles:

- Learning for flourishing cannot be understood only in cognitive, psychological, or individualistic terms. It is an embodied social act.
- Educators must embrace and preserve the risks involved in the cultivation of the new generation, who must decide for themselves how best to live life.
- Learning environments should create and support trust rather than enforce accountability.

Learning with technology, learning about technology

As Clarke (1977) asserts: “Any sufficiently developed technology is indistinguishable from magic”. Many educators are comfortable in teaching with, and using, technologies. However, fewer are as proficient in teaching how technologies work, and how they interact with, and shape, human desires and intentions. Technologies are not neutral objects and can even be implicated in decisions of high moral import, as when sonograms influence life and death decisions. Especially with contemporary technologies imbued with machinic intelligences, carrying with it the intentions of their designers, learning how technologies work becomes vitally important. ‘Decoding’ intentions in technologies and thinking about the societal implications of its mass adoption requires a diverse, interdisciplinary knowledge base. Learning environments should be designed with interdisciplinarity in mind, in order to provide students with multi-dimensional insights into contemporary problems.

Education for human flourishing consists of both a form of nurturance of innate capacities, as well as an introduction to forms of knowledge which may not be intuitively graspable. This may include, for instance, forms of discomfort that may accompany difficult efforts, for which prior generations have derived longer term benefits. Given the extensive role technology (interpreted widely) plays in societies, a factor that requires consideration is the appropriate relationship humans ought to have with technology. While we often rely on technologies, a suitably critical understanding of the intentions and politics of artefacts will be important for young people to acquire, especially in view of the forms of cognitive automation that are quickly becoming reality.

Technology is not neutral

When we think of human flourishing, especially in contemporary and future oriented terms, we often think about technology, either from a point of concern that, for instance, advanced computing technologies and robotics will make entire economic sectors obsolete; or in salvation terms, as in technologies that will save us from the impending climate catastrophe. Along with these visions of what technology can do, we are often persuaded by technology boosters and by notions of 'economic development' that it seems almost our duty to welcome the new, either as promising liberation from the drudgery of our old ways, or as a threat to our continual wellbeing unless we similarly "upgrade" ourselves. In all these cases, schooling seems to have a central role to play, as a responder to the ransom placed upon young people's futures (Smith, 2014), or in collusion when educators mistakenly fetishize the 'new' in confusion with the educational desire to surpass the old ways of doing things (Burbules, 2016).

Technology is not just the special case of info-communications technology that many people around the world are now obligated to be accompanied with. More generally, technology refers to any kind of human-made artifice designed to amplify human intentions (Toyama, 2015). Just as an excavator can amplify one's desire to dig a hole in the ground, smartphones can amplify another's desire to be 'heard' by as many people as possible. The significant question to ask when it comes to the deployment of technology is never "will it work", but rather "what/whose intentions are being amplified." Technologies carry with it political intent (Winner, 1980; Wyatt, 2008), from the large scale as when a decision to build a hydro-electric dam demands the resettlement of entire communities, to the microscopic when social media applications deploy known addictive methods to increase 'user engagement'. This is not to impute moral agency to things, but to simply acknowledge that in the possibly long chain of decision making with moral consequences, artefacts can play significant roles. Technologies shape our moral intentions as when, for example, people become polarized through the amplification of 'high engagement' messages for the ultimate profit of the platform providers.

Technology has also resulted in the creation of hybrid human-artefact cyborgs; or cybernetic 'machines' in the form of organisations dedicated to processing information. A pertinent question here would be if these ways of living constitute a life of flourishing. While it can be argued that technology as means to automate tedious tasks has led to more leisure time, it has also to be recognised that the flip side of such technological deployment is the overspecialisation (Midgley, 1989), eventual deskilling and proleterianisation of the individuals concerned (Carr, 2014). Some problems can be good to continue having even though technological solutions may exist. For instance, while marking student scripts can be tedious, paying attention to student work, especially if handwritten, can reveal more than whether or not students 'understood' the work. It is only because we overdo reductionistic thinking that we believe education is about 'knowledge transmission' or 'learning', and even then, narrowly conceived notions of achievement on standardised tests.

An educational response to the use of technology in teaching

What ought the educational response be, especially if human flourishing were to be the goal? At the outset, it should be fairly clear that an education *about* technology ought to be part of the curriculum for all students. Young people must not be deprived of the power that comes from understanding how the world around them works. One might counter that we do not all need to be mechanical engineers to drive cars, but when something does go wrong, not having competence leaves us in a powerless position. Education about technology needs to be sufficiently critical, giving young people the ability to 'read and write' intentions in/through artefacts.

More than just technologies that are ostensibly neutral and are good/evil according to the intention of the user, technologies are designed by someone towards a certain intention; certainly, users interact and can modify these intentions, but it is not as if the affordances of technologies are infinitely pliable. To overcome these challenges, this technological education must step into the no-man's land bordering technology and ethics. This is an interdisciplinary project that 'breaks' the disciplinary silos of conventional schooling but is sorely needed. We cannot continue to allow technology to have a free rein of trust by default on the one hand, while ethics continues to criticise overhyped (and inaccurate) versions of technology on the other. Beyond interdisciplinarity as a means to engage with issues of technology and ethics, the general approach of interdisciplinarity can benefit from the use of technology as a means to amplify our cognitive capacities to be able to understand more ideas and more quickly. Here, the distinction between information, knowledge, and wisdom will be crucial. While information technologies can quickly process and organise information, discerning between information, knowledge, and wisdom will likely remain a human ability for a significant time to come.

Education about technology requires interdisciplinarity

Conventional approaches to technology education can be limited to inducting students to 'expert user' status. If human flourishing is to be a goal for education, such an approach may not be enough—the numerous technologies and systems that we have today aid our current ways of life, but are also implicated in injustices and crises that we have to confront (e.g., McAllister et al., 2014). To address these issues requires that we understand both 'upstream and downstream' aspects of technology construction and use. For instance, lithium batteries ubiquitous in contemporary devices require cobalt, which in some instances cause environmental damage and health impacts to individuals and societies (Banza Lubaba Nkulu et al., 2018). At the other end of the use of technology, we conventionally dispose or recycle devices and other artefacts, but often neglect its impacts on people and planet (King, 2023; Perkins et al., 2014). In the same vein, glamourous exhortations to innovate dominate public discourse, even in education; calls for maintenance, care, and the extension of the lifespan of existing technologies are far more rare (Russell & Vinsel, 2018, 2019). In some cases, manufacturers actually militate against maintenance, some even deliberately planning obsolescence to ensure future profits.

The educator response to these and other issues of technology would require an interdisciplinary approach. Knowing about technology itself is obviously insufficient, and

ethical deliberation without technical knowledge makes one susceptible to preparing inaccurate responses to exaggerated claims of technology used to generate interest and funding (van Lente et al., 2013; Vinsel, 2021). Much can be achieved with an appropriate attitude towards technology—while it can be fairly common to approach technology in an almost reverential manner treating inventions as the work of inspired genius, this need not be the only way. A more critical approach can instead treat technological artefacts as merely instances of solution to problems. These problems have simply been deemed by communities to be desirable to solve. Students can learn to contend with these rather arbitrary choices: there could be better solutions, and communities may be wrong (or be misled) to desire these problems solved.

One interesting critical orientation to technology can be seen in hacking and hacker culture. The term has acquired a negative connotation to be associated with illegal data access, theft, and online vandalism. We refer instead to its original designation as a form of self-organising culture of creative exploration of technological artefacts (Nikitina, 2012; Wark, 2006), often with an intention of analysing its working principles and modifying it for other purposes (Bratus, 2007; Chan, 2014; Coleman, 2013). Hackers were responsible for the early development of computing machinery (Isaacson, 2014; Levy, 2001), and aspects of its anti-capitalist leanings can be seen in contemporary societies such as the now widely accepted notion of open source software, and the sharing economy.

Designing learning environments for these considerations requires educators to care for far more than the communication of valued knowledge. There are cultural values that need nurturance (Tan, 2019; Toombs et al., 2015), and ethical decisions to be made over which boundaries are legitimate (and should not be crossed), and which others are otherwise. Educators pursuing this form of technology education need a learning environment where there is trust that all involved will make decisions with appropriate judgment. For instance, in order to learn about security, it may be necessary to learn about lock picking of the physical or digital form (Mitnick & Simon, 2005). While it is impossible to guarantee that students never use these skills for nefarious purposes, it is also not reasonable to never teach these skills out of distrust. If we hope that future generations will develop different solutions for existing problems, we need to give them *all* the tools, knowledge, and intellectual orientations that are needed to do so.

In addition to these perspectives, technological developments have always affected the ways in which we have been able to express oneself and our ideas to others. From the rudimentary cave paintings relying on advances in the technologies of pigments and its application on walls, to AI/ML generated ‘art’, human expression has always been interdisciplinary in nature. Certainly, almost nobody needs to know pigment chemistry or machine learning algorithms in order to paint or generate art. However, one is likely to do better with this knowledge as background.

Artificial intelligence in teaching and learning

Of high current topical importance, and likely to have significant impact on education in the coming decade, are the effects of artificial intelligence/ machine learning (AI/ML) on schooling processes. If we look at the effects of automation and amplification systems on

work processes such as construction and manufacturing, it is obvious that over the last century, technology has dramatically increased the efficiency and effectiveness of these processes, if not its nature. It might therefore be extrapolated that forms of cognitive automation will likely 'revolutionise' the way cognitive labour is carried out. In many ways, this has happened—not as many people are reliant on libraries' collection of physical books; and "unintelligent" computing technologies have already changed the way information is collected, processed, and represented.

The history of technology in education has been one of breathless excitement about how the 'next big thing' will 'change education forever', followed eventually by education remaining resolutely unchanged (Cuban, 2001). More recently, a similar outcome met the overblown rhetoric of the promoters of the One Laptop Per Child project, who claimed that their computers could almost literally be flung off helicopters, and positive results would await them when they returned again later (Ames, 2019).

We might however be making a mistake if we were to assume that AI/ML would result in no changes or ignore it altogether. We would be better off learning the lessons of history and appreciate the complexity of the educational interaction as we cautiously engage with these new technologies in education. Education is not merely the communication of conceptual knowledge; education for human flourishing will be even more challenging for AI/ML systems trained on historical data sets (Goudarzi, 2023; O'Neil, 2017). If we want the possibility for future generations to arrive at currently unforeseen ways of being, human educators who can make appropriate judgments about appropriateness will still remain essential. AI/ML will have a role in the assistance of human educators, who must remain as the final moral agent responsible for educational decisions (Cerf & Waytz, 2023). Just as the nature of arithmetic calculation has changed with the advent of calculating devices, we can automate repetitive tasks in order to give educators and students alike more time to accomplish the challenging tasks.

Principles:

- Technology should be utilised in the service of complex educational goals.
- Technological education should be an education in the humanities as well as the technology itself. Students should learn about technology as much as they learn with technology.
- Technological education should not be limited to technical know-how. It needs to take account of the use of technologies in social and cultural contexts and the intricacies of such use.

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DESIGNING LEARNING ENVIRONMENTS FOR FLOURISHING: A SYSTEMS VIEW

As we have put forward previously, learning environments for human flourishing in schools are not limited to physical and technological affordances. They are created holistically from formal and informal opportunities for learning and include both tangible and intangible spaces that interact to create complex outcomes. A coherent learning environment that promotes flourishing has different dimensions. On one level, learning takes place in the classroom or similar confined physical spaces. On another learning occurs in an environment that is an outcome of interactions of learners' cognitive and affective spaces as they engage with their physical or virtual surroundings, academic content and interactional contexts of questions, knowledge, and perspectives from other students in their environment. . All this provides students with integrative and holistic opportunities to flourish. In designing learning through these spaces, some principles about knowledge, autonomy and use of technology should be considered and applied appropriately to the societal and educational context of each country or society.

In this section, we discuss how learning environments are constructed through these spaces in recent education innovations in Singapore. We also revisit some ideas about principles for designing learning environments. For more than two decades, Singapore has focused on helping students achieve a set of desired outcomes of education. Under the student-centric and values-driven education phase (2012 – 2022) these outcomes have evolved into outcomes for holistic student development in the 21st century). The most recent 'Learn for Life' movement further emphasises the importance of lifelong learning in the future economy. In all phases of educational reforms, the creation of appropriate learning environments beyond the building of physical infrastructure has been an important focus even though it was not always expressed in these terms.

Innovations in Singapore's learning environment for students in schools are most clearly seen in the curriculum, pedagogical and most recently, virtual spaces. These interact with social emotional learning, aesthetics and exploration and imagination spaces on the part of the learners. Curriculum and pedagogical innovations can be observed in Singapore classrooms in the form of the 'instructional core', which emphasises the interactions of three key agents in instructional practice: teachers, students and contents (Kwek et. al 2022). The *CORE research programme* conducted by education researchers at the National Institute of Education (NIE) has been providing policymakers with empirical baseline descriptions and evaluations on the state of pedagogical practices across different subject-domains in Singapore schools. Results have also illuminated the intangible spaces of learning such as exploration and imagination, SEL and aesthetics.

We see the system's ongoing efforts at improving teachers' pedagogical content knowledge and practice so as to strengthen students' learning environments in schools. The *SkillsFuture for Educators (SFEd)* initiative was announced in 2020 under the national 'Learn for Life' movement. It aimed to improve teachers' competencies and encourage lifelong learning among education professionals. A professional development roadmap was co-developed by the Academy of Singapore Teachers (AST) of MOE and the NIE. It focused on six priority areas of teaching charted according to four competency levels for each area. The six areas are assessment literacy, support for students with special needs, inquiry-based learning, e-pedagogy, differentiated instruction, and character and citizenship education.

Another achievement in the pedagogical space is the AST and NIE joint development of the *Singapore Teaching Practice (STP)* in 2017. The STP is a model that makes explicit how teaching and learning can be achieved in Singapore schools. Presented in the form of an orchid, the STP has three interconnected components, namely the Singapore curricular philosophy, pedagogical practice and knowledge bases. This model gave all teachers and teacher educators a common knowledge base and language to describe teaching and learning in the Singapore context; hence, creating a supportive learning environment for students through effective pedagogies and curriculum implementation.

Within these curriculum and pedagogical spaces, the Singapore MOE also refreshed the *Framework for 21st Century Competencies and Student Outcomes* that was introduced in 2010*.* It emphasised the importance of core societal and national values in shaping beliefs, attitudes and actions – respect, responsibility, resilience, integrity, care and harmony. It further emphasised the importance of social-emotional competencies to build healthy identities, manage emotions, form positive relationships and engage in responsible decision-making. The aim is for every student to achieve the desired outcomes of education as confident persons, self-directed learners, active contributors and concerned citizens. The latest enhancements to the 21CC Framework will place greater emphasis on adaptive and inventive thinking, communication and civic literacy.

At the same time, Singapore's sole teacher education institution NIE reviewed and enhanced its *21st Century Teacher Education Model (*TE21) first introduced at the turn of the century for the preparation of teachers for Singapore schools. Three teacher core values remain central to the model while the role of technology as an important enabler for teaching is now made explicit to prepare teachers with pedagogical skills for the pedagogical and virtual spaces of a learning environment (Chua, 2023).

One of Singapore MOE's key initiatives in the virtual space is the *Singapore Student Learning Spaces* (SLS), an online learning portal that provides students with learning resources for all major subjects in the school curriculum. It includes self-paced lessons to enhance digital literacy and AI literacy. The SLS is also a virtual space in which teachers can improve their pedagogy by sharing and adopting innovative pedagogies such as verbalisations of thinking processes. Artificial Intelligence (AI) tools are also being added as part of the environment that students can learn in.

The enhancement of the virtual space is further seen in the launch of MOE's *"Transforming education through technology" Masterplan 2030*. The purpose is to equip students with competencies to thrive beyond school in a world of rapid technological advancements. Specifically, it aims to sharpen uniquely human skills, develop digital literacy and technological skills and equip students mentally to guard against the negative impact of technology. The plan aims to complement the school curriculum by enabling students to strengthen their 21st century competencies and embody the desired outcomes of education to navigate the globalised and technologically advanced world. Besides targeting student learning outcomes, the plan also aims to equip teachers to be technologically-adept in their pedagogy and to transform schools to become intelligent, responsive and digitally-equipped learning environments.

Character & Citizenship Education (CCE) which includes National Education and Social-Emotional Learning (SEL) is delivered for the holistic development of students to achieve positive life outcomes. The CCE21 curriculum provided an integrated and coherent approach to achieving this. It is enacted through several platforms consisting of CCE lessons during curriculum time, Key Student Development Experiences (SDEs), school-based initiatives, teachable moments in all subject lessons, learning opportunities beyond school and personal reflections and application. SEL which is integral to the 21st Century Competencies and Student Outcomes for Singapore teaches five interrelated key competencies: self-awareness, social awareness, self-management, relationship management and responsible decision-making.

To create learning conditions that are more inclusive and learner-centred and that promote social-emotional learning, the MOE implemented *Subject-Based Banding (SBB)* in secondary schools. Progressively rolled out over several years, SBB gave students of mixed academic abilities the opportunity to study in the same class and take six common curriculum subjects together. These are Art, CCE, Design and Technology, Food and Consumer Education, Music and Physical Education. For other subjects such as English and Mathematics, students will attend different classes based on their ability for each subject so that they can learn at their own pace and progress according to their strengths. From 2024, streaming of students into specific classes according to academic results will cease with the full implementation of SBB. At the end of secondary school in 2027, students will sit for the common national examination and receive a new national certification with subjects at three levels.

In response to the need to nurture a green and sustainable environment for the country, MOE also introduced a coherent curricular approach to sustainability education with the launch of the *Eco Stewardship Programme* in schools in 2021. The curriculums for Humanities, Science and CCE were enhanced to strengthen the teaching and learning of sustainability concepts. Schools strengthened the understanding and practice of sustainability as part of school culture and promoted as students' mindsets and daily habits.

In 2016, MOE announced an annual fund of $50,000 to develop *Science, Technology, Engineering, Mathematics Applied Learning Programme (STEM APL)*. A related development has been that of the *Makerspace,* which was enthusiastically adopted by many schools in . Predominantly designed as a junior 'mechatronics' (mechanical/electronic) engineering workshop for young students, the makerspace serves as a site for engaging students into the themes that we have discussed in this paper. The goals for makerspaces can vary according to what educators prioritise. As metaphorical low hanging fruit, makerspaces can be sites for STEM instruction especially for simple demonstrations and 'follow after me' kinds of pedagogy to introduce students to complicated technological systems that surround them. Schools report success in getting students familiar with programmable microcontrollers to do simple tasks such as coin sorting, or having students assemble small solar powered vehicles. Many of these projects can be done quickly in less than 10 hours, and are popular with schools as after school projects.

Enhancing *physical spaces* to support learning is a continuing focus of the Singapore MOE. From 2024, MOE will introduce a $64 million '*School White Area and Canteen Grant*' to enable schools to convert and optimise existing physical spaces to meet new learning

needs. Schools will also be supported with additional funding for the purchase of new furniture and equipment to support diverse learning approaches and programmes.

Some reflections on building learning environments for flourishing

The success of Singapore's education has been well acknowledged internationally. It can be attributed to sustained good planning for educational reforms and the layering of strong policies over the decades (Kwek, Ho & Wong, 2023). Stability in the governance of the country has enabled systemic changes to proceed with policy control, iterative feedback and continued improvements. The provision of supportive learning environments has been a hallmark of Singapore's success. This is seen particularly in the curriculum, pedagogical, virtual and physical spaces. The unique tripartite relationship among the MOE, the NIE and Singapore schools has further contributed towards the creation of learning environments that meet the system's aspirations of developing students holistically beyond academic achievements and fulfilling economic needs.

Singapore's development in education to its current state has been rapid for a relatively young nation state. It went through several phases of educational policy reforms since the time of independence in 1965: survival-driven; efficiency-driven; ability-based, aspiration-driven; student-centric, values-driven; and learn for life. The country may now have surpassed the stage of development where there are relatively easy answers to the questions of how life ought to be organised (and therefore what constitutes flourishing for students and this society). Early development problems in some systems can be considered as 'optimisation' problems, with models to emulate and therefore, in education, 'correct answers' to be had. Now that for the most part, basic education needs are met to a high level, questions about what flourishing should constitute become far more open. How the system should create learning environments for human flourishing in present and future states of the nation's development will be an important question for all.

Moving forward, educators would need to continually moderate a culture that still privileges the efficiency of achievement of singular goals, particularly academic ones. If left unmitigated, the new learning environments that prioritise diversity and holistic development may not achieve its original intentions. We may also struggle to accept the openness and fluidity about human flourishing represented by some contemporary 21st century movements. While recognising the paradoxes in ideas about human flourishing and learning environments, it is important to build on the current successes of tangible spaces to cultivate the intangible spaces for learning environments more fully. There is also room for moving beyond current approaches.

In curriculum theorising, for instance, there is still much fondness for the safety of traditional knowledge boundaries. More can be done in the curriculum space for including interdisciplinary projects of significant meaning and value to learning. There could be more encouragement of public thought and debate about what kinds of collective projects we ought to pursue for truth, beauty, and goodness, and less on the biological and economic perspective (Gardner, 2012).

The epistemic security of disciplinary knowledge can be also seen in curriculum making and teachers' enactment of the curriculum. To achieve learning objectives that have been identified in syllabuses, teachers select teaching strategies that can help students achieve those objectives. While this provides strong scaffolding and support for learning in the pedagogical space, there is little autonomy given to students that takes into account their aspirations and prior knowledge. There may also be little attempt to convince them through reference to a 'big picture' problem beyond syllabus specifications that the lesson of the day is worth learning. An environment that helps students learn should also allow students to direct their own learning based on their curiosity, and the social influences of the day. This is not meant as a radical overhaul of all of schooling, but an argument for more of classroom instruction to move away from teacher directed forms of pedagogy, towards those that give students more autonomy and control of their own learning. This mode of instruction is certainly very risky. However as we have argued in the theme of Autonomy and Risk, this risk is the very essence of education, and efforts to eliminate this risk, such as with accountability systems run the risk of undermining the first order goals of education (O'Neill, 2013).

Flourishing will require young people to choose between established orders of being on the one hand, and forging new paths on the other. While we can never be sure if the young people will be making mistakes and destroying the legacy of their predecessors, it is certainly not a decision that is ours to make for all time. What remains a challenge, therefore, is how educators and policy makers can achieve a balance between allowing students to have more autonomy over their learning and their life while mitigating the risks that may occur from poor decision making on the part of the young people for lack of appropriate insights into the world and its future.

A clue may be gleaned from makerspaces as a learning environment. At the middle and higher end of the challenge will be schools who make use of makerspaces as a site for longer term engagements with groups of student on projects and challenges. Many of these schools will be making use of design as a creative problem-solving method, often paying serious attention to user needs, deliberating meaningful responses to problems. With this approach, teachers can make clear with their students that technologies are to be designed in the service of other people, and not simply to attempt to make money selling the next "must have" gadget.

Singapore has provided a suite of systemic-level innovations to create supportive and meaningful learning environments for students through the school curriculum. These have created many opportunities for students across different levels of schooling to learn and potentially thrive in the world that they will be entering in the future. Singapore has been particularly strong in five spaces: curriculum, pedagogy, social-emotional learning, virtual and physical. This has been the result of careful planning and informed projection of current and long-term learning and educational needs. While curricular and pedagogical innovations in the last two decades have included the intangible spaces of social emotional learning, more intentional embedding of aesthetics, exploration and imagination is still needed to create even better conditions for students to thrive as individuals. A challenge remains in how a system that has hitherto meticulously planned a rich learning environment in schools will address some of the tensions in designing learning environments for flourishing when

confronted by a future that is increasingly complex and fast-moving and influenced by current shifts and volatility.

SUMMARY AND CONCLUSION

In this paper we have attempted to delve further into the OECD project of how the learning environment can support education for human flourishing. We explained the concept a learning environment as an interaction of seven tangible and intangible spaces that collectively create the conditions for learning to take place. We also examined the question of what education for human flourishing would require and proposed three interlinked themes of knowledge, autonomy and technology and discussed the tensions and paradoxes within each one. Being familiar with the Singapore education system, we described several recent innovations that have all contributed to the creation of supportive learning environments for students that aimed at their holistic development. In reflecting on the rapid successes of the Singapore education system and specifically in the creation of quality learning environments, we posed the question of what education for human flourishing would mean in the next phase of development for a high performing system such as Singapore. This question, we believe, is a significant one if such systems are to transcend current successes to nurture the next generation of citizens for future contexts that will likely be more challenging than the shifts and disruptions we have experienced in recent years.

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