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Towards the mapping of learning, playful, and frugal aspects for developing 21st century competencies and resilience

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Abstract: The paper draws from the development of playful approaches in education in the ACES project (<http://aces.gchangers.org>), which aims to underpin a playful approach as an empathic, agentic, and frugal means for engaging young people within a creative inquiry process to enhance social resilience. Play is considered an enabling instrument for equipping young people with the relevant skills to manage the realities of tomorrow, where play is the freedom for them to engage with, develop curiosity about, and learn from the world and people that surround them in positive ways. Acknowledging that there is a link between play and the development of a range of competences young people will need to flourish, this paper proposes a mapping framework towards articulating the relationships between the aspects of play, the competencies that playful learning may afford, and the types of resilience that these competencies may develop. Such a mapping approach can be used to analyse and form considerations for the design of playful educational activities. The mapping is co-created with the ACES partners in Malaysia, Vietnam, and Indonesia, and the approach takes inspirations from Arnab et al. (2015)'s Learning Mechanics-Game Mechanics (LMGM) mapping model which has been extended to consider motivational theory (Proulx et al., 2017). The paper will present the mapping framework of the aforementioned aspects and provide a mapping example using the "STEMBucket" programme in Malaysia, which is designed to engage teachers and learners in playful STEM activities towards social innovation and resilience development.

Keywords: playful learning, resilience, 21st century skills, frugal education

1. Introduction

The COVID 19 pandemic has reinforced the perception of the importance of resilience. The concept is of particular relevance to the development of the United Nation's Sustainable Development Goals (SDGs). It is noted that crises such as the pandemic could impede SDG development for years to come (Bahadur et al., 2015). Despite such an international significance, resilience is not a straightforward concept to define. In different contexts and to different groups, the term has discrete meanings. Resilience includes how well a person can adapt to the events in their life and their ability to cope (emotionally, cognitively), when in a crisis, and to build on this to support future ways of coping. Resilience can be viewed at the level of community, group, as well as at the personal level. Resilience is not only an outcome but a process, which can become transformative over time.

The characteristics of playful approaches to learning (Zosh et al., 2017) also contribute directly and indirectly to the development of resilience. Play in an educational context enables creative and exploratory practices for constructing knowledge and skills, intrinsically driven by our motivational needs for autonomy, relatedness, and competence. Play in itself is an important capability (Nussbaum, 2011). Playfulness is about being open to new experiences, imaginations, and abilities to explore possibilities. As emphasised by the World Economic Forum (WEF), play is a vital instrument for equipping young people with the skills and tools to address and embrace the realities and uncertainties of tomorrow, where play is the freedom for them to engage with, develop curiosity about, and learn from the world and people that surround them in positive ways.

There is a strong link between play that is iterative, experimental, and socially engaging towards the development of competencies young people will need to flourish. Iteration and experimentation can lead to the development of resilience through fostering the capacity to persevere with a task. One problem with an education system that focuses on high stakes assessment is that this does not encourage experimentation as the risks associated with failure are too significant. Playful approaches, however, encourage multiple iterations of the same task. By repeatedly attempting an activity, multiple outcomes and alternatives can be explored. The players take centre stage, where the "rules of play" evolve to accommodate their needs (De Koven, 2013). This facility is useful in adapting to new circumstances. Learning through play should lead to developing higher

degrees of flexibility and tolerance, which are indicators of resilience. Furthermore, iteration encourages reflection, which also facilitates resilience.

Social engagement is also likely to foster resilience. Play encourages social interaction and subsequently the development of social and communication skills. Communication and information dissemination are key components of resilient communities (Folke, 2016;) and resilient institutions (Grefalda et al., 2020). Communities and institutions with effective avenues for communication are likely to be more resilient. The development of communication skills among individuals who inhabit communities and institutions is then likely to improve the communication, and subsequently, also the resilience of those institutions and communities.

With these perspectives, the paper draws from the development of playful education in the ACES project (<http://aces.gchangers.org>), which aims to underpin a playful approach as an empathic, agentic, and frugal means for engaging young people within a creative inquiry process to enhance social resilience and innovation through social constructivism. The paper investigates the relationships between the aspects of play, the competencies that playful learning may afford, and the types of resilience that these competencies may develop towards providing a mapping framework that can be used to articulate the context and design of educational intervention programmes. The mapping is co-created with the ACES partners in Malaysia, Vietnam, and Indonesia. The paper will present the mapping framework of the aforementioned aspects and provide a mapping example using the STEMBUCKET programme in Malaysia which is designed and developed to engage teachers and learners in playful STEM activities towards social innovation and resilience development.

2. The aspects of play

Play in an educational context enables creative, experiential, social, and exploratory practices for constructing knowledge and skills (Winthrop, 2019) through a creative inquiry process (Nørgård et al., 2017). Play is intrinsically driven by our motivational needs for autonomy, relatedness, and competence (Deci and Ryan, 2004), providing an active learning context for intrinsically encouraging learners to engage with and learn from the world that surrounds them (Brodin et al., 2019).

Play and playfulness demonstrate values related to openness (Hug, 2017) that relies on the value of creativity, curiosity, and experimentation in learning, emphasising the aspects of autonomy and agency (Dalsgaard et al., 2017). Hug (2017) suggests that there have been implicit dimensions of openness throughout history, such as how children educate themselves through free play and exploration, which can be interpreted as a prototypical example for openness in education. Pavlas et al. (2012) suggests that play experience can be analysed through four key elements, which are freedom (autonomy), intrinsic motivation (no external influences), play-direct (activities feel like play), and autotelic-focus (engagement with activities is the actual reward).

There are therefore various aspects that are intrinsic to many playful activities and are often interrelated. There are values in identifying these aspects in both abstract and concrete granularity to help articulate the “playful” characteristics that can be embedded in learning. Examples include:

- **Autonomy** refers to self-organisation and regulation of one’s own behaviour (Deci and Ryan, 2004). In terms of playful experiences, the voluntary aspect afforded by the experiences (often through free-play or loosely set up guided play or gameplay) through its aesthetics promotes a sense of control and enjoyment, enhancing intrinsic motivational approaches. The concrete representations could be the availability of options for how learning activities could proceed, such as role-play scenarios that give control to the learners to define their narratives, or creative activities that relies on imagination, such as Lego.
- **Fun** associates with engaging experiences that can evoke emotionally driven participation. It often involves increased arousal, perceived freedom, fantasy fulfilment and escapism (Holbrook et al., 1984). Our perception of fun depends on our mindset, ability and skills, the environment, and those around us. Lazzaro (2004) proposes four types of fun, which are easy, hard, people and serious. Easy fun is often associated with fantasy and imagination. Hard fun can be linked to our intrinsic motivation for competence (Deci and Ryan, 2004). People links to social play, and serious refers to purposeful play.
- **Agency** is the capacity to respond and to act. Play is an agentic learning context, where learners can take charge, making choices about what they do and how (including non-participation) (Koster, 2013). “Having agency does not equal ‘anything goes’ for children, either at home or in education contexts. Agency in learning through play means seeing the child as capable rather than a blank slate to be filled” (Daniels & Shumow, 2003 as cited by Zous et al., 2017, p. 15).

- **Curiosity** is the 'state' triggered by an environmental situation that exhibited "complexity, incongruity, doubt and/or difficulty" (Berlyne, 1954). These conditions create arousal of uncertainty, that motivates explorations, experimentations, and reflections. Clarke and Arnab (2019) introduce the 'Curiology' model - a hybrid disciplinary approach of learning through play, focusing on perceptual (linked to senses), empathic (linked to emotional intelligence and ability to empathise and reason), and epistemic (linked to our internal desire 'to know why') curiosity aspects.
- **Iteration** or experimentation encourages multiple "tries" of the same task. By repeatedly attempting an activity, multiple outcomes and alternatives can be explored that can be embedded in branching role-play scenarios or in hard fun activities where hypothesis testing can occur to discover different alternatives (see De Koven (2020)'s 'What-If-ing' approach). Learning through play should lead to developing greater degrees of flexibility, tolerance, and reflection.
- **Social** has an important role in development, where social interaction is key to learning. Learners become "more informed, gaining a wider perspective, and being able to make better decisions by engaging with others...learning happens with and through other people, as a matter of participating in a community, not just by acquiring knowledge" (Bingham and Connor, 2010, p.7). Individual transformation can be achieved as a result of participation in a socio-cultural environment (Bilandzic & Foth, 2013), where through playful exploration, learners can holistically understand the realities around them and experiment ('play') with different strategies.

"The dynamic interrelationships of dimensions of opening and closure are essential for a differentiated understanding of the various aspects of free play" (Hug, 2017; p. 73). The introduction of intentional rules can provide a structure and context for when learning is deemed to start and how a player could then level up in the experience as part of the 'action-feedback' cycle. The inclusion of playful aspects in learning can consider varying levels of 'structure' and 'formality', often adhering to the play-learn rules (in free play, children create "rules" and "narratives") i.e., the 'magic circle', also echoed by Zosh et al. (2017)'s playful learning spectrum of the balance between child-adult involvement and constraints from free-play to games. "Whereas more informal forms of play do not have a distinct boundary, the formalized nature of games makes the magic circle explicit" (Salen and Zimmerman, 2004, p. 99).

3. Frugal education aspects

Taking inspiration from frugal innovation (Radjou & Prabhu 2014), design thinking (Kelly 2016), systems thinking (Acaroglu, 2017), and SDGs, the concept of frugal education has been developed to address the need for more frugal, practical, and sustainable practice within education globally (Masters 2019). With the existential threat of climate change, growing education disparity between the global north and global south (Fleisch, 2018), and the need to increase resilience in preparation for varied unforeseen crises (Yasser-Bhatti, 2020), frugal education seeks to address these needs through a participatory action research approach to education innovation.

In this context, Frugal education aims to empower educators to create new educational interventions that respond creatively to adverse social, cultural, and environmental changes. Resilience and creative problem solving are fostered through co-creation, open education, and the innovative use of available materials, sustainable resources, and trailing-edge technologies. The following three principles, comprising nine associated aspects, have been proposed for consideration in educational programme design:

- **Design with an Open Mind: Creativity, Collaboration, and Openness** – Creativity, creative problem-solving, and inventiveness are a staple of frugal innovation and are therefore an integral aspect of consideration within frugal education practice as a means of imparting "life-relevant skills to students, using practice-based learning methods that foster creativity and keep students engaged" (Ahuja 2012, p. 177). Collaboration can be leveraged to foster competencies and resilience development at the individual, community, and environmental level (Clarke et al. 2020). Openness supports the democratisation of education through the sharing of open education resources within the public domain.
- **Leverage Available Resources: Resourcefulness, Practicality, and Resilience** – Resourcefulness includes repurposing, recycling, and experimenting with existing resources in innovative ways (Yasser Bhatti 2020) to develop new playful activities. Practicality pertains to the design of education activities, spaces, and resources, and their effective execution/delivery in real-world scenarios, considering ways to design lightweight, cost-effective, user-friendly, scalable, agile, and sustainable education practice to mitigate against impractical solutions that can impact the effectiveness of teaching and learning. Resilience refers to the ability to deliver quality pedagogic practice under changing environmental circumstances. "A curriculum

for the future has to be flexible and change-ready, open-minded, enquiring and more about possibility than certainty in design, delivery and outcome” (Hays and Reinders 2020, p. 4).

- **Build at the Speed of Need: Minimalism, Sustainability, and Iteration** – Minimalism refers to reducing the unnecessary consumption of valuable materials and resources, such as staff time, financial costs, equipment and consumables, etc. Doing more with less (Radjou & Prabhu 2014), replacing multiple meaningless activities with one very meaningful one (McKeown 2014). Sustainability is where we create as we seek to protect our natural world, the resources within it, and the ecosystems that rely on those resources to thrive, for the sake of all life on our planet (Raworth 2012). Iteration allows for rapid prototyping of solutions that respond to the needs of the target audience, through a continuous virtuous cycle of refinement, fostering sustainable education that “continually renews itself, incorporating principles and aspirations of sustainability in design and delivery, and educating in ways that promote sustainable learning” (Hays and Reinders 2020, p. 3).

Aspects of play share many characteristics similar to those found within aspects of frugal education, making the combination an effective tool for educators when designing playful activities.

4. Playful learning and 21st century competencies

The 21st Century competencies are typically non-disciplinary specific transferable skills. WEF (2020) recently detailed key individual skills. These fall into the four categories of problem solving, self-management, working with people and technology use and development, which align with the skills developed through play. The Brookings report from 2020 describes six key skills associated with play. In both cases communication, creativity and criticality feature. Perhaps most important of all is the link to lifelong learning. This is stressed as key by the WEF and is also highlighted as a key element of playful learning (Zosh et al., 2017).

The link between skills-related outcomes and playful approaches to learning has been explored in detail by Zosh et al (2017). This work linked specific teaching pedagogies with playful competencies and outcomes. The alignment to the WEF skills can be seen in Table 1. There appears to be a clear link between 21st Century competencies and playful pedagogies. Playful approaches can foster intrinsic motivation through the creation of contexts which provide autonomy, competence, and relatedness. Furthermore, the low-risk nature of play encourages multiple problem-solving attempts from different angles, creating an environment where transferable skills and competencies aligned to critical thinking and communication can flourish.

Table 1. Mapping playful pedagogies and competencies (example)

Skill domain from What we mean by learning through play (Zosh et al., 2017)	Selected outcome as described in the literature reviewed (Zosh et al., 2017)	Integrated pedagogy as described in the literature reviewed (Zosh et al., 2017)	World Economic Forum Key Skills 2020 (WEF, 2020)
Cognitive skills	Cognitive achievement, Conceptual understanding, Conflict resolution, Decision making, Higher order thinking skills, Inductive and deductive reasoning, Interpreting, Knowledge transfer, Metacognition, Negotiating skills, Planning skills, Problem solving skills, Reasoning strategies, Recall skills, Study skills, Thinking skills	Active learning, Collaborative inquiry-based learning, Collaborative learning, Cooperative learning, Guided discovery learning, Inquiry-based learning, Montessori education, Peer tutoring, Problem-based active learning, Problem-based learning, Project-based collaborative learning, Scaffolding, Socio-constructivist	Complex problem-solving, Critical thinking and analysis, Technology use, monitoring and control, Technology design and programming, Reasoning, problem solving, ideation
Creative skills	Creativity, Divergent thinking, Inventiveness	Collaborative learning, Montessori education	Analytical thinking and innovation, Creativity, originality and initiative
Emotional skills	Confidence, Emotional skills, Engagement, Enjoyment of learning, Executive function, Learner wellbeing, Listening skills, Motivation, Positive classroom behaviour, Science self-efficacy, Self-efficacy, Self-regulation	Active learning, Collaborative, active learning, Cooperative learning, Experiential learning, Guided discovery learning, Inquiry-based learning, Montessori education, Problem-based learning	Active learning and learning strategies, Resilience, stress tolerance and flexibility
Physical skills	Fine motor, gross motor	Active learning, Guided discovery learning, Montessori education	
Social skills	Collaboration, Communication skills, Interpersonal skills, Negotiating skills, Positive peer play, Social connections, Social regulation, Social skills, Verbal/social skills	Active learning, Cooperative learning, Experiential learning, Guided discovery learning, Inquiry-based learning, Montessori education	Leadership and social influence

5. Competencies and resilience development

In proposing a model linking competencies development and resilience, we must first acknowledge that the terminology is often debated (see, among others, the reviews by Chaka, 2020; Joyce et al., 2018). It is therefore important to explain where this model moves from, while also acknowledging that it is a snapshot (see Figure 1) of an ongoing conversation, benefitting from critical engagement from all partners involved in this study.

For the purposes of defining, theorising, and proposing evaluation methods with regards to resilience within this model, this paper referred mainly to the following sources:

- Bené et al.'s (2012) tripartite model (then adopted by Oxfam) development studies perspective, articulating resilience in terms of absorptive, adaptive and transformational capacity.
- Nicholson McBride's model of individual resilience, based on a psychometric perspective, with five key components (Optimism, Solution Orientation, Individual Accountability, Flexibility, Stress Management) and a summative Resilience Quotient.
- Saja et al.'s model of social resilience, comprising "5s" (Social Structure, Social Capital, Social Mechanisms, Social Equity & Diversity, Social Beliefs & Culture) and 80+ indicators.

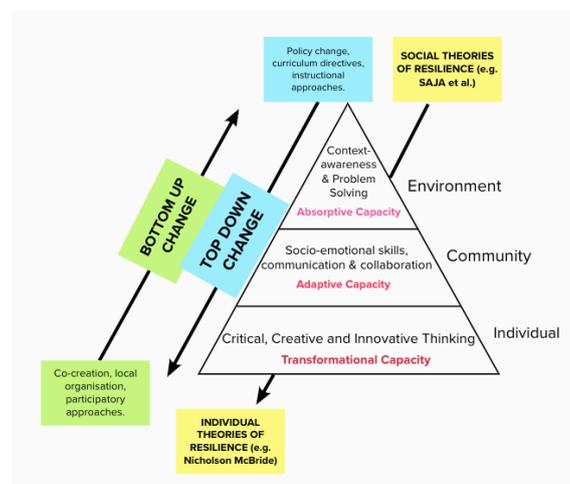


Figure 1. A snapshot of the interconnection between the competencies and resilience aspects

While there are theoretical differences between these approaches, we argue that these perspectives provide complementary approaches to understanding a diverse landscape. Bené et al.'s model in particular informs the overall architecture of the model across the three levels, around which competences and levels of systemic analysis are aligned.

- Absorptive: The capacity to take intentional protective action and to cope with known shocks and stress.
- Adaptive: The capacity to make intentional incremental adjustments in anticipation of, or in response to, change, in ways that create more flexibility in the future.
- Transformational: The capacity to promote intentional systemic change to stop or reduce the causes of risk, vulnerability, poverty, and inequality, and ensure the more equitable sharing of risk so it is not unfairly borne by people living in poverty or suffering from discrimination or marginalisation.

Regarding competence, the clustering explored in this model (to be understood in a direct link with the 3 levels of resilience capacity mentioned above) was developed starting from the WEF and OECD reports (2019), and refined in ongoing conversations with partners, reflecting their individual nations' educational policy, cultures, and values. While it is important to note that competence-oriented framings have been broadly contested for its de-emphasis of subjective human elements in favour of objective behaviours (Preston, 2017), they constitute an important point of reference in framing international and national policy and, indirectly, pedagogical research and practice. They are therefore acknowledged as a starting point that will be critically interrogated when utilising them as an interpretive lens for fieldwork.

The individual – community – environment split (systems level) articulated in the table was developed in conversation with partners, starting from existing fieldwork and framings. It can also be associated with Ecological Systems Theory (Bronfenbrenner, 1992). In this framing, the individual level is situated within Micro-

systems, the Community level broadly aligns with the Micro- and Meso-system levels, while the Environment level broadly aligns with the Exo- and Macro-system levels of analysis.

The individual level links to the development of critical, creative and transformative capacities. This arrangement is also suggested with consideration to literature about political and institutional inertia (i.e., making the top of the pyramid budge - see Boston & Lempp, 2011; Zantvoort, 2017), highlighting both the pre-eminence of bottom-up organisation in promoting social change, and how top-down environmental conditions can facilitate or hinder the emergence of this organisation. It is important contextually to note that the model allows for (and is aimed at promoting) synergy between different levels of resilience and system analysis, but also has space for conceptualising (and hopefully preventing) conflicts between those. For example, an individual's transformative capacity might be curtailed by their environment/institution's absorptive capacity.

6. Towards the mapping of aspects

As illustrated in Figure 2, the mapping of these aspects potentially provides an overview of the pathway from the playful aspect of an educational activity (with frugal considerations) to the development of competencies that would foster resilience in learners. This mapping could both underpin the purposeful design of playful educational activities and facilitate analysis of existing activities and programmes. This perspective is inspired by the mapping of learning mechanics and game mechanics (see LMGM as discussed in Lim et al., 2013; Arnab et al., 2015), which has also informed the design of serious games, such as 'PR:EPARe' (Arnab et al., 2013), 'Circuit Warz' (Callaghan et al., 2015), and a game for photovoltaic systems (Venson et al., 2017), amongst others. The LMGM model has also been extended to consider motivational theory (Proulx et al., 2017). The rigour of the design process of playful instruments as addressed by the LMGM model, is often in question due to the lack of studies offering insights into why and how games are effective on a granular design level (Arnab, 2020). The challenge includes the inherent incongruities between game design and pedagogy (Arnab et al., 2017), where the multifaceted nature of purposeful game design complicates the 'balancing' process of "gameful" and "serious" aspects.

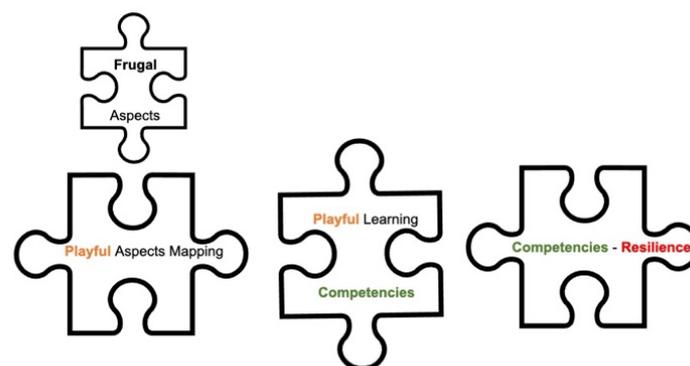


Figure 2. The interconnection between the aspects

For an understanding of the playful and gameful mechanisms that cause serious outcomes to occur, we need to look more closely at the relationship between the multi-dimensional aspects. The mapping of learning onto gameplay, for instance, is essential for informing the types of engagement and interaction we wish to create. Högberg et al. (2019) suggest that "there is no point in gamifying if the aim is not to achieve a gameful experience" acknowledging that "the gameful experience is a mediator between the motivational affordances of the gamified solution and the targeted behavioural outcome" (p. 622). This argument echoes our perspectives on playful experiences fostering engagement with purposeful activities which in turn enable human development.

Table 2 demonstrates a mapping template articulating the various aspects that can be included in playful educational activities or programmes. From left to right, it shows a pathway of considerations from the learning aspects and the relevant playful aspects through to the competencies and the resilience capacity that could be targeted, which include the system level analysis of the impact to the target learners or the communities. The competencies could also be localised to actual needs (as in the ACES project) and mapped against national expectations that may influence the formal curriculum. In this template, Bloom's taxonomy has been included as the starting point, as this is commonly used in ACES project partner countries, and it serves as the basis for embedding the development of lower and higher order thinking in the design of activities.

Table 2. The Mapping taxonomy template

Learning (pedagogy) perspective			Playful and Frugal Aspects mapping			Playful Learning - Competencies			Competencies – Resilience Mapping			
(Learning) Objectives	Bloom Learning Aspect	Learning Aspects (concrete verbs)	Playful Aspects	Proposed activities/Implementations	Frugal Aspects	Playful Learning-Competencies	C21 Skills	Country specific skills	System level analysis (impact level) – individual/community/env	Competence Cluster	Resilience Capacity (spectrum) – absorptive, adaptive, transformative	Indicators
Obj. 1												
Obj. 2												
Obj. 3												

7. Example mapping

This example draws from a playful programme (“STEMBucket”) that is being developed by the Malaysian partner. The programme is a response to the digital divide in education accentuated by movement restrictions during the pandemic, where children from remote parts of the country do not have access to the necessary digital infrastructure. The main objective is to support and encourage STEM learning. The main resilience capacity to be developed is the ability of both teachers and learners to be more agile and adaptive towards a more transformative capacity through creative and active learning approaches. The “bucket” refers to a container filled with various physical materials and resources (sourced frugally), contextualised with guided activities, that can be used as instruments for fun STEM learning. An example mapping on the activity level is shown in Table 3.

Table 3. Aspects mapping on activity level

Learning (pedagogy) perspective			Playful and Frugal Aspects mapping		
(Learning) Objectives	Bloom Aspect	Learning Aspects	Playful Aspects	Proposed activities/Implementations	Frugal Aspects
1. To identify materials and understand instructions	Understand	Identify Interpret Discover	Agency Curiosity Autonomy	<p>DIY Plasticine</p> <p>Materials: 1 cup of multipurpose flour, ¼ cup of salt, ½ cup of water, food colouring (different colours).</p> <p>Learners to follow these instructions:</p> <ol style="list-style-type: none"> Put flour and salt into a bowl and mix them. Pour water into the bowl and mix into a smooth non-sticky consistency. Add 3-4 drops of food colourings to the dough and mix them. Experiment using a colour chart. <p>Learners can then create various figurines based on their imagination.</p> <p>Learners can co-create bigger objects.</p> <p>Learners can compare their materials with each other’s leading to discussions on colours, material consistency, the combination of medium, etc.</p>	Creativity
2. To learn dimensions and volume	Understand Apply Analyse Evaluate	Questioning Hypothesise Testing Reflecting	Curiosity Agency Iterative Hard Fun		Openness
3. To explore materials, colour combinations, shapes, and consistency of materials	Create Evaluate Analyse Apply Understand	Creating Reflecting Testing Iteration Construct	Autonomy Agency Curiosity Easy Fun Iterative Social		Resourcefulness
					Iteration Minimalism

Playful Learning - Competencies			Competencies – Resilience Mapping			
Playful Learning-Competencies	C21 Skills	Country specific skills	System level (impact level)	Competence Cluster	Resilience Capacity	Indicators
Cognitive Skills Creative Skills Emotional Skills	Critical Thinking Reasoning	Knowledge Thinking Skills Critical Thinking Numeracy Communication Collaboration	Individual	Context Awareness	Absorptive	Learners are able to critically respond to challenges, demonstrate creative problem solving, and reflections as part of the creative group discussions on their creation
	Reasoning Problem Solving Ideation		Individual	Creative	Absorptive Adaptive	
	Ideation Creativity Originality		Individual Community	Creative Collaboration	Transformative	

This example activity is one of many within the full STEMBucket programme. On a programme level, the context of the various activities as a collective can also be described using the aspects mapping. Even though this

example is based on the activities being developed in Malaysia, the pedagogical and playful constructs can be adapted to respond to other localised needs.

8. Discussions and Conclusions

There is a strong link between play that is iterative, experimental, and socially engaging and the development of a range of competencies young people will need to flourish. Iteration and experimentation can lead to the development of resilience through fostering the capacity to persevere with a task or activity. There is however no fixed formula nor methodology for articulating the mapping of the different aspects that could be embedded in the design of such an activity.

This paper argues that it is essential to gain insights on a granular level into the multi-dimensional aspects of the experiential design of playful activities. The relationships between the various aspects will contribute towards a better articulation and analysis of how playful activities could develop competencies for nurturing resilience.

It is a challenging task to ensure that engaging with the mechanics of a playful activity will actually facilitate transfer of knowledge and/or skills that they are designed to impart. For an understanding of the mechanisms that cause the learning cycle to occur, we need to look more closely at the relationship between the various aspects from playfulness and learning through to the expected outcomes, such as competencies and resilience.

The subject of resilience exists on a scale from individuals to communities and environment (Table 4). While there are overlaps and a blurring of borders between these categories, the evidence that individuals, communities and institutions constitute discrete categories of resilience stems from the observation that these categories can compete between each other. "A collection of resilient individuals does not guarantee a resilient community" (Norris et al., 2008, p. 129). Subsequently, considering the subject of resilience is important when considering how factors impact that resilience.

Table 4. Types of resilience and examples

Type of Resilience	Examples
Individual: at the level of a single person	A student, a teacher, a parent, an employer/Business owner
Community: at the level of a group of people with a shared identity/common ties)	Peer-to-peer, a classroom, a village, a teaching faculty
Institutional/Environment: at the level of a socially constructed entity with a specific purpose/s)	A school, a local government/council, a religion

The discussion in this paper posits the importance of the granularity of intervention strategy, which also include the focus of what level of resilience could the activities respond to. This opens up opportunities for a more informed design of activities on the activity level (such as in Table 3) or a programme level that can contain various activities. A simple activity exemplified in Table 3 demonstrates the development of competencies that could impact individual resilience and also community. Community in this case is represented by peer-to-peer collaboration.

The paper demonstrates a simple example of how the mapping could be carried out, which opens up opportunity for discourse around the rigour of playful experience design. The mapping approach can be adapted and localised to any specific needs concerning the pedagogical constructs the educators or learning designers are aligning to. For instance, instead of Blooms taxonomy, other learning models such as experiential learning and problem-based learning can be applied to articulate the concrete aspects for both the learning activities and playful design. Playful learning solutions are more likely to be accepted by educators as useful resources if they are more readily blended with existing educational techniques and practices (Tsai et al., 2009). The mapping model also provides the opportunity for existing priorities on competencies from the formal education and policy level to be included as considerations. To embed playful learning in education, initial buy-in from educators is usually constrained by practical and institutional constraints, such as the need to optimise their

time by keeping close to the standardised curriculum (Mohamad et al., 2018). The 'blending' of practices should include pragmatic considerations, such as how well an intended play session fits within a teaching practice and perhaps address didactic shortcomings. These perspectives are relevant for educators in any educational institutions globally. Moreover, the non-prescriptive approach promotes autonomy and agency for educators to experiment on the various aspects and how can these be embedded in their learning activity design.

The proposed mapping approach serves as a hypothesis that is currently undergoing testing through fieldwork. Further work includes analysing playful activities that are implemented with learners, and by using the articulated mapping, the concrete aspects of each category can be further elaborated and reflected on. Conducting such analysis based on well-articulated mapping will allow us to have deeper investigations into the granularity of playful learning activities, i.e., what part of these activities develop specific competencies and to what extent is resilience nurtured. A retrospective approach is also possible, where existing playful activities can be analysed using the proposed mapping for describing the relationships between the various aspects in the design and implementation.

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10. References

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