Constructing Collaboration

Collaborative experiments in the setup of a makerspace for students in an international school

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Introduction

"Space is room, Raum
is roominess, a chance to
be, live and move. The very word
'breathing space' suggests the choking,
the oppression that results when things are
constricted. Anger appears to be a reaction
in protest against fixed limitation of movement.
Lack of room is denial in life, and openness
of space is affirmation of its potentiality.
Overcrowding, even when it does not impede
life, is irritating. What is true of space is true
of time. We need a 'space of time' in which
to accomplish anything significant. "

(Dewey 1934 pg. 217)

11/05/2020

The class teacher and I have separated Legos into different boxes and written each students' name on their box. Due to COVID-19 we have to take extra precautions in the classroom, cleaning all their materials and the resources. We divide all of their books, pens and pencils, we have been recommended to not give out any soft fabricated items. The shared spaces are out of bounds and our space is restricted. We mark out areas to divide the students from the teachers area, and we consider how to introduce these new rules to them in a "fun" or interesting way.

The students are excited to have their own box, delving straight into making their own constructions and becoming fixated on certain pieces (sometimes sneakily snatching pieces from another child's box.) Slowly over time we introduce more materials, recyclables and wooden blocks. Now that we've become increasingly acclimatised to the rules, regulations, and cleaning, we all feel safer to make and play.

As the COVID-19 restrictions loosen, the students remain completely, or even increasingly more, attached to their own box. One student even remarked she doesn't like to share the Lego because of an affinity to what she had personally made. How can one be content with our box yet still be aware and share what's outside one's box?

Figure above

Illustrates dividing materials into separate boxes

This project looks to build a collaborative approach with primary year students. It endeavours to construct a makerspace together.

As a reader navigating through the writing, the piece is broken down into different aspects: context (personal, professional, and outside contexts,) the theoretical underpinning, practical experiments and reflections. These different elements are represented by shapes, which will be used to better build a picture of influential thematics. Like a jigsaw puzzle, these pieces can be played with and read in any order, as individual components or as one large piece. It is not necessarily to be read as one definitive way to set up a makerspace, moreover a personal reflection on how to create a makerspace through experiments by working together. The reader has the choice to read what areas they are drawn to and relate to parts of the process they wish to explore. This document intends to be accessible and can be played with, in the sense that this paper can be physically cut up, rearranged.

The project came directly from the urgency within the context of our school needs; however, it is relevant to educational practitioners who would like a new perspective when learning about spaces, and an alternative angle on teacher-student dynamics. It is also for individuals who are interested in formative or artistic spaces.

Key:

Personal Context

Wider Context

Theoretical Underpinning

Practical experiments

Personal Context

Ongoing Adaptation

This research emerged from my involvement with the formation of a makerspace for primary year students (aged 6-11) at an international school in Amsterdam, which is an ongoing project that continually adapts itself along the way. Its evolving nature responds to its collaborative quality, one where the process is deliberately open to student and fellow teacher input. Starting with the purpose of this research is to start by elaborating on my position and therefore my direction. My role as student support at schools I have worked in has provided me with experiences that have developed into a liminal outlook on the ways schools are structured.

Currently I work as a teaching assistant (or support role) and this serves as an intermediary between the student-teacher relationship. Often my day is structured in a reactive way to the decisions of the teachers preparation and to the child's needs; this changes on a day to day basis. It means I have to be open and it can often be confusing; in terms of whether I'm assisting in the way I "should". I have some voice or influence in how the learning environment is shaped, but often it means coinciding my own practice to complement another teacher(s) practice. It occasionally requires compromising my own agency for the style of a teacher; however, I have found that the most effective relationships are one of a collaborative nature with the teacher. I spend a large percentage of my time building a rapport with the students; I support specific academic needs to emotional wellbeing and usually on a very micro scale. I adopt an informal manner working with students out of preference, but also because my role can afford this type of mediatory identity. However, there is also plenty of room for big ideas, and I can share this with the teacher and we can devise how best to materialise this, we often shape my suggestions to tie into what is happening in the lesson.

I have been fortuitous working in varied educational contexts, alongside diverse ranges of practitioners which in effect has shaped my own practise. Though in time it has given me space to be reflective and critical with insight into such divergent customs. During the time I've worked at schools I have shared spaces with over 10 teachers. I have worked as an Art, Design, Photography Technician and provided support sharing my own skills whilst continuing to learn specialist subject matter due to the nature of being in contact with so many educators.

Liminal

I have found this collaborative approach a necessary method to bridge these educational interrelations. Though I understand and seek to maintain a realistic perspective on the pitfalls of complex collectivity, I have found that I enjoy and feel comfortable providing spaces for social engagement, artistic integration, and educational experimentation. My art and design based background drives my intention of integrating these fields into educational practice. Furthermore, putting on different hats during the setup of this study, as a participant but also a researcher, became a comprehensive experience with two perspectives which were symbiotic in nature.

liminal

ˈlɪmɪn(ə)l/
adjective
1.
relating to a transitional or initial stage of a process.
2.
occupying a position at, or on both sides of, a boundary or threshold.

Whilst working at Amity International School Amsterdam, my perspective grew ever more prominent due to the school being new and in a continual place of change and adaptation. I became curious about the systems, space and relationships which were being built.

The liminal viewpoint provides an in-between space, and foregrounds a process of transformation or change. From my personal stance, I use liminal as a term to illustrate being a mediator in the student-teacher relationship, and this can be quite complicated due to my tendency to empathise with both viewpoints. This is not to give the impression that teachers and students have complicated or negative relationships;

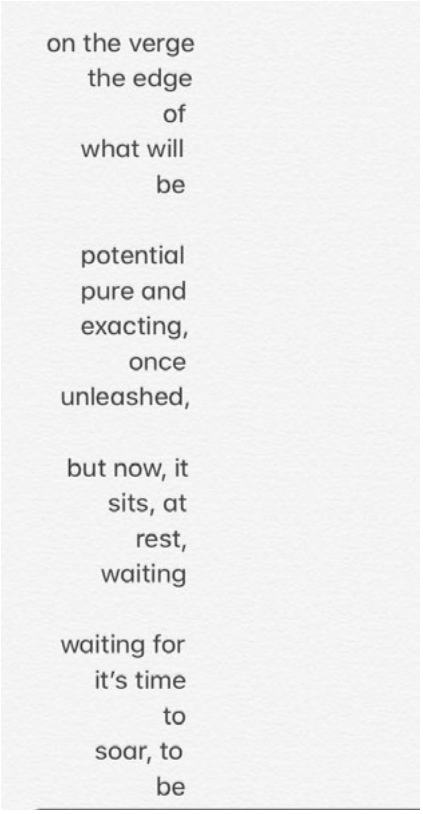
instead, I would like to highlight that this dynamism between two relationships can enable a different dimension.

Working in support roles has brought an awareness of power-play, hierarchy and varied agency within the system of school. However, this position can be used as a constructive aid to extend these two different domains and to bring light on the complications. This perspective holds an insight into the in-between and for the reader who wants to orientate themselves in this transitioning space. I see my position as an opportunity to explore limitations, boundaries, and restrictions. By bringing an awareness to this, I aim to illuminate how we can collectively work through these ever-present factors. It shares a unique place, in which practitioners can use this research to reflect through a different angle as well as bringing forward the student voice; giving opportunity to this connects us.

What personally drew me to this project is the "yet to become" quality of the makerspace, it is an exciting prospect due to its liminality. (Vasudevan & DeJaynes, 2013) beautifully describe, "emergent ways of doing and making come alive through experimentation and exploring the marginal spaces of the "not yet'." In other words, the unknown can hold potential for great change. Whether it be a "good" or "bad" outcome, change is an inevitable process. The approach is not to presuppose an end goal or a vision of how the space should be, but to accept change and dynamism in the process. Whilst the makerspace is not fully formed, focusing on the process is crucial to its success, to feel a part of and one with the transformative stages.

However, over the course of time I acknowledge that my privilege has allowed me to take certain routes. My current position is within the context of an international school at Amity International School Amsterdam, yet I often find in these settings, a siloed nature tends to follow, creating a "bubble-like" state. I use the term "bubble-like state" as a metaphor for a sustained sphere, one that segregates different classes and structures. From living: in a rural village, to attending design school, to volunteering at a youth centre in Manchester, to working in a high school and Sixth Form in London (or rather what feels like living in the bubble of London itself), I have edivently shifted through various bubbles in my life.

With each bubble I have been able to tune my behaviour to each system and maintain a growing questioning about its structure. I also saw how often falling into this siloed system can prevail. As Henri Lefebvre writes in *The Production of Space* (1991), "[h]uman beings or societies produce space together to structure, open up and limit activity". My curiosity about the spaces we occupy grew initially from working in a newly opened school and it brought an awareness of the changes going on around me. I want to delve into the different systems and spaces; makerspace practice, international school context and communities, in order to see how it affects this project from both a narrow and wider perspective.



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With thanks to Craig Randall, fellow colleague at Amity, a poem on the idea of liminal [1]

1 https://www.facebook.com/pages/category/Art/Craig-Randall-Writing-115826383164064/

After
cross-examining and
observing the pre-established
systems at the educational spaces
I've previously worked in, I began thinking
about who determines space and for what
means. This established my line of inquiry: *Why don't students participate in designing their own learning space and curriculum?* The perception that students are not active participants in their learning environment is common. We see that students are the end "product" of education and learning, where they receive but cannot engage in the decision making of their learning. This broadened my intent, acting on; ***"Collaborative experiments in the setup of a makerspace to provide student agency."*** Throughout this research I aim to provide a structure where co-creation or collaborative activity in an educational setting can realistically flourish. The collaboration ideals are an opportunity to open my own practice to develop different potentials with others, though the viability of the project is determined on the interactions and changes to the space.

How to determine the word space?

The spaces that humans inhabit often have political undertones that critically frame the ways in which we interact and occupy them. Space is about ownership. Community and public spaces are becoming harder to find due to ongoing privatisation, (Carmona, M. Hanssen, et al., 2019) so it is important that when there is space available to us, in our schools, that we are given the freedom or autonomy to decide how we organise it – there are positive implications here. It is imperative that students and fellow teachers work together to prevent recycling systematic praxis found in school spaces and create an open approach sensitive to the current situation and needs of the people who engage with the space.

In E. Tucker-Raymond, B. E. Gravel (2019) analysis on the ***Artisan's Asylum***, (a shared learning space); "This means that the ways in which people communicate and what they are doing when they communicate create the space. The space in turn, mediates the communication. As new members join, bringing with them their own histories, values, and practices to the Asylum, the social, culture and physical spaces are incrementally, yet continually reconstructed."

Similarly, I attribute and advocate these concepts in my own project, asking how the values of the community affect the space and how we continually regenerate this together. This involves the students, the teachers and myself, whilst taking into consideration the wider community; such as parental/ family aspects or businesses and how they could have an influence on a meso-scale, this must also be called into question and pursued when devising the makerspace in this study

Why a makerspace?

The urgency for a makerspace is not only generated from the needs of the school but from a personal interest. Learning through play is the foundation and direction to my practice. This began during my time working with students of an early age; it determined my perspective of the significance play has to a child's learning experience. I wanted to promote this to other age groups (indeed accessible for all ages.) Play is a fundamental element in connecting the student to their learning. Learning through play is synonymous with makerspace culture, which takes on a Constructivist approach (which I later go into more depth.) The founder of Constructivism, Jean Piaget, quotes "play is a child's work." (S Martinez and G Stager, 2019 pg.41) interpreting that play is present when we learn. In their *Invent to Learn (2019)* they go onto to determine the definition "tinkering" a term summarised in makerspace practice often; "tinkering is a mindset - a playful way to approach and solve problems through direct experience, iteration, experimentation, and discovery" (pg. 36) There is this notion of being able to play whilst you work (or otherwise learn); to tinker with different materials.

When developing a makerspace it offers not only a space for a pedagogical framework of using play to learn yet it also offers a sociological one, in which this research is based. Collaborative learning is coming together to share ideas and deepen learning through shared exchange. There are ways in which collaboration can become effective yet also unproductive. Different strategies of how to utilise group work effectively is dependent on the context/background of the students and of the project. Keeping groups relatively small and setting an atmosphere which is non-competitive (which may need to be reminded frequently with younger years) is generally a starting point on how to negotiate with others on a project or topic.

It is in collaboration we notice comparable attitudes seen in play. We are both equal yet individual participants in a "game"; we can work together or against one another. In play there isn't necessarily one certain intention (sometimes we just play for plays sake) yet we tussle out ideas with one another when more than two individuals come together. Perhaps this is a crude comparison, but this attitude, playfulness; of how one can create altruistic, selfish, or even neutral interactions, are seen in a collaborative environment, and can be observed when playing. We decide on our level of engagement and participation and that behaviour negates the "game" or interaction.

With the question I propose, the answer can already be found in a makerspace or at least what a makerspace promises. The point of the study is to unearth whether it actually does do what is stated of it, whether it is feasible. Through the experiments of the setup of the makerspace it critically looks into makerspace practice to decipher what parts we need to build our own makerspace culture. Do we need STEAM (Science, Technology, Engineering, Arts, Maths)? Do we need agency? Do we need to work together? Do we need Constructivist/Constructionist theories to provide us with ways of learning? Do we need this space?

Although the answers may conjure straight-forward assessment, this research really is an opportunity to delve into this subject matter consciously. My main lines of the argument focus on agency, collaboration, informal and embodied learning.

Some of the questions that I seek to ask and answers for, include:

"Is the process of setting up or a makerspace a necessary tool for embodied learning?"

"How does agency play a factor in the setup of a makerspace?"

"How can a space determine the quality of our learning?"

"How can we use embodied and playful exercises to learn?"

Why a makerspace, not a shared learning space?

The decision to research and develop a makerspace and not the shared learning space started from mutual interest between the team of teachers and support teachers; we collectively showed enthusiasm in the growing trend of makerspaces in schools. After hearing such positive feedback from others, and about the intriguing and flexible nature of such a space, we decided to take it further. Amity International School of Amsterdam was a newly established school at the time (opening in 2018). During our first year of setting up the school, the teachers and I marked out an area for the makerspace with great enthusiasm, but lacked the required depth of understanding "how", "why" and "what". We urgently needed to research this type of space further, and I felt compelled as a researcher to take this responsibility on myself. The dual responsibilities of researching and facilitating put me in an ambiguous position, and at times I was conflicted in asserting my personal intentions whilst simultaneously seeking more democratic roots.

I began by inquiring into our shared space. A shared learning space or an open learning space emerged from a reaction against the industrial era and authoritarian classrooms (S Alterator & C Deed, 2013.) As mentioned in this paper there is already a breadth of research on the benefits and downfalls of these spaces. Whilst these types of spaces offer flexibility and an integrative approach, a makerspace provided us with a springboard, a structure into how to organise this space to support these questions of "how" "why" and "what" could happen in this space. Or quite simplistically giving a name to the area. Through the research I expand on why a makerspace let us explore this shared space together through a more autonomous approach.

What is a Makerspace?

In the context of our school at Amity, the makerspace has been and will be the backdrop for learning to take place; pedagogy is a crucial part to the learning rather than a movement, such as a makerspace. During the course of the research, the term 'makerspace' has taken on many different meanings. The terminology of a makerspace is ambiguous, it assumes many forms in varied contexts. Terms like "learning by doing", "critical making", "disciplinary and transversal learning", "experiential learning", have all been related to a makerspace practise (Dewey, 1902, Ratto, 2011). The diversity of where a makerspace can take place is also unique to its setting, be it a community, school, library, moving vehicle, or even a shed (S Davee 2014). Often a student embarks on making a project around a certain concept they wish to understand in further depth. This could result in a product, a creation, or an experiment that blends different subject matters. It is often open-ended, learning through making. It can also be used as a space to play with different materials with no determined outcome.

A makerspace uses a blend of digital and analogue tools, from learning specialist skills to DIY projects, a variety of mediums and approaches are intended to enable the learner to interpret different concepts and ideas through making. However, an overemphasis on these tools can come without proper consideration for the needs of community development, and is a warning in how we deploy these powerful tools, summarises Davee et al (2015). Proper engagement with the students whilst building the makerspace is important to centralise their needs. Putting their needs first, rather than the tools, enables a more student-led learning environment.

Wider Context

However, research on makerspaces are relatively new grounds on which to decipher, especially in the realm of primary and early years education. According to the MakEY project 2017 report, Makerspaces in the Early Years: Enhancing Digital Literacy and Creativity, limited attention has been given to the digital and creative literacy of young children and delves into these issues through makerspace analysis. The age group primarily involved in this study is 6-8 years – although it refers to other age groups in primary years as well. This is a challenging avenue of research due to makerspace practise largely dominating in an adult sphere. Furthermore, the diverse social and emotional expansions and developments of this age group add another layer of meaning and interpretation to the research.

The maker movement's wealth and growth exploded in popularity over the past 15 years, this could be due to the versatile and amiable nature of a makerspace which tailors to many sectors of the public, from schools to libraries to community initiatives. Until most recently a pivotal turn when MAKE Media[1]; a driving force in marketing the makerspace movement, became bankrupt in June 2009, and had to close operations. Now a time of reflection has settled in, I come to question: what does maker practise mean? In the essays of Makers Reader (Un) learning Technology (L Bogers & L Chiappini 2019) the authors ask: "[w]hat was making? What is making? And perhaps most critically, what could making become?" (pg. 8) As I come to terms with these such questions through my research, I found myself looking through different lenses: one through a Constructivist/Constructionist view of building and sharing knowledge and one through a Deconstructing or (Un)making lens, that takes apart what we have learnt to better understand it. I go into further depth in the writing and their purpose to the research of these two lenses, defining their meaning and importance to the process.

Makerspace under construction and the wider context

The history of the formation of the makerspace at Amity has been precarious, as it has always been susceptible to change and transformation. This was due to a number of factors, including; the school being international, the increasing number of students, the makerspace being a new concept to myself and other staff members, and other factors such as the wider context of makerspace practice and how this could affect us.

Elaborating on the situation of an International School - what that means as an institute and the differentiation to say a public school or a more traditional onset. The complexity derives from internationality, to be international. Students and families from across the world engage in one space, often children arrive here due to agency that exerts itself over a child: their parents' economic prospects and new jobs or opportunities. Different backgrounds bring different expectations, and the admissions team aims to keep a balance of varied nationalities. However, this can create a selective process, which, by and large, is not necessarily what the school intends. Contradictory tensions may originate, as a result of this process. The school has to hold space for this in a delicate and thoughtful way.

International schools typically are susceptible to change, with plenty of students coming and going. When I first started at the school three years ago there weren't any students. Since then it has rapidly grown and has gone from having just three enrolled students to more than 200, and growing. The maker space exists within a context of growth and expansion, with the needs of the students changing rapidly before our eyes. In some ways, it has been a struggle to keep up. Therefore, the makerspace is

1 [Last accessed 01.11.2020]

https://makezine.com/

designed to facilitate space for these developments, and give room for failure. When you combine this free space with the addition of the transient nature of the students, (some students don't stay longer than a year, and sometimes enter mid-term) creating a sense of personal community or establishing a stable environment can be difficult as outlined in the "zone of entanglement" (Ingold, 2008: 1807 cited in Hackett 2015). How can we provide a space that promotes a sense of ownership to the students if the conditions are so transient?

In the broader context of a connected and diverse world, viewing my position in an international school and interacting with students from varied cultural backgrounds establishes interesting and astute grounds to reflect on this wider situation. The relevance of how students from different nationalities interact, and how this happens in a school space is a

*Neoliberalism is an ideology which relies on competition between citizens. It positions citizens as consumers whose democratic choices are best exercised by buying and selling. It's a process that rewards merit and chastises inefficiency. Neoliberalism reinforces hierarchical structures and protects the reasoning of the very privileged that their success is the outcome of hard work and talent, rather than advantages such as; education, class, wealth and inheritance. Its ubiquity allows it to permeate in the economy, public sector and community; and its effects cannot be dismissed in the franchising of a makerspace.

In contrast a makerspace relies on community spirit, as a space for "bringing people together" and "exchanging ideas" (A Lakind 2017) but this ideology can be contradicted when often the affiliated ties come from neoliberal investment. Neoliberal ideals could be argued as the exact opposite to those of a makerspace. Neoliberalism exacerbates and exploits inequalities, and puts responsibility on the individual to compete for their education against their classmates, their community and drives individualism. Whereas a makerspace promotes a shared learning space with the view of exchanging learning with individuals and connecting knowledge.

A Lakind (2017) argues how arts education has turned the arts into the term "creativity". Neoliberalism drives this notion that in order for the individual to believe that anyone can, and should, achieve success they must compete in the marketplace. Arts education is used to develop "industry creatives" rather than opportunities for open-ended or reflective experience, and where "creativity" is now positioned as a marketable skill. M Fischer in "***Against Competition***" (2006) argues how the art world is structured to favour competition "artists compete with artists – stealing ideas instead of sharing them, or using copyright laws to guard against thoughtful re-use." Yet suggests how through building a network with the use of communication strategies helps connect artists using a collaborative style.

Whilst investigating this research neoliberalism plays in the background; the significance of the institution(s) we are in or in support of should be scrutinised. Using the makerspace as a relief for collaborative ideals helps us to shift from what is purely expected of us and a more explorative road. Deviating away from a competitive nature does not necessarily mean an "idealized world of shiny happy people holding hands - some of the most productive collaborations can have a lot of tension and disagreement" M Fischer (2006) and this is the reality of the work of these experiments.

reflection of how the world is situated in this current universally linked network. The online make-up of our society pushes us to make these connections between continents, knowledge and resources; expanding our base to form us into neighbours. We are both in a large yet small world simultaneously. However, the affect of this transitioning between land masses and culture can affect us positively or negatively, so how can we support this sensitive subject, especially in a school setting? One approach cannot fit all and yet it is becoming an increasingly significant issue as we become progressively affiliated and intertwined. The diversity of students and varied expectations that surround this is a precarious and ambiguous topic in the context of an international school, how we communicate these expectations can be uncertain. In Dr N Austerlitz et al *'Mind the Gap'* paper (2008) frame how we must establish "meta cultural sensitivity" between students and tutors to bridge gaps in expectations. Rather than expect all our students to conform to our expectations, we should be aware of their perspectives. Addressing the needs of an international school community is inherently special in this sense of range of outlook coming from students/ families, it becomes apparent that not one way or view is better than the other. It also determines and defines this uncertain space.

Regarding the relevant context of other makerspace customs; there are views surrounding them of discourse embedded in "white-washed" neoliberal* (please refer to triangle opposite) ideology and the maker culture becoming commodified (Ratto, Hertz 2019 cited in L Bogers & L Chiappini 2019) This then raises further difficulties in providing a space which rejects these expectations and brings attention for a need for alternative power structures. Whilst embarking on this study realising the privilege of one's situation; having the resources to study, access to the wealth of knowledge of young children, the openness of the space, accommodates such affordance to implement such alternative routes. This is not to undermine the challenges of un-cooperative circumstances and hurdles yet a view of the broader picture.

Transdisciplinary Practise and STEAM

STEAM (Science, Technology, Engineering, Arts, Maths) is another factor to the makerspace success, meshing transdisciplinary learning and enabling the student to have a wide range of experience. Working across disciplines and blending knowledge is seen as valuable but a necessary 21st century skill; to work flexibly as preparation for the diverse and fast paced nature we live in. A makerspace can encapsulate these different dimensions, through the process of 'tinkering' (Bevan et al 2014) with different materials, repurposing meaning through making, and playing with different sources of knowledge. It's clear how a makerspace can then be seen as a gateway to reinforce transdisciplinary learning to happen. Furthermore, it is apparent how this integrative approach in a makerspace could support the PYP (Primary Years Programme) curriculum at the school, whereby it encourages a transdisciplinary curriculum. For example the PYP/IB (International Baccalaureate) is broken down into transdisciplinary themes, in order to cover varied subjects rather than the traditional approach of teaching one subject at a time, units should cover many strands. The MYP (middle years programme) integrates STEAM opportunities explicitly in their design cycle[1] often referring to a makerspace context for this learning to take place, this philosophy is filtered and encouraged through the whole curriculum of different age groups.

The research on STEAM initiations in schools and makerspaces is considerable, partially due to it being a popular area of investment, according to Cunningham (2017); 'some practises are bought into neo-liberal discourses of the creative economy through sponsorship or a focus on entrepreneurship, becoming part of the process of the de-politicisation of urban spaces.' pg.4. Although our context differs from an urban landscape it is a point of caution to comprehend who these spaces actually serve and how we must be critical when inquiring into these ties. In an era where socioeconomic segregation and inequality is prevalent 'some researchers are concerned with ensuring that

1 [Last accessed 01.11.2020]

https://www.ibo.org/programmes/middle-years-programme/curriculum/stem-education-in-the-myp/

making is leveraged to challenge rather than reproduce existing inequities.' (Bevan et al 2014 pg 4.)

This need to foster these skills seen in STEAM can override other important issues at hand, the focus can't necessarily and shouldn't always be focused on learning skills to better prepare children for the "real world" and solve "real world" problems (Hatch 2013, Shin 2016.) There is this rhetoric that surfaces around preparing children in this manner, that they are somehow becoming a transactional object; 'in learner-centred, self-directed pedagogical processes skills promise to prepare the individual for economic and technological change. They seem to be measurable and transferable, and in the economic logic within education these features provide important and quantifiable proof' (A. Krauss, 2018 p. 79) The individual becomes a product of labour, continually updating their skills; however, skills are not equivalent to knowledge. Neither skills or knowledge is better than the other; however, a skill can be easily capitalised as it can be a quantifiable element to determine with what labour to work in. Having the access to learn by doing while focusing on personal learning experiences can be one way to tackle this.

It is perhaps an issue of how we define the term making 'these voices caution that making can sometimes be implemented a step-by-step, recipe-like, construction activities, running counter to the inquiry-based explorations that the maker movement espouses' (Resnick & Rosenbaum, 2013 pg. 165) How we define the term making and makerspace in our context is crucial to counteract contradicting objectives whereby we begin with the students first and the community at hand. Blackshaw, 2010 states, 'there is no intention here to signal that there is a standard model for a community makerspace that should exist; rather, we need to acknowledge that there is a wide variety of spaces that operate according to their own sets of principles.' pg. 34. The non standard model is the confusing element to forming makerspaces, and could be feasibly argued the reason for it's exploitation, or commercialisation due to there not being one way of implementation and the constant demand for innovation. Is it a case of feeling out what works and what does not work best for the context by initiating the project with the students and teachers?

Taking into account the voices of the colleagues, there is a general consensus that we must provide an environment for agency, that we would like to have a makerspace yet acting upon this and it materialising is a slow process. This is due to time limitations and weight of importance on other developments. There is support for someone to take the lead, but lacks backing or funding for resources. Interest in the project from another teaching assistant provided me with the support I needed to ensure the project did not become a completely siloed mission. Her being in a similar role to myself positions us in a way we can relate. This however accentuates the hierarchal structure within schools and acquisition of time; how this is spared and decided between different roles.

The makerspace's development is tested by this structure. The issue at hand is that the makerspace will undoubtedly become institutionalised due to it being in an educational setting at a school, it must meet the demands of the expectations and tailor to the rhythm of the ways of working already determined there. So how can we intentionally re-purpose it in a way that meets the demands of the students and co-exist with an institution?

Agency was one determining factor to adopt a new way of working, to enable different systems, routines and connect the relationships with colleagues and students. I speculated the makerspace could be one way to accommodate this, further expand or trial our understanding of agency and how this could look like in further depth. By providing a space where students could be active members was a major factor I wanted to push and also to connect the dots of putting the actions to the words.

Theoretical Underpinning

Constructivism, Constructionism and Makerspace Practise

The open approach of makerspace didactics means it can be adapted and tailored to the space, but the pedagogical principles can become somewhat lost in this transmission. The foundation of makerspaces has been related to Constructivist and Constructionist values and it is decisive whilst developing methodologies for my own working practices. I will briefly outline the difference between these two concepts and how they interconnect with makerspaces. I find it crucial to delve into the archival background to examine how it resonates with my current understanding of a makerspace and how and why they are the way they are.

Jean Piaget (1896-1980)

Jean Piaget was a French Swiss developmental psychologist and theorist. Though not an educator by profession he wrote one book on pedagogy. His interest grew from observing his own children learn and play together, but his basic research inquiry was epistemological and philosophical: What is the nature of knowledge? How does it grow and develop?

Piaget's Constructivism, "offers a window into what children are interested in" (E Ackermann, 2001) the framework attempts to build on children's knowledge, and how their ways of doing and thinking evolve through different stages of development. A child's knowledge and their world is constructed and reconstructed through personal experience. "Knowledge is not merely a commodity to be transmitted, encoded, retained, and re-applied, but a personal experience to be constructed." (E Ackermann, 2001) the emphasis on the words "personal experience" here connotes the core value of constructivism.

In constructivism students are not passive learners but engaged in discovering personally meaningful artifacts (Piaget, 1968) and learning experiences. In M Rob and F Rob's 2018 study they consider how the constructivist teacher "sets up the environment that fosters individual learning for students and presents a problem to be solved, while the students go on their own way to produce a personally meaningful artifact without any further teacher's intervention. The learning environment can be termed as teacher initiated." Learning is fostered through asking questions, problem solving and independently engaging with the material.

Constructivism outlines important cognitive developments in childhood, "recognizing that this process occurs within each individual student at a different rate, this base helps the teacher facilitate constructivist learning. Piaget's cognitive constructivism theory incorporates the importance of understanding each individual to get knowledge and learn at his or her own pace" (Powell, & Kalina, 2009). These were advancements in the teacher-student dynamic at the time; emphasising the value of the child's personal knowledge and the central notion being that learners play an active role in "constructing" their own meaning. This theory has affected the sphere of pedagogy and my own views of the learning environment, whereby using a child's prior knowledge as a starting point is thought to lead to a more meaningful, purposeful learning experience. A constructivist approach changed my perception on how the makerspace project should incorporate student voices.

Seymour Papert (1950/60-2016)

Seymour Papert was an educator researcher for Massachusetts Institute of Technology, specialising in the impact of new technological advancements and how it impacts education. Papert developed a theory of learning based upon Piaget's constructivism and was the key founder of the theory of Constructionism. Papert worked with Piaget in Geneva in the late 1950s and early 1960s and together complemented their findings. The slight difference in their theories and terminology is explained by Papert himself:

"Constructionism—the N word as opposed to the V word— shares contructivism's view of learning as 'building knowledge structures' through progressive internalization of actions... It then adds the idea that this happens especially felicitously in a context where the learner is consciously engaged in constructing a public entity, whether it's a sand castle on the beach or a theory of the universe." (Papert, 1991, p.1)

Constructionism is not dissimilar to constructivism, yet it differs in that the learning experience is intended to be shared with the community or "public". "[Piaget] was interested in how learners engage in a conversation with their own or other people's artifacts, and how these conversations boost self-directed learning, and ultimately facilitate the construction of new knowledge." (Ackermann, 2001) The co-construction of knowledge is within the community. The art of "learning to learn" was through the significance of making (Papert and Harel, 1991; Ackermann, 2001; Han and Bhattacharya, 2001; Kafai, 2006; Hoban et al., 2010) it is this making part that provides the association to makerspaces.

Both approaches stem from an interest in the learner or student. However, Papert's shows us how students' ideas get transformed and expressed through different media and become objects to think with. These representations of the individual can perform as a tool to have a conversation with others on what they have learnt. According to M Rob and F Rob's 2018 study, "a constructionist teacher sets up the environment for collaborative learning of students, then he or she defines the problem to be solved and the meaningful end product to be developed, and then guides them to reach towards the goal. The learning environment can be termed as teacher facilitated." The slight difference from the constructivist view is that it is; "teacher initiated" to the constructionist view which is, "teacher facilitated." The difference hinges upon the emphasis on the "public"; through constructionism the experience is to be shared, whereas constructivism is valued for the personal experience of the learner.

Papert guides us away from instructionism, a model which views understanding as being developed through transmission of facts from one person to another such as seen in the dynamic of a teacher at the front of the class feeding new information and where the child would need to retain this. Instructionism is an educational practise opposite to constructionism, it being teacher focused, non interactive and highly prescribed (G Johnson 2005.) Whereas constructionism posits that the experience and process of building something physical or digital provides a rich context for developing and representing understanding. The decision to adopt a constructionist approach in the makerspace is to deviate away from instructionism and integrate a method using making as a diverse learning experience, going beyond the directive way that can be typical to schooling, it is an opportunity to explore learning through materials.

These theories influence the basis of makerspace learning through the constructivist theories of learning as a reconstruction rather than a transmission of knowledge and with constructionist building something meaningful and tangible learners can share. Fleming (2015) explains, "the Maker Movement is about moving from consumption to creation and turning knowledge into action" (p. 7). It's this "knowledge into action" piece that reflects the pairing of constructionism with makerspaces, the physical aspect of action which provides its basis.

Furthermore as Papert begins to question in his "***Situating Constructionism***" (1991) he deliberates on interdisciplinary learning, how we can combine maths and art for example, and the rich learning experiences we get from "building and playing with castles of sand, families of dolls, houses of Lego, and collections of cards provide images of activities which are well rooted in contemporary cultures and which plausibly enter into learning processes that go beyond specific narrow skills." pg 7. The acknowledgement for the need of diverse activities aimed at student interest provides this foundation of makerspace practise. Constructivist and constructionist principles, through their emphasis on active educational opportunities, have led to the development of the maker culture and STEAM (science, technology, engineering, arts, and mathematics) focused approaches to student learning and engagement (Hamir, S. et al 2015).

Agency

What and why do we need agency?

Words such as voice, ownership and agency are emphatic terminology, and yet are often used in the outlines of the IB/PYP (International Baccalaureate/ Primary Years Programme) curriculum targets. What does it mean to have voice? In terms of the curriculum it is shown through student agency, whereupon a student has independence and active engagement in their learning, and therefore the role of the teacher is to facilitate these opportunities to happen. The 2017 IB0 (International Baccalaureate Organisation) document claims[1] "agency is the power to take meaningful and intentional action, and acknowledges the rights and responsibilities of the individual, supporting voice, choice and ownership…". Personally I find the terminology heavy in IB/PYP documents and this tension between theory and practise, what does voice, agency and ownership actually look like? What is authenticity? Meaningful?

To refer back to Piaget and Papert's term "meaningful object," how I offer an interpretation on what this could imply is to create this connection, whereby the student assembles a personal object to tie the theory and practise of their knowledge together. Enabling learning through making or project based pedagogy can provide a view whereby a student becomes an active agent in the creation of their work, the framework of constructionism and constructivism equips the student with these tools to do so.

1 https://www.ibo.org/become-an-ib-school/useful-resources/resource-library/

How S. L. Martinez and G Stager in ***Invent to Learn***, (2019) elaborate on this sentiment; "the "meaningful" part of constructionism is not just touchy-feely new age language. It acknowledges that the power of making something comes from a question or impulse that the learner has, and is not imposed from the outside...learners are empowered to connect with everything they know, feel, and wonder to stretch themselves into learning new things. We seek to liberate learners from their dependency on being taught." (pg. 36) The independence to act upon an individual's right to learn in their own way is closely tied to agency. As S Martinez and G Stager suggests this can be found through making as the individual can tap into this independence. In this study it is not only the act of making yet also creating the space to be able to do this that is integral in providing agency.

Through the practical experiments agency is used as a means to provide a shift in power dynamics and a way to access a collaborative approach with the students. The challenging aspect of giving a voice to students is catering to the individual's needs, it becomes individualistic, so we must understand the variety of social contexts and a student's preference to learn; are they quiet, observant, or confident and social? Addressing these needs, to cater for each type of voice is essential for effective collaboration in order for a balance to resume, we must listen in order to build meaningful learning.

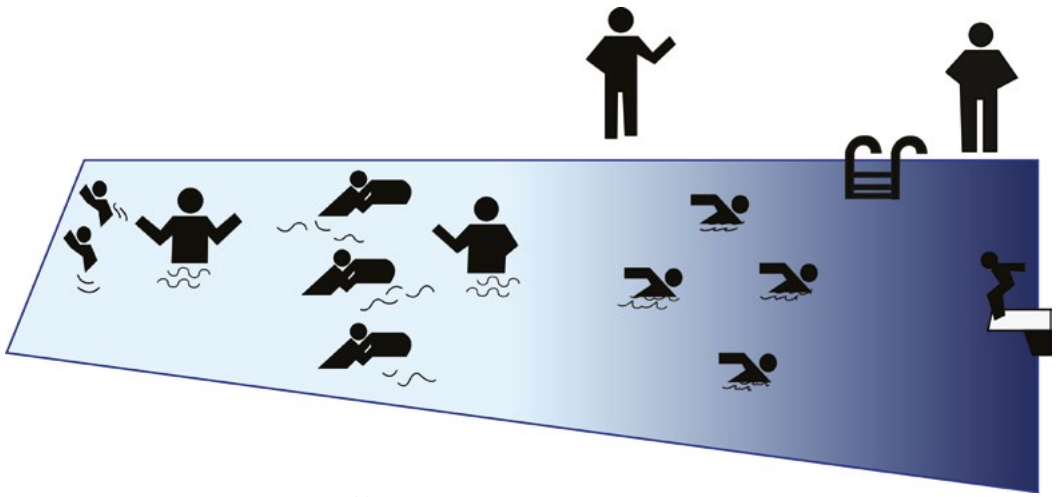


Figure left

Swimming analogy illustrating agency and inquiry[1]

1 [Last accessed 01.11.2020] https://www.edutopia.org/article/bringing-inquiry-based-learning-into-your-class-trevor-mackenzie

Recognising there are different levels of agency that students can access, will help scaffold their learning more effectively; the apt analogy of swimming lessons and how to use agency in the classroom is a useful gauge on how much guidance a student needs. A beginner swimmer may need the guidance of a teacher to take the lead, they will model how to do it and break down the steps. As the student becomes more confident the teacher can encourage them to be more independent, promote questioning for themselves and support them to "take risks" in the classroom. These risks could look like finding out information independently, from other students or through different forms of research material. A student at the deep end would be interpreted as having more agency into inquiring into their learning, adapting to their environment.

Lastly as the teacher devising an environment for agency, it is an integral feature for a makerspace in order for students to engage at an appropriate level which is not purely based on instructionism yet exploration in the materials, projects and activities available. In the PYP "Examining Learner Agency in your Setting" report, states that the adult/facilitator 'strives to position students as actors and authors of their own learning' it's an environment where students feel they can make their own decisions and act upon this. It is not something you give but the student already has the power, the apparent positive aspect of agency is that the student has the free will to determine and act upon their decisions and choices. However, even though inherent deterministic structures come into play, I seek to look to the makerspace to deploy some strategies to tackle this, such as working on methods whereby we work with student involvement and embodied practises. Furthermore, realising my personal agency and fellow colleagues' power could intermittently affect a students determination must be taken into consideration as the exercises are fleshed out so that there is an equal representation.

For the makerspace to elicit making through agency "we first need to realize that the students are not in our classroom; we are in their classroom. And the room is not set up for us to teach; it is there for us to be facilitators in the students' learning. Combine access with motivation and you have an increasingly self-educated population led by experts and amateurs alike." (R Cirmo 2014: P Blickstein et al 2016) The environment must support choice for the student, this could be exhibited as presenting options for students, or reflecting on student feedback in order to tailor their learning experience.

Here, I suggest to contradict my intentions slightly, I begin to hark for the individuals needs or individualism which is important in accommodating for their voice, choice and agency to be heard yet primarily collective agency is the innate ambition. "The intrinsic value of participation is that it offers a range of opportunities: it develops individual and collective agency; it develops friendship, sociability and community spirit." (Alkire, 2002: C. Sarojini Hart 2014) Participatory methods facilitate action and to act is a part of agency, without others agency our own cannot be performed with as far reach or potential without others.

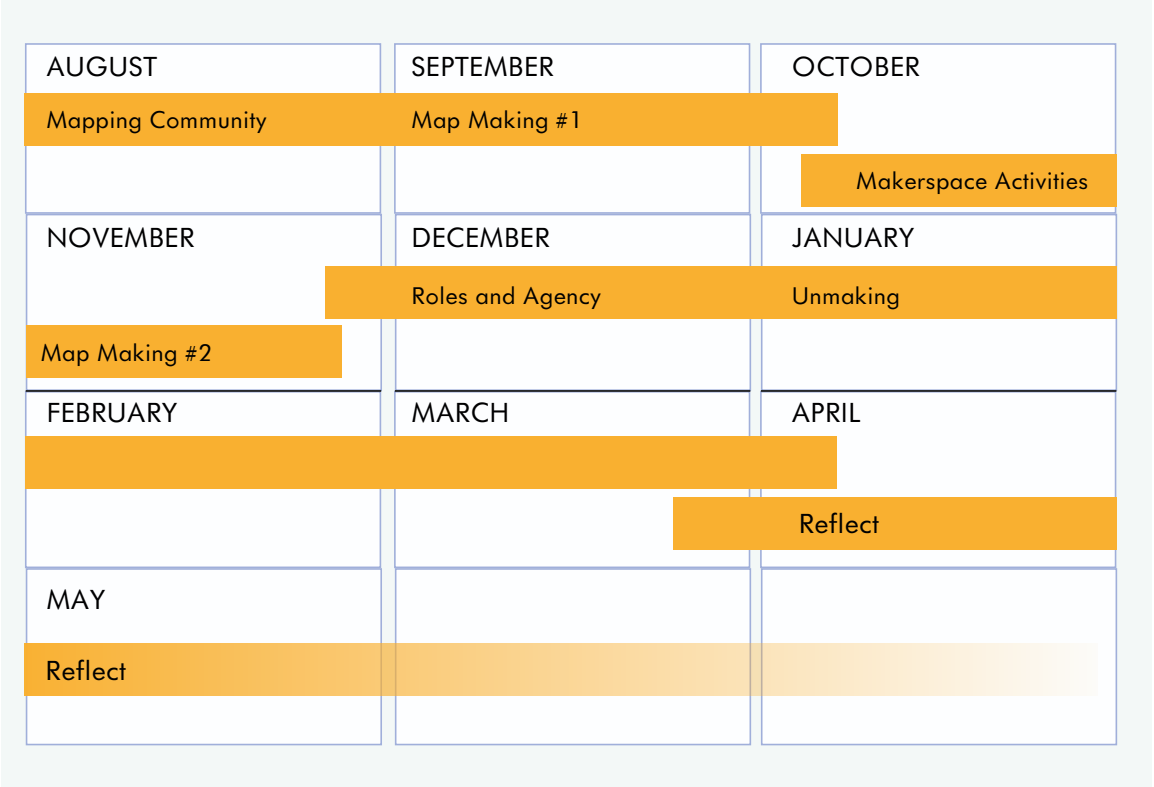
My personal interpretation of agency stems from my position that I outline prior; situating myself in an in-between state has generated questions around how our individual agency correlates with others and of our context. Being in a liminal position means continuous reiterations of deciphering our own intentions, others and space. I must reason that my own agency is influenced by its context, yet this is not necessarily debilitating if each agency has equal representation. If I want to emanate this agency in the process of setting up the makerspace I want to bring awareness of this exchange between relationship agencies. The students can come through realisations of this through collaborating. It also means giving a voice to the students and decision making.

Practical Experiments

During the period from August 2019 to January 2020 fellow colleagues and I began initiating the setup of the makerspace. This process included planning and structuring of the space, as well as preliminary acitivities to demonstrate and test ideas. By centring this work on a collaborative structure, a reflective practise was enabled. In the timeline, you will see how the different experiments panned out and informed one another in their development.

I have grouped the Map Making Workshops together in one chapter, though the work was carried out in multiple iterations due to positive resonses. For each experiment, I have roughly outlined the steps, materials and strategies taken, and recorded the ways the reality differed from my planning. The Makerspace Activities and the Unmaking exercise were exercises within the makerspace, the others formed the structuring, planning and collaboration stages.

During mid- January we were affected by the COVID 19 pandemic. As a result, everything drastically changed and we adapted quickly to home learning. This brought in a period of pause and reflection, in addition to many other changes.



Mapping Communities

In this exercise we used an adapted version of Robin C Moore's version of the Bronfenbrenner's micro to macro concentric system. The students drew their community on the map.

On the following page you see a design I created for students aged 7-8 and (therefore the language is stripped down and simplified.) It was the starting point to drafting ideas around the notion of community. The final result was collaborating with fellow students to make one interposing map. Here we went big and used one large strip of paper to promote more freedom.

At the beginning of the school year I organised a lesson on mapping ourselves in place and time to help each individual visualise their positions, communities, interactions and what they value in their environment. Before firing into constructing a makerspace the focus is to research and uncover ways to be able to collaborate with one another. This activity aimed to provide a bond between the students, and for the teacher and I, to gain an understanding of the individuals and learning styles that were present. This exercise was developed from a workshop I took part in called ***"Global and Local Inquirers"*** which was run by Marcelle Houterman on the 19th-20th August 2019. It was also further shaped by Robin C Moore's study: ***Play and Place in Child's Development*** (2018) where the reference of a mapping system is used (please refer to figure 1 on the next page) which was used as a structure to collate information of where children play.

The concern of this exercise was to grasp other influences outside the students' own world (how they view their context) To collaborate together we must recognise who we communicate with and how they affect our own perception as part of this collective action. Noticing how some students create their own world and prefer to stay inside this, for example playing with their own set of Legos, this activity is one way to look outside of their own mindset.

The importance of space being a third teacher recognised by Reggio Emilia (1962-1976) illustrates how environment shapes our learning and how it can encourage communication and relationships. Giving the children the chance to map their setting is one avenue for helping them (and us) to better understand their influences. By mapping the students setting it brings

A map of my Local and Global Community

Name: _____

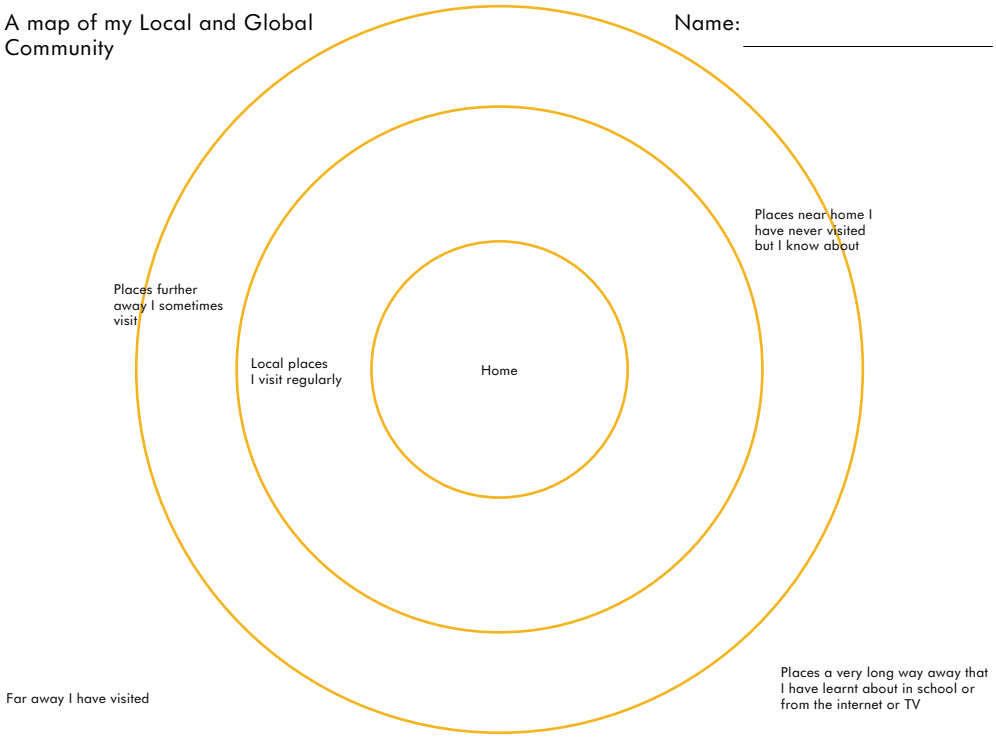


Figure left

An adaption I designed of Robin C Moore's micro to macro map (see below) edited with simplified language for the students to be able to use.

us closer to their influences. In ***"Making Space"*** N. S. Newcombe and J Huttenlocher (2000) interpret "to understand human cognitive functioning, we must understand how people code the locations of things and navigate around the world, and how they represent and mentally manipulate spatial information." They suggest how mapping is a way to decode how we work together. The design that we created for the students contained concentric circles that were similar to Moore's example, in order to illustrate 'small' to 'big'. The exercise going from small to big scale (micro to macro), can be analysed as both a visual representation and a metaphor for 'significance', such as what they value within their sphere of perception.

After first demonstrating an example on the board, we discussed what a "community" meant. For children aged 7-8 this was a complex exercise - with the term "community" requiring effort for us to explain and for them to grasp. Students started slowly, by jotting down ideas individually. Many students, especially speaking English as another language (EAL), initially found the task quite difficult.

Based on a drawing by Reuben Hill, adapted from principles contained in Bronfenbrenner: The Ecology of Human Development, *1979.*

Figure 1 above

Robin C Moore's (2018) adaptation of Bronfenbrenner's (1979)model which determined multilevel, ecological approach to human development. It emphasises the importance of local-global connections in policy formulations. The example is used to consciously adapt to implementing a child development policy, centring around the child.

Two images left

Student responses to mapping their community. Firstly they individually draw and write their response, then come together to see how their maps interact when they draw a large map. The post-its were to record first initial responses

However, as the students began to draw and work with others it became easier to visualise how their lives and worlds interacted. They explored commonalities and differences, drawing on a larger scale map while having conversations with their peers, opened the process. As N. S. Newcombe and J Huttenlocher (2000) note: "even from informal observation, that exposure to maps is much less ubiquitous and much more individually variable than is exposure to our dominant symbol system, language." This became visible during the mapping activities after the students started working together. One new EAL student not only found the language difficult but also where to place herself on the Cartesian plane. The question being; "home or here?" Which raised some very valid questions; are communities based on your current location or where you have grown-up in? There were many options for elaborating, and together we decided to start from her hometown, the place she knew "best". In pairs, students compared how their stories related, realised commonalities and discussed the communities they were part of, and therefore, what they valued .What would a football club value; teamwork? Friendship? Physical health?

Through this exercise of introducing the idea of community, we also explored the idea of shared agency. How other systems are interdependent with our own. Difficult terminology became more concrete through mapping concepts - such as "values" - together. It didn't necessarily need to be defined by the students but rather became apparent through decisions about what students decided to include and present on their maps. Keeping the groups in pairs was an optimal interaction to begin, allowing each individual ample space for sharing their thoughts. The mapping provided a mutual envisioning.

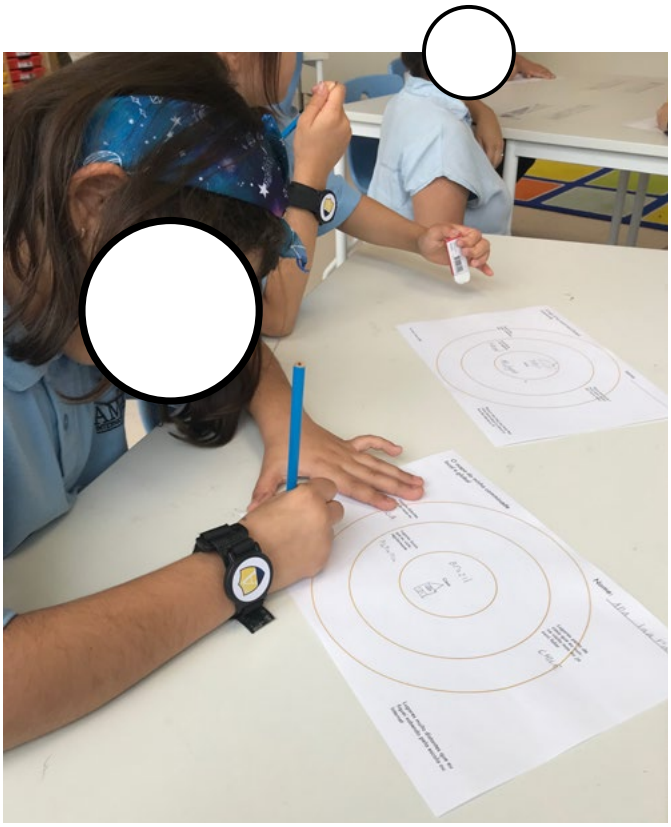


Image above

Student questions what a community means in terms of their situation and context

Makerspace Activities

From 7/10/2019 - 28/11/2019 I led some makerspace activities after school, as a way of bringing early life to the project, and also testing concept and ideas outside the 'classroom'. These sessions were organised as a way to kick-off the project and gently prove its orientation. Teachers and teaching assistants were invited to sign up to lead their choice of projects on selected days of the week. On other days the school contracted specialists in: baking, sports (tennis, kickboxing, yoga, mindfulness) dancing (Bollywood flamenco and contemporary), IT skills, maths challenges and music.

The activities chosen were; 'build your own car,' 'electro dough circuits', 'origami animals' and 'make your own marble run'. 'Build your own car' consisted of assembling a moving like vehicle out of off-cuts of wood. "Electro dough circuits" were an introduction into electricity and how it is conducted by the students creating their own circuits. 'Origami animals' were different templates of animals they could choose from, folding paper to form an animal. The 'marble run' consisted of using recyclable materials to make different ramps for marbles to go down, here we spoke about the use of angles, speed and motion.

I arranged the makerspace activities into different sections. I introduced each activity to them and let them decide amongst themselves who would participate where. This decision was partly due to the fact that the resources weren't abundant and partly because I wanted to offer choice to the students.

In these exercises we start making in the makerspace; concentrating on learning by doing. We played around with transdisciplinary subject matter blending some science exercises with creative subject matter. Students used available materials in the makerspace that teachers and students had brought in. Materials such as Lego, wood off-cuttings and the Playdough circuits had been bought by the school, recyclable materials had been brought in by teachers and students. For more information on the different activities please find the related pictures which have attached links with further details.

The different projects had been based on a constructivist/constructionist way of learning through doing and making and as the facilitator I tried to practice a non instructional way of performing, also exploring the materials with the students, yet not giving answers.

The students were all very absorbed with the activities which on the surface looked like "success", but to me, the sessions felt a little too condensed - brief even - due to the limited, after-school time slot.

When planning for the future, I would spend more time in discussion. Asking the pupils before the lesson what kind of activities they'd like to do, and also spending time afterwards reflecting on how they would like to continue their making or which activities they would like to try next time.

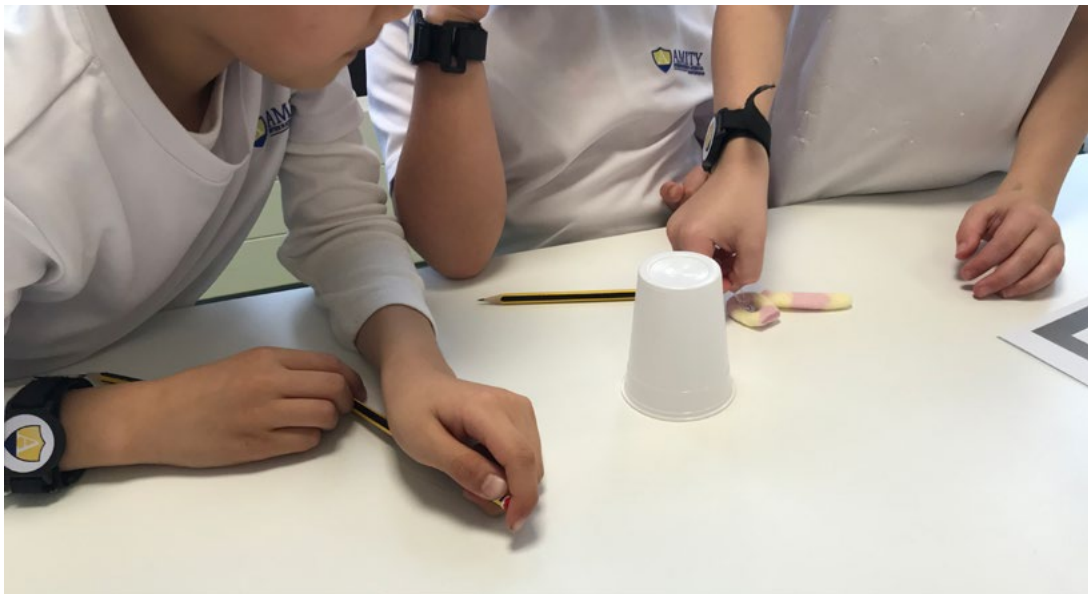


Figure left

Collaboration exercises "Save Sammy the Worm"[1] problem solving game

[Last accessed 30.10.2020]

2 https://mariventurino.com/2018/08/12/saving-sam-a-team-building-activity/

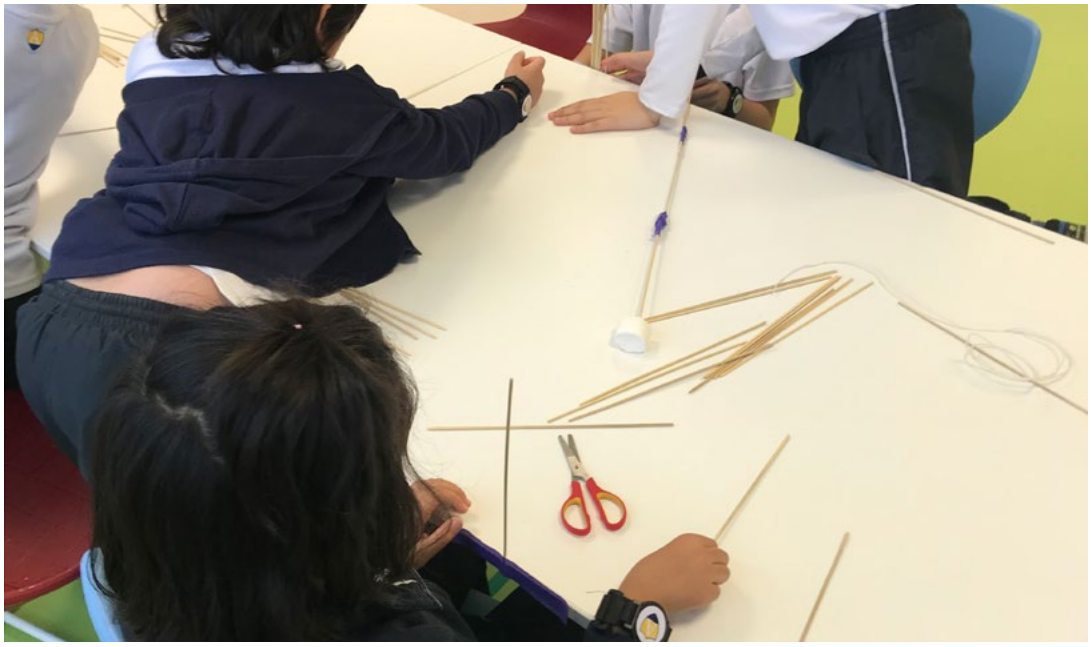


Figure 2 left

Student collaboration exercises "Marshmallow Tower" construct a tower with limited materials.[1]

[Last accessed 30.10.2020]

3 https://toolbox.hyperisland.com/marshmellow-challenge

I worked with a small group of 8 who were aged 6-8. Due to students coming from a range of year groups, some students were familiar with each other and some who were not. These activities were early on in the stages of the makerspace setup and therefore felt quite experimental, as a united decision on a structure had not yet been made. Due to this being presented as a 'club' running alongside the framework of school it had a different purpose and as such, the expectations were more undetermined, and activities were carried out with freewill or lightheartedness. In its basic form it was not only an experimentation with the students but also for myself - with the focus on doing, learning through making and material focused lessons.

I started each session with team building or collaborative exercises in order to establish collaboration and inclusivity at the core of forming the space and the approach from the outset. These different exercises were perhaps difficult for this age group, so it really challenged all of us.

For instance, the marshmallow team building activity (see left figure 2) pushed their communication and problem solving skills. At times, they wanted to give up in the process, saying it was too hard. Despite the challenges they kept on inquiring nevertheless. Often, I observed students asking for help, or for adult interjection; students can have difficulties with overcoming a problem independently. They often followed established designs without considering different or creative solution; or wanted to give up after trying one idea due to being frustrated when something didn't work the first time.

Consequently, the activities were quite confronting and new to them, as they do not regularly work together in this team format, and sharing can be difficult at times somewhat due to their age group. However, they responded positively and adapted quickly to this way of working. Considering that this was a new experience, they were generally very competent at making and constructing within the encouraging and collaborative environment. Work that was hands-on and shared rather than individual and familiar (like drawing, for example) yielded new and interesting results. My observations were that engagement through physical exploration worked as an effective way to assimilate groups, and that these challenging and collaborative activities and methods can be used successfully with this age group, at an introductory level.

With deeper insight, the decisions on these activities were inspired by STEAM enterprises, especially from one online practitioner in particular who shares projects through social media (please refer to this link[1] for more details [last accessed 01.11.2020])

When considering the makerspace as part of the wider school system, there is a strong pull to incorporate 'outcomes'. According to, integrating transdisciplinary learning into the curriculum requires reflection on the genuine interest of the pupils. As such, the popularity of playing and working with materials such as Lego can be noted not just as 'fun' but also as a significant opportunity for learning.

By focusing time on making and exploring, a positive attitude towards learning can be created. However, by separating these activities from the 'normal' learning day, a distinction is indirectly created which in some ways undermines the importance of alternative learning. Elements of creation and discovery can and should be incorporated into students daily lives, so that children apply their learning through their own agency. When these opportunities are presented as 'optional' and 'outside' of the school system, the decision and value judgement often depends on the priorities of parents and not the expertise of educator.

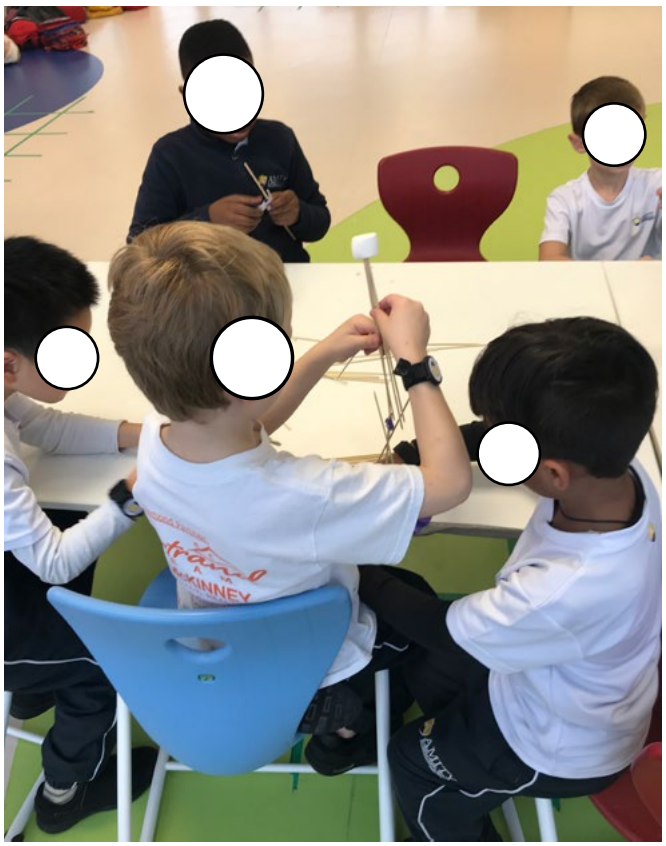
As we discovered through this example, ideals must co-exist with the power constructs of a school, which can have slight inhibiting effects, including expectations, longevity of projects and meaningful alignment of learning goals.

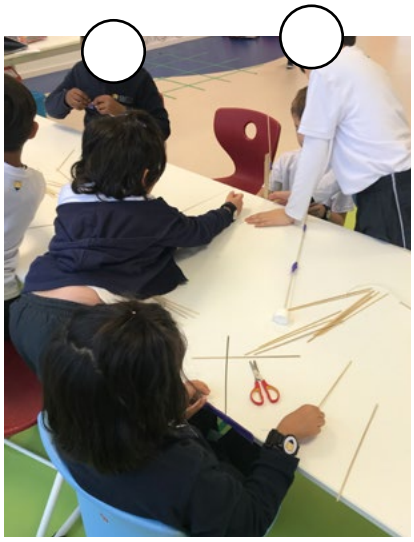
Here my own personal agency was often challenged both reluctancy and apprehension when contemplating how to proceed with creating a powerful and shared learning environment. My personal preference towards informality was omnipresent in the activities and resulted in some tension within the context of the school.

It was comforting to find that this interplay between informality and formality occurs throughout the literature I surveyed, which helped me to better articulate why projects should maintain an informality and intimate space for learners. "Formal learning environments cannot easily give groups of young learners either truly meaningful roles or opportunities for participation in longitudinal projects" (Heath p. 257 as cited in B Bevan & S Vossoughi 2014)

Despite these challenges, there are also upsides to the informal space we created. Namely, extra flexibility and reduced scrutiny when compared with the limits of a school routine. An obvious example being through testing students' performance and the accountability that surrounds this. The fact that extra-curricular clubs are non-tested provides a freeing idealism and allows for additional student and educator agency.

1 https://babbledabbledo.com/





Figures top left and right

Student collaboration exercises "Marshmallow Tower" construct a tower with limited materials.[1]

[Last accessed 30.10.2020]

4 https://toolbox.hyperisland.com/marshmellow-challenge

Figure above

Students create a marble run out of Legos. They can use any materials, recycled or new.

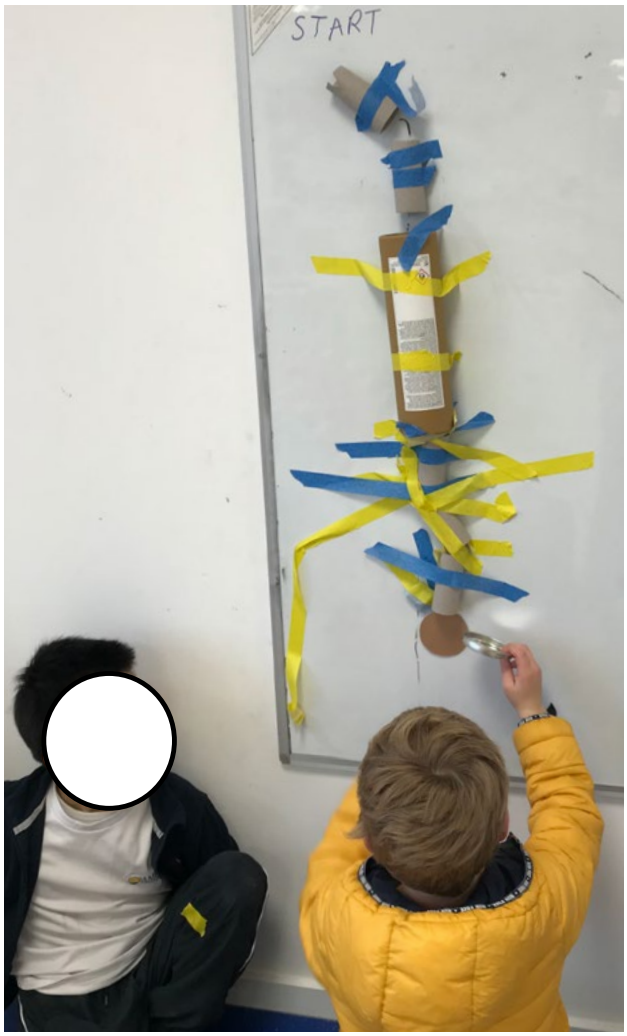


Figure left and above

Students work in groups to create a marble run[1]

[Last accessed 30.10.2020]

5 https://babbledabbledo.com/how-to-choose-or-make-a-marble-run-your-kids-will-love/

Figure above

Students playing with Playdough circuits taken from Tech Will Save Us[1]

6 https://www.youtube.com/watch?v=x-EBOu5K_v0&ab_channel=TTPMToyReviews

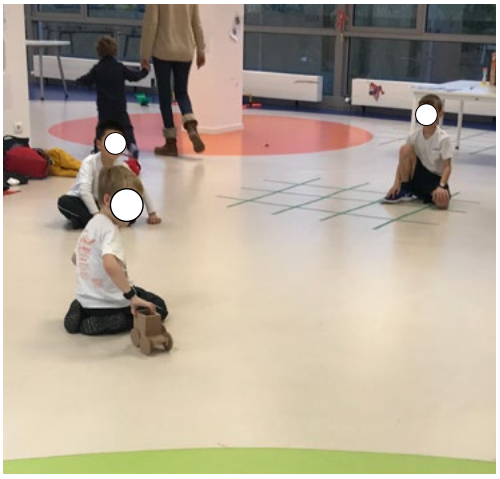


Figure above

Students make a car out of off-cuts of wood together

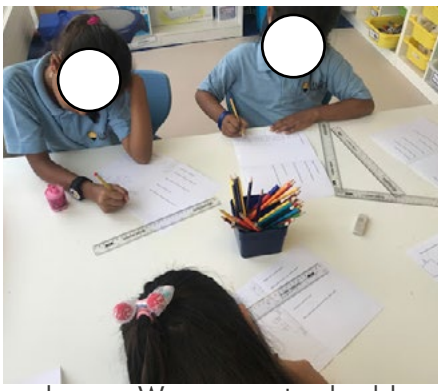
Map Making

The map
making exercises
were split into two different
occasions, to explore different methods
and incorporate different viewpoints.

In the first occasion, I showed a suggestion and the students then drew onto a plain piece of paper. It was an introduction into what a makerspace is, idea sharing and the main aim being to initiate the space as the students. The second time the objectives were similar but a pre-drawn map served the foundation. The results are explored in text and photos.

Figure below

Students draw their own designs for the makerspace, taken 27.08.2019



Mapping our context is a great reflective tool for gathering insights and dispositions at distinctive points in time.

It can also be considered as one multimodal way of listening. As we learn in *"Ways of seeing: using the Mosaic approach to listen to young children's perspectives"* (Alison Clark 2005) the concept of listening can be extended to include activities of collaborative making and mapping.

In this study, children used mapping as a way to record their surroundings and then acted as 'tour guides'. Encouraging students to use photographs, video, presentations, or 'galleries', interviews, tour-guides and mapping techniques also worked to create a rich bank of evidence about what the children are learning. This emphasis on giving students opportunities to participate through varied mediums is very significant within my own practice as an educator.

The first map making session was on an introductory level and with one small class ages 7-8, the second adversely was aimed at eight different classes of ages ranging 6-12.

Reflecting on the maps the students and myself created, I see how they have served as the basis for powerful expression and exchange. We were not only able to share and create stories about our shared space, but these maps can be a tool to view more complex and abstract ideas about leaps in time and changes in our context.

By expanding the project and research to welcome the interests of different year groups, a

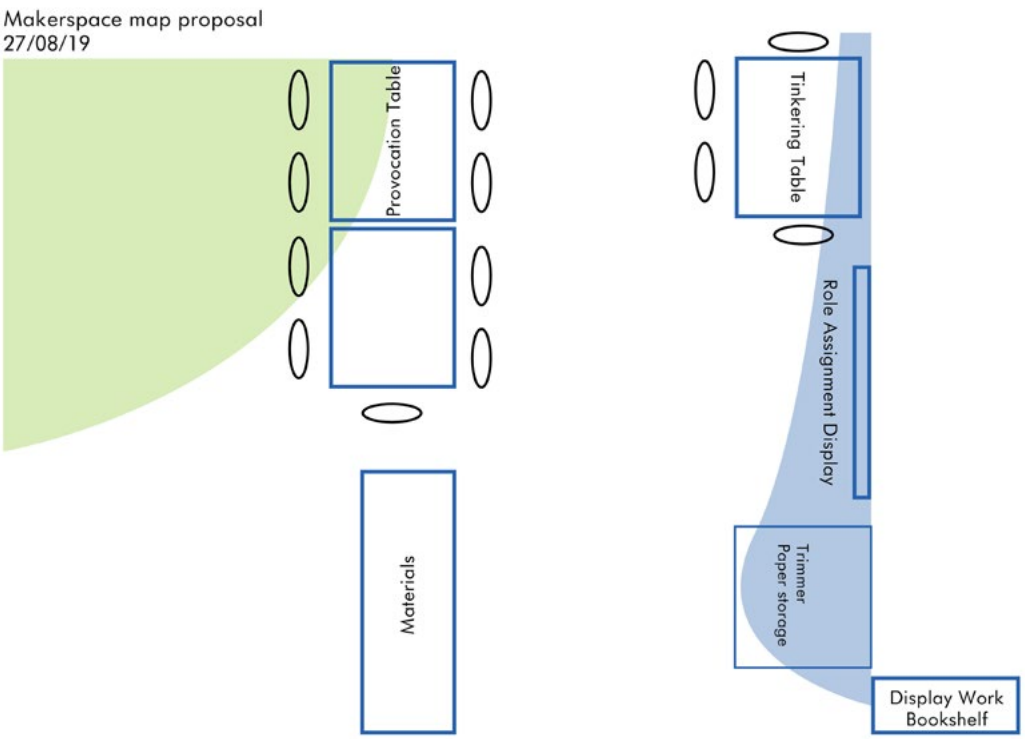


Figure 3 above

This map proposal was sketched on 27/08/2019 by myself, this transformed over time as the project began to open up and with more focus on student voice. This original draft was intended to open the discussion with students before collating their map proposal idea.

multitude of ideas and interests were exchanged. We gained insight into student preferences, learning styles and priorities. We also gathered knowledge about our shared space, and in the process, were able to create a sense of shared ownership. Together with the students, we compared and discussed maps as the space changed. In this way, the maps served as pointers in time which helped to create dialogue and reflective learning.

Map Making 27/08/2019

The first session began with me introducing what a makerspace is, and we mind-mapped ideas of what this word or place could be. After showing my design proposal (Figure 3 above) of the makerspace I asked the students to do the same. They mapped out their preferences, considering the best way they learn and how this would look on paper.

After creating their design we made a gallery walk of our designs (refer to Figure 4 next page), with 3 votes each (one vote for one design) we discussed the similarities and differences, what worked and what didn't from the drawings with the most votes.

Prior to this we had some valuable conversations on what a makerspace could be, I transcribed what they said on a board, discussing what making was. For the students, myself and fellow teacher we were testing out a democratic method whereby we tussled out between us through conversations and voting together. However, pressures of competition still ran through some of the students, wanting to earn their spot with others. We emphasised that it wasn't the drawing or favourites that mattered.

Discussing ideas and coming together was the main exercise; it was unfortunate that these competitive forces were present yet it was necessary to tackle this together and communicate in new ways; sharing ideas.

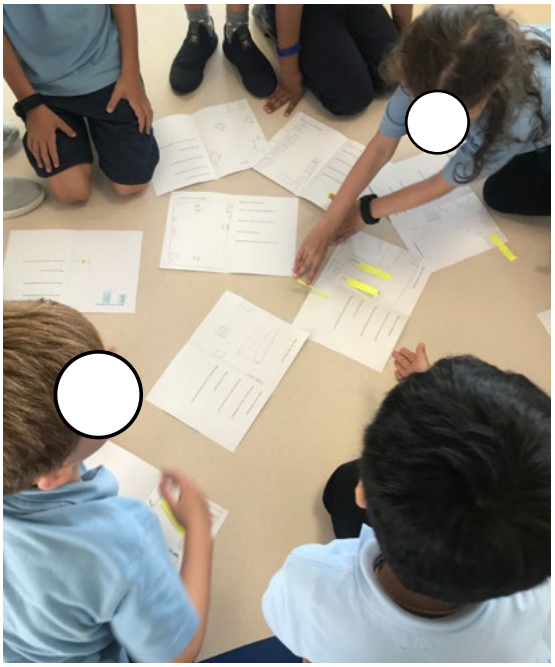


Figure 4 left

The pupils discuss and compare the maps. We use a voting system to decide the ones that stand out the most. Though some frictions arise due to a competitive nature.

Map Making 19/11/2019

For the second iteration of this workshop we came to join together with more classes. It had become a department goal (for professional development) for other classes to join in evolving the makerspace, the project opened to include 6 other classes for this activity, from ages 6-12 and their respective teachers.

Our department recognised how we wanted to prioritise setting up a makerspace yet we hadn't come together as a collective to discuss this in detail, which added a layer of uncertainty with regards to expectations. Personally, I had wanted this to be collaborative on all levels from student body to staff. However, advocating for this approach proved difficult due to the limitations of times and an overall lack of persona; authority over the project design.

As a result, the second map making exercise took a different direction compared to the first session held in August 2019. Students were asked to consider the full shared area and how to divide this space. Many classes were included in the process, due to the common nature of the area. Though complicated and at times tense, this collaboration was absolutely necessary to establish shared equal ownership.

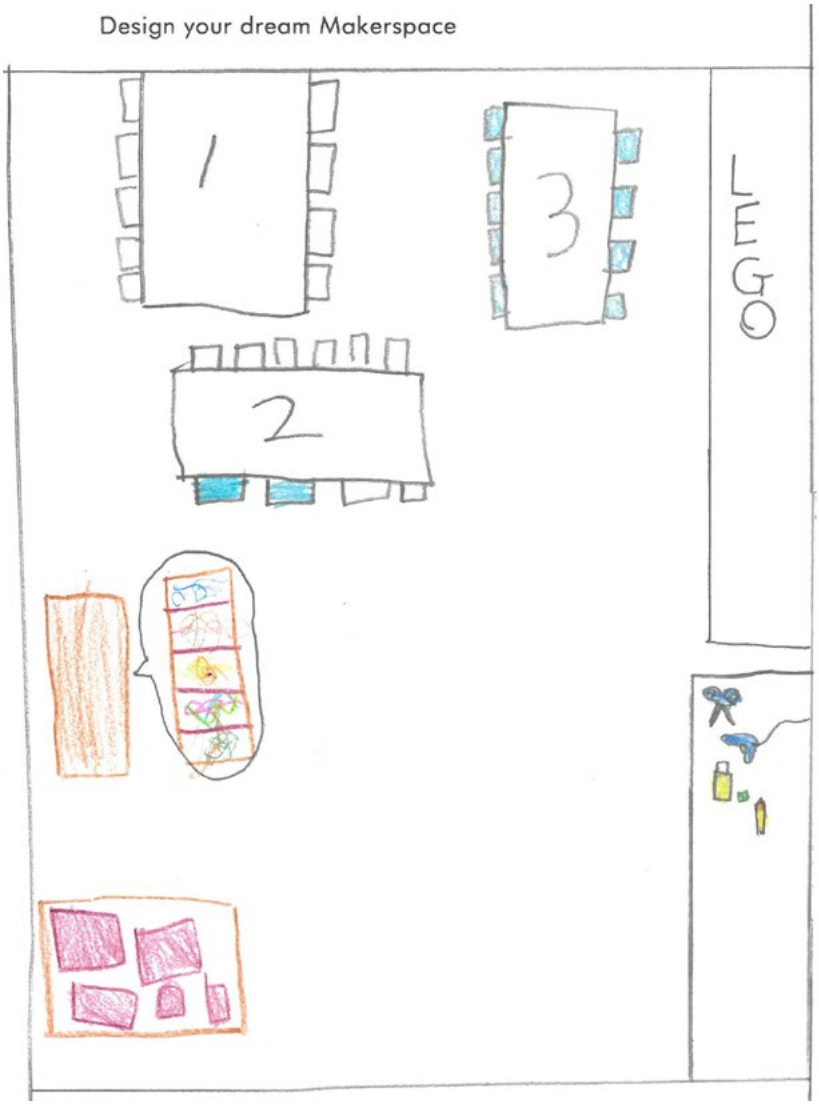


Figure above

Students were given a blank template to draw their own map after viewing our suggestion. Student drawing taken on 19/08/2019

The teacher's involvement, in particular their response to the activities and presentations, significantly shaped the way the workshops evolved.

Myself and a fellow teaching assistant presented our ideas to the whole of primary year students and staff, my main objective was that I wanted to introduce the intention of how we can work together. During our presentation we asked students to jot down notes on post-its, any ideas that came to them whilst discussing what a makerspace could be. We posed problems about the space, and we also offered suggestions, such as how we designed the area and also potential roles students could take to help. The post-its could then become helpful when we asked them to draw a makerspace in small groups, so they could share their ideas amongst themselves and as a starting point to help combine ideas.

In some cases, the pupil's choices guided the work, whereas others were strictly defined by teachers. For example, some of the teachers asked the students to work in the space in groups of their choices, whereas some had asked the children to go into the classroom and work individually.

Uncertainty surfaced throughout the course of the project due to multiple iterations becoming possible. I observed that uncertainty can be challenging yet rewarding. In Participation is Risky (L. Huybrechts 2014) raises how participatory projects involve risks due to the "maker putting ideas on the table where they, then, are open to adapting, changing or critiquing by the participants. By doing so, these ideas may well be transformed and personalised by the participants for new, unexpected contexts that the maker did not forsee." (pg 55)

We certainly experienced the 'risky business of collaboration' through the varied ways that participant's approaches, interpretations impacted the collective goals and outcomes. It was interesting to see the different ways in which this developed, especially when compared to my plans and expectations. Especially when decisions needed to be made on-the-spot to negate and share the space.

Observing the different styles and interactions with the separate classes showed this quality the challenge of the exchange, converging from prior expectations and revealing new perspectives. A myriad of narratives were provided by the students, and assimilating all this information to one defined action was a difficult task. However, dealing with a large amount of feedback and rich ideas was also an extremely valuable starting point for the project.

However, this approach of starting 'small' (small as in the act of coming together) gave a large insight into use of language and the sometimes limiting effect it can have.

Viewing the maps later revealed that our specific terminology had indirectly created boundaries around the imaginative possibilities of their designs. For instance, some of the older students had simply written a STEM (Science Technology Engineering and Maths) area without mentioning 'Arts' at all, and without making clear what this might look like or be to them, especially in comparison to what this might look like or be to a teacher.

Therefore, we saw clearly how ambiguity and power often lies within the use of terminology; which educators like myself must be wary of using without careful consideration. The term 'languaging' Postman & Weingartner (1969) can be used to reflect on this, especially how language operates to 'close' or 'open' the mind of students. In an international school, language is additionally challenging due to the diverse forms of communication and expression. The issue is not necessarily just if the mind is to be opened or closed, moreover to accept each form of expression as a valued contribution in the context given.

To provide another example, we take the scenario of two students who speak English as a second language working with a teaching assistant to translate their ideas onto the map (figure 4 next page.) What we see is a translation of adult, student, divergent languages and ideas coincide. The teaching assistant later told me the students hadn't really grasped what a makerspace was and therefore had ideas such as "looking point - for binoculars" and an "area for Miss. Pixie" (the school dog.)

Here, you have more visible adult interjection or direction, such as what clear definitions about what materials might be used, in an "Art area" for example, there would be: pencils, makers, pens, paper, glue, scissors", clashing with the imagination of the children.

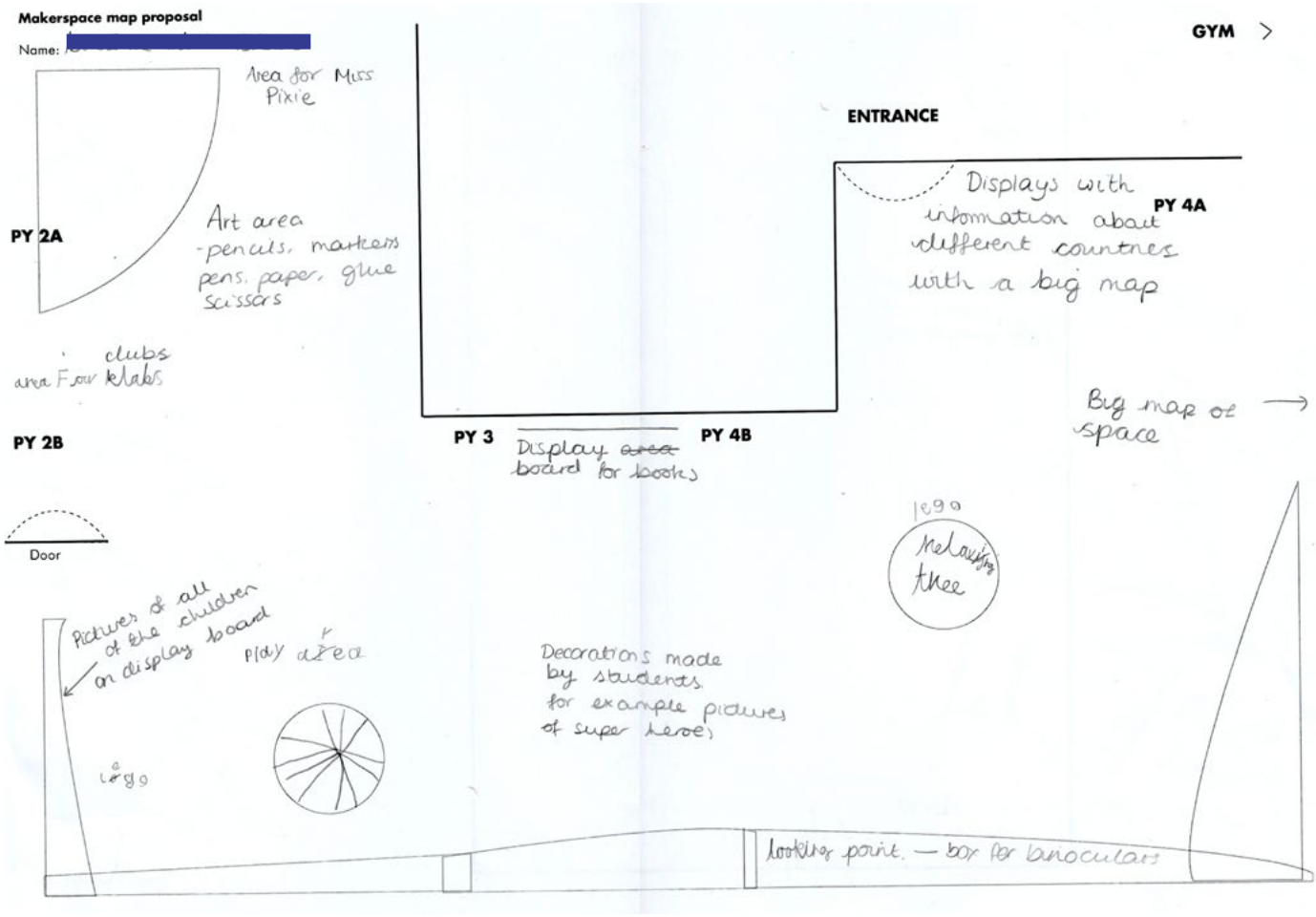


Figure 5 above

Map designed by students who speak English as a second language and supported by a teaching assistant

Figure left

Presentation on "What is a Makerspace" led by Natalie and I.

What we (hope to) see is an acknowledgment of all voices on one page, without hierarchy. In this particular example where the students have missed the subtleties and precise definition of a makerspace, an array of ideas, beautiful misunderstandings, and quite refreshing ideas and concepts emerged.

In the research paper "Principles for Equity-centered Design of STEAM Learning-through-Making" (E Tucker-Raymond 2019) outlines how 'current conceptions of making as part of scientific inquiry are often situated in dominant, white, male, middle-class cultural values and practices which are offered to communities and youth of color as promising interventions (Vossoughi, Hooper, & Escude, 2016). This approach, both ideologically and in practice, continues to position non-dominant cultural and linguistic communities, including youth of color, as needy, rather than as sources of powerful thinking'. Here, language can be used as a tool to exclude or segregate, or even to alienate; the words become empty.

This one particular post-it note (figure 6 right) from a student caught my attention due to its hopeful tone; that the makerspace could provide a way to collaborate and to help one's future.

It also caused some tension whilst reflecting on the weight of the words and on the potential of the space. How do we decide which expectations and values should be at the forefront of the learning? What is appropriate for an 8 year old to expect of any space or place of learning? How do we, as educators, best 'help' the 'future'? Were these ideas or just our own words and concepts being echoed back to us?

Being aware of how we use language is a constructive

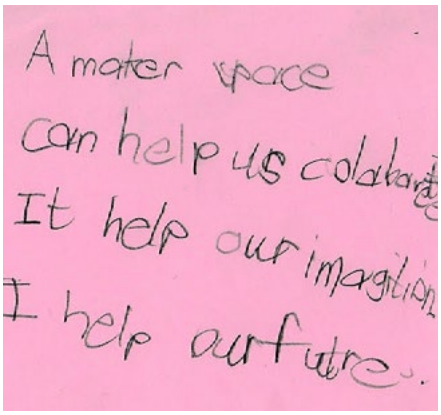


Figure 6 above

"Makerspace can help us collaborate. It helps our imagination. It helps our future" post-it taken from: map making workshop 19/11/2019

realisation, developed from this practise. Considering other makerspace communities we see how language can be used to transform and commercialise them. The language must become understandable and accessible in the education realm, becoming a commodity or a 'step by step' guide of 'ideas-on-demand' style.

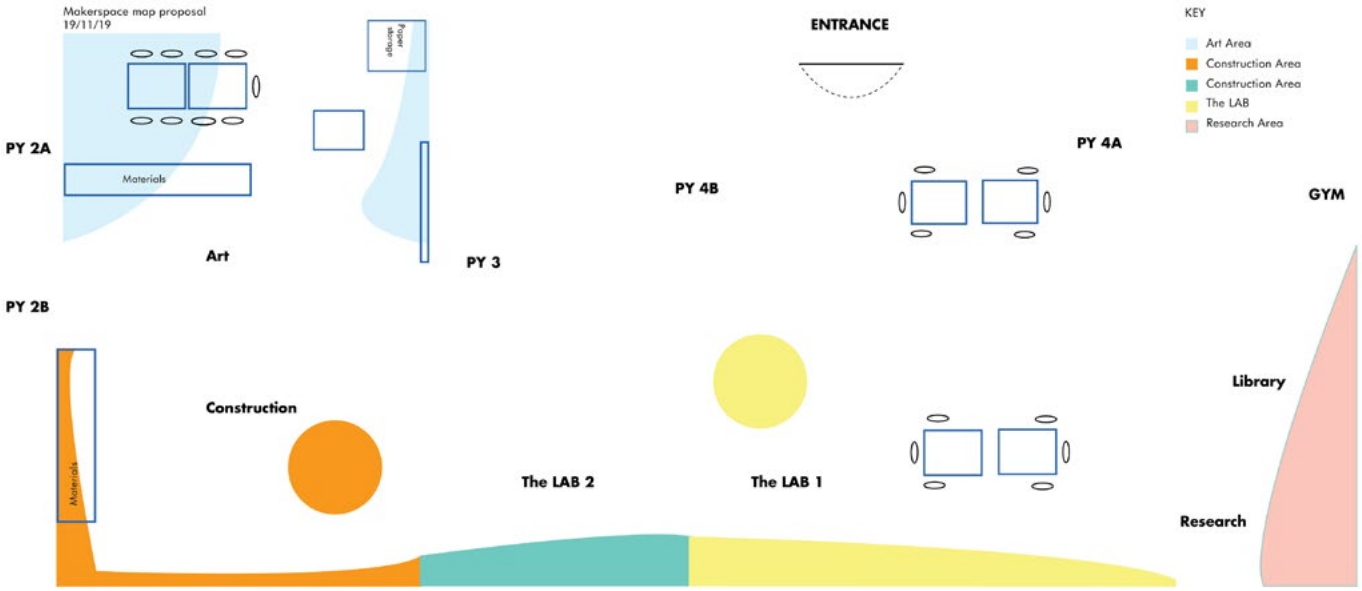


Figure above

Map design suggested by myself after discussing with staff on how to separate areas, this was subsequently shown to students as an example

Then there is also the transformation language undertakes when it is aimed specifically at children's education.

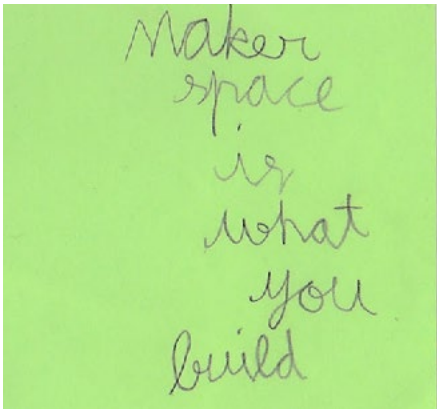


Figure 7 above

"Makerspace is what you build" post-it taken from: map making workshop 19/11/2019

Then, there is a transformation of language as it reaches different demographics. Language transformation is endless; until you are left with the shell of its original purpose? Language simultaneously deconstructs meaning in relation to the context of the perceiver. How can we better ensure that it best serves what it intended to do? If we are to become a critical maker as Verena Kuni (2019) proposes, then these discursive tools must be understood and unmade, to reveal new productive forces. 'Perhaps critical making is most adequately defined as a simultaneously constructionist and diffractive process of learning: a tacit, material, and conceptual transformation' (pg14.)

A concluding thought is that we must make a concerted effort to rid ourselves of the regimented function of language and focus our attention on what we are making and why. This post-it (figure 7 above right) particularly stood out with regards to this sensibility of focusing on the process - what is being built. In a literal sense it could be interpreted as the space is all about what you personally make. However, abstractly it could be read as what is being built as a whole.

Considering how we introduce this space seemingly becomes indicative in how we want it to develop. Starting with a heavy language approach will produce such input, how can we propose a language that is more demonstrative, open and active? This practical iteration determined that language and the use of language is the greatest hindrance in encouraging more embodied practice, how can we promote students to think, act and feel at the same time?

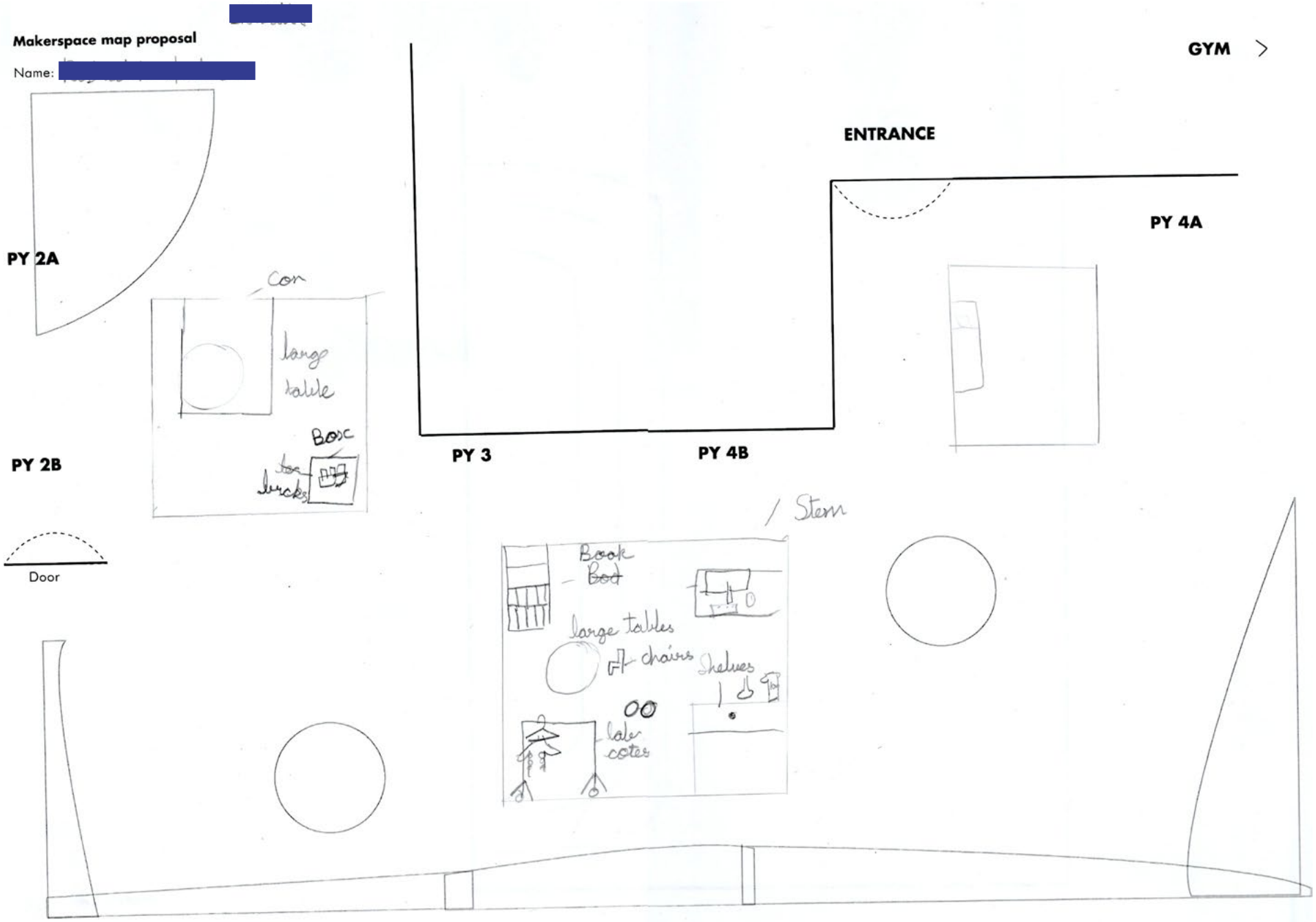
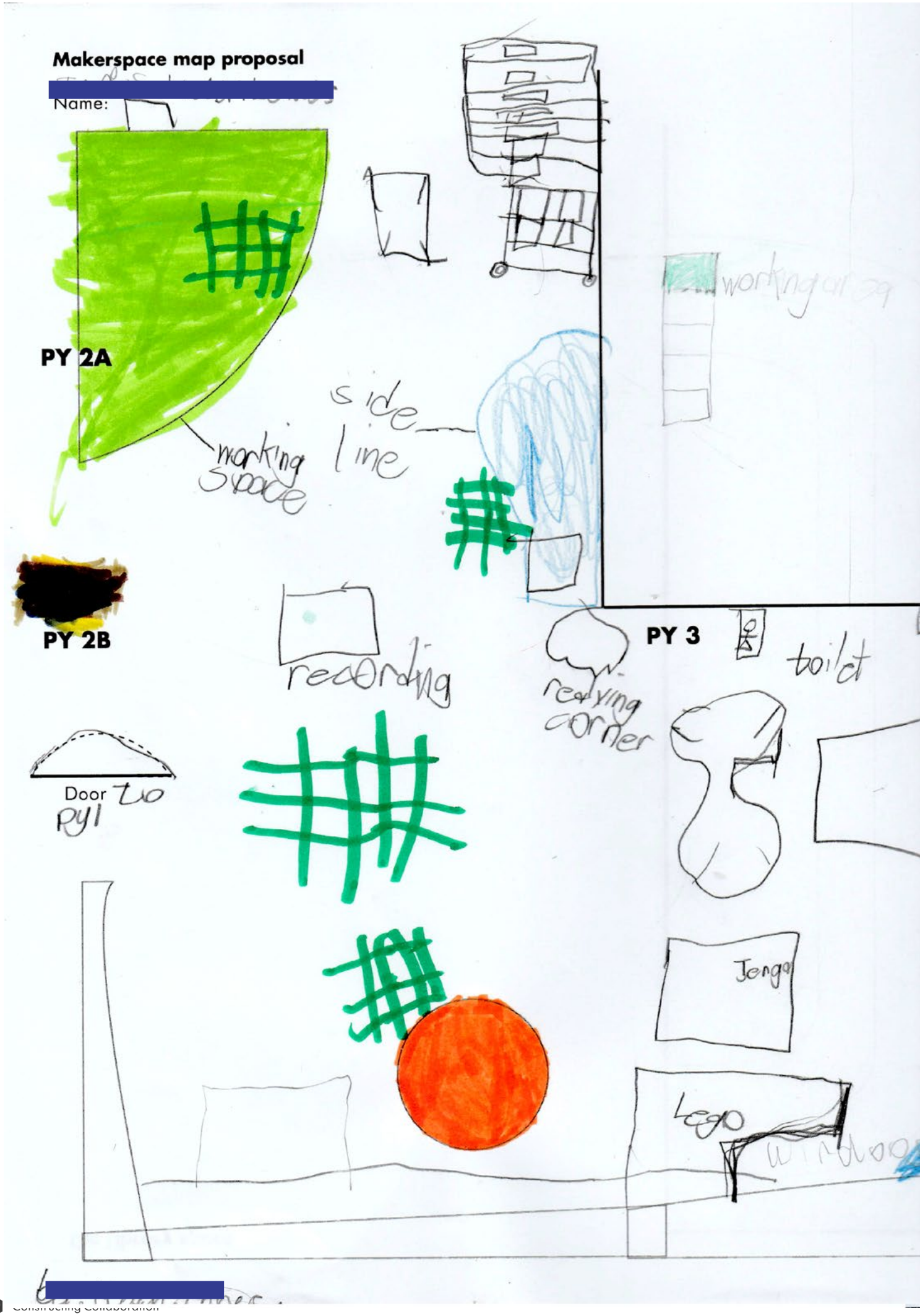


Figure above
A group of students map design from 19/11/2019


Makerspace map proposal
Name:
PY 2A
marking space
side line
working area
PY 2B
recording
resting corner
PY 3
toilet
Door to PY1
Jenga
Lego

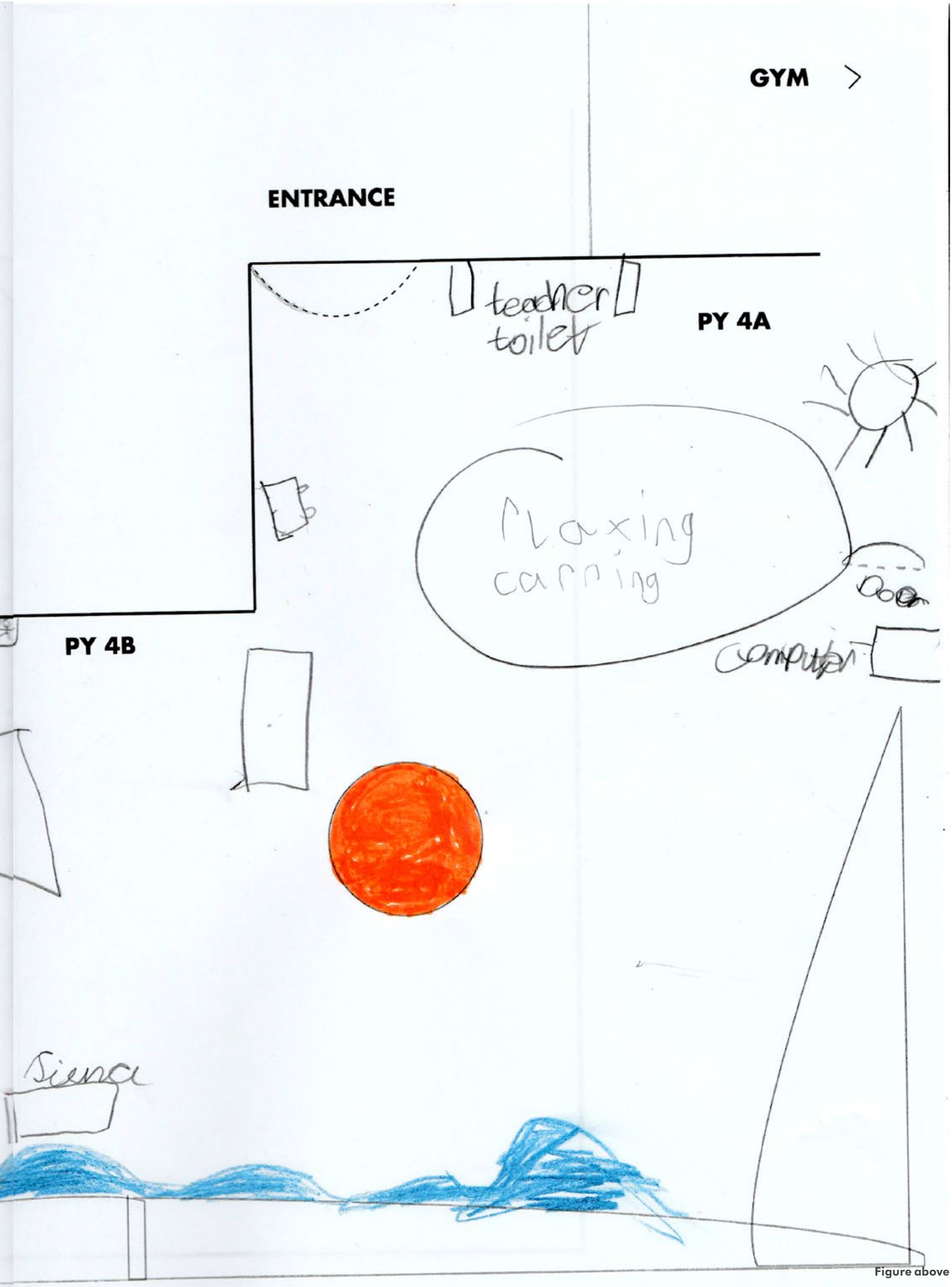
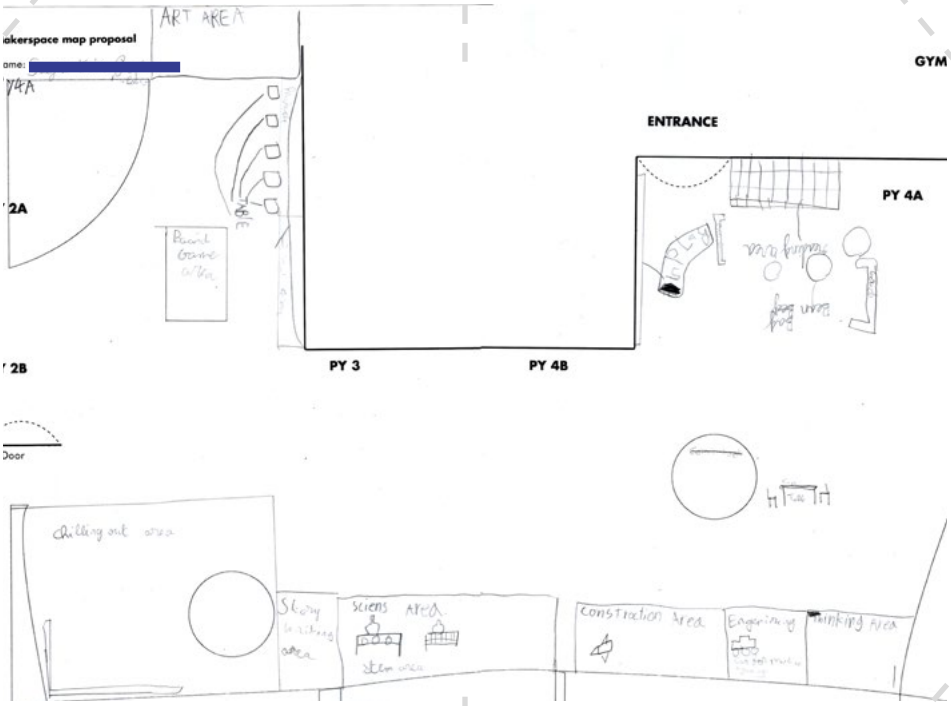
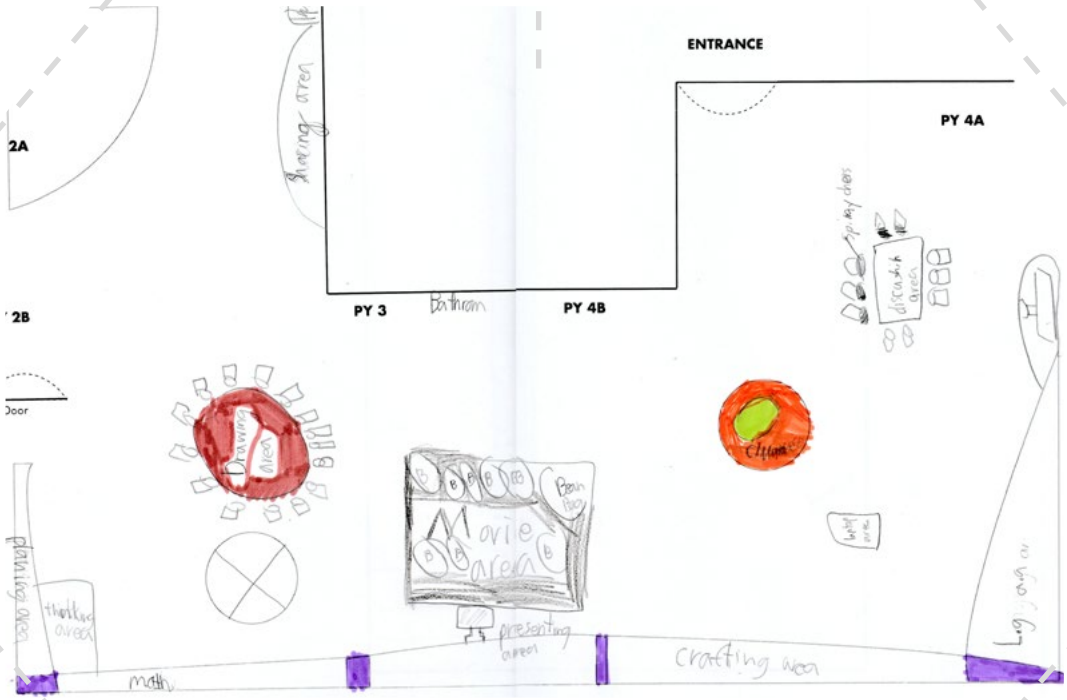


Figure above

A group of students map design from 19/11/2019





Two figures above

A group of students map design from 19/11/2019

Roles & Agency

This exercise became a purely organic or spontaneous one due to the children's curiosity. We designed and made a display board, with the aid of a projector, we drew out a map then collaged over the top. It culminated over 3 days or so, slowly adding pieces of tissue paper when we found the time to. The students and I had conversations on what we would like to draw on there together.

Figure right

Students offer to help design and make a new display board. We take the time respond to each others ideas

The value of having a role in a community is one element of empowering an individual. Offering roles to students can include them in the infrastructure of the school, taking part of the decision making affords agency and to take action. Implementing agency could challenge power dynamics, here I outline how encouraging various roles could achieve this. Instilling a structure based around agency is motivated by a constructivist/ constructionist viewpoint which I go onto illustrate in this example.

Listening to children can be a catalyst to decision making, in this example it started with the student's curiosity, asking "what are you making?" Developed into us having a conversation on what kind of display to make and what it could be about. The class teacher and I then arranged the students who were interested in rotating the role of a "display artist." Following student interest led us to student initiation, student responsibility and a more communal act where the power or decision making was not just dependent on teachers or myself but through a shared effort. Working with a class teacher who fosters a similar approach to myself further developed an environment for us to naturally come together, without her trust in our process we would have had less freedom to have these conversations or to act.

I began to identify how nearly all students when asked if they'd like to participate responded really well to drawing and beginning the map display art board. However, one student who is not particularly confident became overwhelmed and didn't end up participating, she stood there frozen at the board. There seemed to be a breakdown in communication or trust and so this response surprised me, and yet it was an important reminder on the struggles of collaborative work. It relates back to the swimming lessons analogy and what personal "risk" a student is willing to undertake, perhaps you want to be included in the group yet do not feel comfortable with trying something new and so stay towards the shallow end. Offering the choice however is vital for a student to be able to have the chance to take risks, try something new and to feel a part of the responsibility of their environment and their actions. Furthermore not feeling comfortable or even wanting to participate should be accepted and an option; being able to decline offers should be a reassured conversation and constructive with alternative suitable opportunities.

Figure left

Students over time add to the board, it is interesting to see how each individual responds to the collective agency

In the Reggio Emilia approach they illustrate how in group dynamics they recognise democratic participation as a way to negotiate meaning and shared experiences. (C Edwards 1998) The Reggio Emilia school of thought has been a backbone and source of practical resolutions that have been rendered into the makerspace. The Reggio Emilia curriculum is constructivist by nature, student led and exploratory, all of which aligns with the collaborative approach of setting up the makerspace which guides this project. It additionally advocates for a concept of agency, for example a goal of Reggio Emilia, is for the children to develop a sense of autonomy and that the idea of school works on a system of relationships. It aims to reach beyond the individual through mutual exchange with others (C Edwards, 1998, pg.297) suggesting how, through the agency of the individual student they can connect to others in their community through their understanding of sense of self, to acknowledge others and create a sense of collective autonomy.

As a result of this experience and motivated by the outcome of the students being interested in sharing responsibilities, I decided to share a list of different roles a student could sign up for in the makerspace area with fellow colleagues. Display artists, technicians, eco friend, stock inspector, and co-teacher were a few suggestions I gave; this was received well by the teachers however, there was confusion surrounding how to instigate this into their situation. In comparison to the natural occurrence and fluidity with the experience with the other teacher and myself, it becomes evident that these receptive situations often cannot be replicated unless there is an intrinsic shared reasoning. It also highlights that experiences must be consequential to each class, to each individual.

To conclude from this study, the makerspace would need a system to centralise this way of working as its own discourse, not for individual classes (or age groups.) The space should be open for different classes to work together, here I give the example of working with just one class and for the future I would have to trial working with different classes in order for this to really be unified. By responding to the environment or the situation we redirected the flow of power to one of ownership to the individual, giving space to decision making. It opposes a formality that certain types of education settings can constrict, it does however mean we need space and time to be able to respond in such a manner. And in a time of efficiency this approach is perhaps not sought after.

Unmaking

This exercise was inspired by Project Zero (please refer to image for further details) and as a response to observing what activities we should utilise in the makerspace. It involves "unmaking" or "deconstructing" disused or old gadgets, technology or mechanical/moving objects. Students are able to physically take apart with tools or to observe or play with the item, to gain an insight into how it works.

At the beginning of January 2020 this investigation was a trial in an Unmaking exercise with the students. A colleague and I brought in some physical objects (an old film projector and an automatic film camera) to investigate how the gadget works. We also suggested that they could do something similar and bring in old objects or unused technology to discuss or take apart, to reinforce the element of agency and having an active role in their learning.

This activity was partly inspired by researching Agency by Design: thinking routines + tools + practise activities by Project Zero[1]. Their ideology on encouraging active processing and critical making skills (learning through making) have activities based on unmaking and agency which were a springboard into inducting this exercise. However, I came to the conclusion after assessing the students prior knowledge that most of the activities were not appropriate for age 7 to 8 years old, so

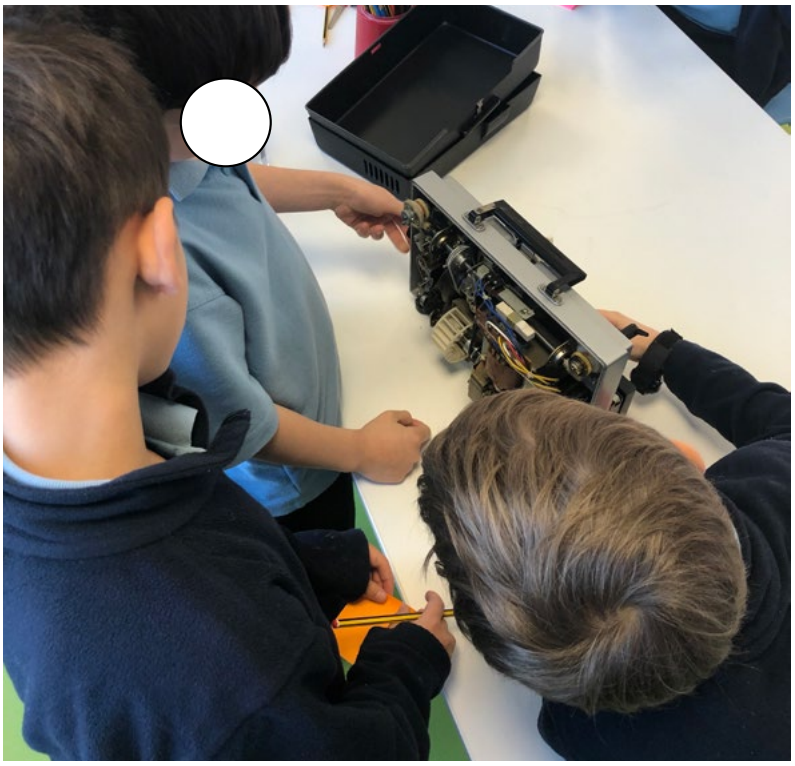


Figure 8 above

Students in a hands-on activity, they are engrossed by how the gadget works. We used Project Zero as grounds to implement and inspire our version of an Unmaking activity. [Last accessed 30.10.2020]

https://pz.harvard.edu/sites/default/files/Parts%20Purposes%20Complexities_1.pdf.

http://pz.harvard.edu/sites/default/files/See%20Think%20Wonder_2.pdf

1 [Last accessed 30.10.2020]

http://www.agencybydesign.org/thinking-routines-tools-practices

Figure 9 left

Student post-it notes on what they "see, think, wonder" about the gadget, taken 13/01/2020

Generally students wrote for "See" what they guessed the object to be, such as "camera" however many found the old projector harder. Their comments were more focused on what they actually saw such as"wires" or colours that they observed

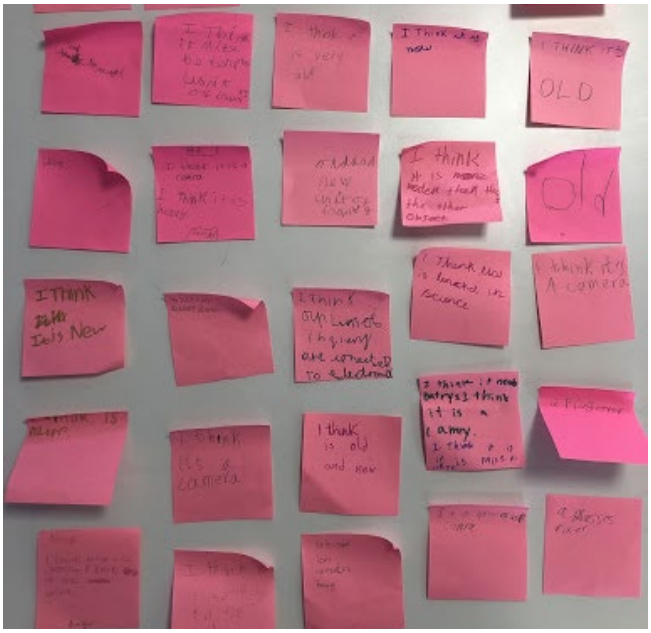


Figure left

Student post-it notes for "Think"

Students were generally confused whether the object was "new or old" and were most likely making connections with the unit as a whole, guessing what the subject matter would be as a bigger picture, rather than analysing just the object.

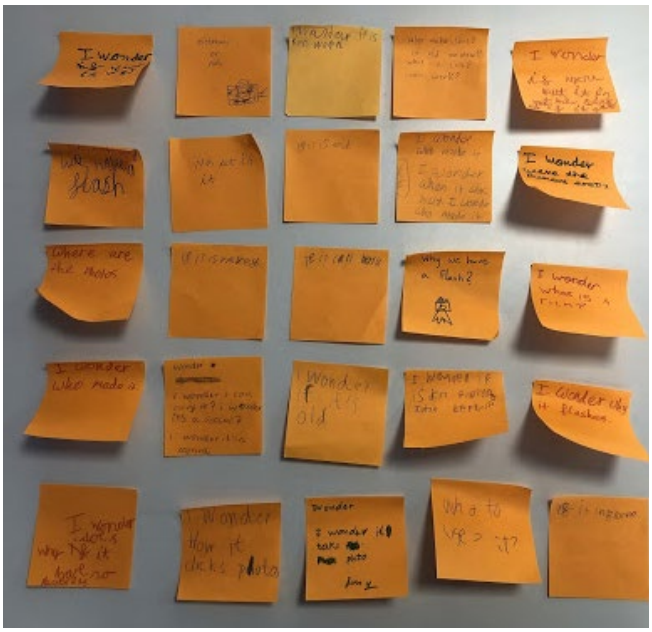


Figure left

Student post-it notes for "Wonder"

With this final part of the exercise the wonders were more varied in response. Comments such as; "why does it have a flash?" or "how do we use it?" were comments that primed to explore the gadgets, it helped the students to tune into the "how" it works.

we tailored the 'Parts, Purposes, and Complexities - Looking Closely" thinking routine (please refer to figure 8 (last page) for further details on the exercise and website) to involve the students in a way to start thinking about parts and systems in more depth. The reasoning behind introducing this type of activity came from studying the implementation of the makerspace activities after-school. This unmaking activity anticipated for a more attentive thought process to making.

To enable students to access this activity in a recognisable manner the class teacher and I adapted the Project Zero routine to include the "See, Think and Wonder" routine (please see figures 9 left for more information on this.) The students already have an awareness of this routine and so could connect more easily to the activity. The student used post-its to jot down what they See, Think and Wonder about the item in front of them. It was fascinating to see how they responded to the objects - engrossed in seeing how the mechanics worked. For example, with the automatic film camera they could recognise it was a camera yet confused as it was different to the type of camera they were used to. They would play with it and when they used the flash button they enjoyed the surprise of the flash, but further wondered why the need for this and how it worked. We asked them to work together and deliberate on why we were looking at these objects, this meant they had to communicate and share their ideas with one another. From the post-its generally there are a lot of repeated thoughts throughout the group and this was from having shared discussion.

The main issue that arose was sharing, they really wanted to play with the object individually, they really wanted to be hands on with it and have the object to themselves. Therefore it gives me confidence that these types of activities could be left as prompts on a table as a provocation for students to freely take apart and engage with. To move away from language, another adaptation could be to draw the objects and label, rather than limit to post-it notes extend this into what else could you make with these parts?

As a result of this, having an "Un-making" area or table is an element I have proposed for our makerspace. The learning potential of questioning can arise from such an activity, students began asking such questions; "why doesn't it work?" "what makes this move?" "how can I take it apart?" It challenges the viewpoint of one time use for objects, giving new life to investigation, curiosity and recycling materials. Rather than purely adding new and imaginative pieces we should have the opportunity to question these pieces, think of new meaning further than the immediate, therefore the additive can be broken down and reconstructed.

Through different thinking routines from Project Zero it framed their curiosity in a way in which they could connect to the experience of making at a deeper level.

KAY RYAN

POST-CONSTRUCTION

Who knows better
than the builder
not to trust
a structure, where
it's off kilter,
how too few
verticals bear
too much roof?

And still it
may stand, proof
against craft,
strong as though
ghost ribs and rafters
had been added
after one left.

Figure above

[Last accessed 31.10.2020]

https://www.poetryfoundation.org/poetrymagazine/browse?contentId=41370

Further Research

Here I explore a retrospective outcome from the practical experiments . For this research to continue and progress, I regard this new insight as a means to provide a sustaining conscious practise and an ever evolving structure to space. This section is a personal realisation; the term deconstruct came to the surface towards the latter half of this research. This lens that I introduce here, I go onto interpret how it could influence both on a practical and theoretical sense. To the side of collaborating with students and staff members I deliberated on how I could maintain to provide an embodied and playful activities, structure and attitude to the makerspace.

Deconstruct

The terms deconstructing or unmaking can be slowly formed from a shift of criticality, whilst simultaneously beginning to add more practical activities to the makerspace (exemplified in the Unmaking exercises). During writing and researching I recognised a way of looking which stemmed from analysing our discursive systems, by breaking it down to understand it or partly deconstructing its meaning. This theory or lens shaped the practice. I was curious to apply this in a physical sense, how could we unmake or deconstruct through the makerspace as a method?

I employ this viewpoint because I noticed that a key element in making is the process of adding. As we construct something, we have an additive response; we either make a physical object or keep on adding to the building blocks of our knowledge and experience. Not only must we construct our learning but look deeply into how we use this awareness; through making and unmaking we configure and then reconfigure. We experiment.

This is not to say deconstruction is not present in makerspace practice, hacking has also been linked to deconstructing; "hacking is therefore related to 'tinkering', to the deconstruction and reconstruction of existing artefacts and making related to the creation of new products." (J Marsh (2017) pg. 7) Deconstructing materials brings us in touch with the production side of making in a more attentive and hands on experience.

Hackerspaces are not too disimilar to makerspaces yet their ethic is more active in striving for more inclusive knowledge sharing, alternative spaces for under represented communities.

A hacker is not necessarily a person who breaks into computer systems as perhaps the main misinterpretation stands commonly. They are an individual who use hacking as a way to dismantle systems to better understand them and a process to promote open source learning; who are fundamentally against capitalistic systems.

Though many aspects of a hackerspace could contribute to a less neoliberal affected space it still must marry with the structure of school. Within The Hacker Manifesto (2004) M Wark strongly opposes the institution of education: "Education is the organization of knowledge within the constraints of scarcity, under the sign of property. Education turns the subjects who enter into its portals into objects of class power, functional elements who have internalized its discipline" (pg. 36.) This is not the purpose of the study

to reject education organisations, it does however wish to promote learning enthusiasts who wish to take something apart in order to learn through doing, embodied practise and a shared learning experience.

Settling on the term deconstruction opened more avenues. Although I'm wary to use the term deconstruction due to its philosophical ties to Derrida's (1930-2004) coining of the phrase, it has been quite a literal element that I would like to use to describe and understand some parts of this research. And though I recognise the deep complexities of his meaning to deconstruct language, I have interpreted that to deconstruct, as a way to take apart the knowledge we have, is to see them as separate components that enable a deeper understanding. A suitable example of how that would look like in this research would be a child's curiosity in taking apart an object to see how it works, not necessarily destroying it but individualising components, perhaps piecing it together but more of investigation into 'how', how does this work?

Unmaking is also a suitable analogy for my context, though this is quite largely a physical representation; to deconstruct is to look deeper into the knowledge gained, examining individual learning blocks. Unmaking would be the method used to deconstruct the knowledge present at hand. Derrida was fundamentally against deconstruction being used as a methodology or pedagogical tool, 'it is always already at work in the work' (McQuillan 2001: Derrida 1989 pg. 29). To be effective, deconstruction needs to create new terms, not to synthesise the concepts in opposition, but to mark their difference and eternal interplay. This explains why Derrida always proposes new terms in his deconstruction, not as a free play but from the necessity of analysis.

Furthermore, to refer to the constructionist and constructivist lens of thinking, deconstructivism is found to already exist within this lens. We cannot have one without the other. Using Reggio Emilia's constructivist approach as an example indicates how the process of "unpacking" or defamiliarizing everyday objects and events can be deeply meaningful, interesting, and instructive for students. (C Edwards 1998 pg 33) It is a more reflective method that has the potential to reject some aforementioned neoliberal systems.

Retrospectively, this concept is a slowing down process; it requires one to be reflective. To build is a ceaseless mission of progression. We need the time to reinterpret this structure. By promoting this lens in my practise I intend to create a collaborative structure which recognises individual aspects in a connected system.

Reflections

These reflections, are comprised of staff and student responses. They are condensed from the varied practical experiments taken over the period of the project. The reactions from staff and pupils about the setup have been through continuous dialogue and also through post-it note form. The post-its were helpful snapshots into their immediate personal thoughts, recording this way meant that I could also deliberate on them at a later stage. The idea behind this format stemmed from reflecting on meetings usually being of a regulatory nature or brief moments and so I wanted to use that time effectively. Due to the project also reaching a wide range of students and staff this provided a simple solution to record varied thoughts. It was further influenced by design sprints - where big ideas are simplified onto post-its, usually in a short space of time. The structure can be tailored to a situation/problem, and through these different experiments I've very loosely used this method; the inspiration mainly came from the post-its, due its transportability, cheapness and succinctness.

Staff Reflection

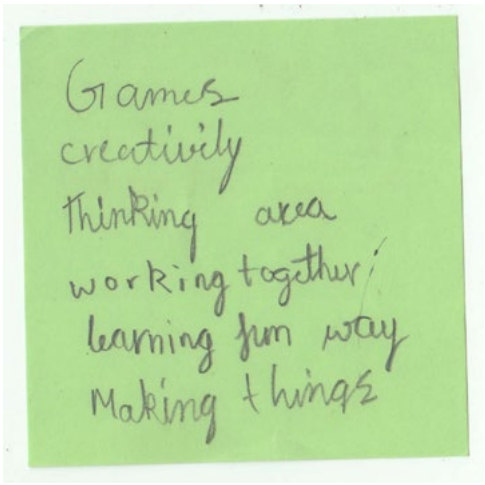
Early on in the process of the project I was given suggestions from staff members (teachers and support staff), especially when it came to the after school club to focus on creating work to be displayed or to organise the physical makerspace area, such as coordinating the layout, which was a valid suggestion to get the space to visual expectations. However, I had started with activity based projects or focusing on the students, firstly to aim towards being more hands-on with them, reflecting upon what they had enjoyed in the classroom and gauging what their preferences were. Though there could have been a discussion with the students whether they'd want to partake in organising the space in the after school club. For future reference this could be an opportunity to add this into activities; forming/organising the space whilst still catering to student interest.

The main outcome was relating staff feedback to students and to create a dialogue filtering both opinions. However, the reality being that with the 5 sessions (with regards to the after school club), we had to be realistic on what we could achieve; with the focus to collaborate and work together. Therefore "doing", making together and intuitive work was at the forefront initially. For next steps incorporating both staff and student opinion into a session so there can be a mutual relation, whether that be to pose the staff reactions to the students or to have the staff present in the discussions would be valuable.

Teachers generally would use the makerspace as a respite from the classroom, for times when students could have free choice. This is positive, in that it utilises the area for the students needs and promotes a playful attitude towards learning. For the project to continue in this light I will study what areas and materials the students are most drawn to and expand on this further.

Concluding from the spontaneous Agency and Roles experiment, challenges were found regarding implementing a reactive structure around the agent. Some teachers responded with wondering how to organise these roles within their own classroom, with their students. Enabling the decision making for the student implies that the student must be aware they are free to partake and be a part of how they organise themselves in the makerspace. There should be transparency of the setup of the space in order for them to be able to make informed decisions. However this does take time and depends on what the teacher believes best for their class.

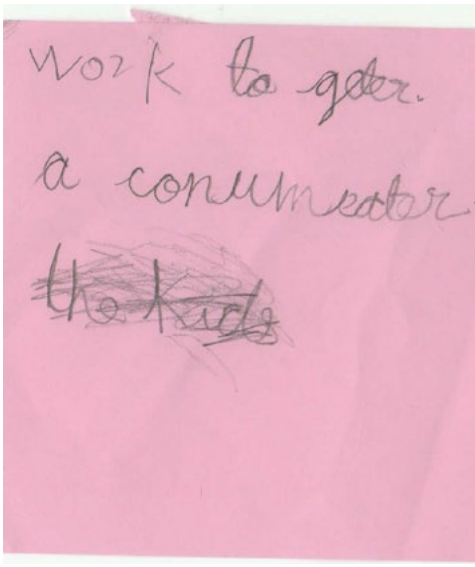
Overall general frustrations that brewed from the staff was the pace of the process. The back and forth between student, staff to management was slow. Similarly I wanted to see resources, furniture in place; however, that was never the purpose of the study. It was to set-up a way of working together and the way it developed at the pace that was necessary.



"Games, creativity, thinking area, working together, learning fun way, making things"

Student Reflection

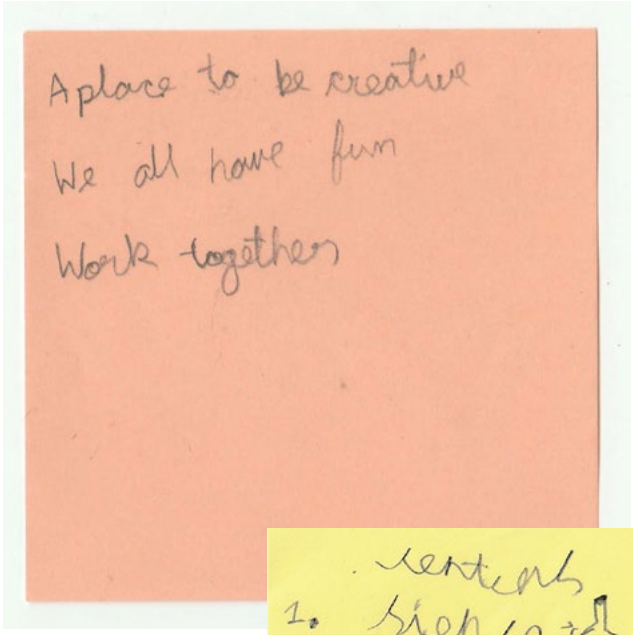
Accounting and collecting student post-its gave a vignette of their thought processes, behind their wants and needs of the makerspace. Themes began to pop up through the language; play and fun being the most prominent, the terms "play" and "fun" elicits a notion of being beyond what a space can specifically acquire. Most of the points the students emphasised were surrounded on mentality: "teamwork" "communication" "open-minded" and "imaginative" for example. It strengthens the viewpoint that the emotional needs are valued and more notable than what they are doing in the space or what is in the space. How can a space provide this holistic nature, as an atmospheric way of being yet also embodying these elements? Realising its importance and bringing attention to these terms sets grounds for the kind of place we wanted to achieve.



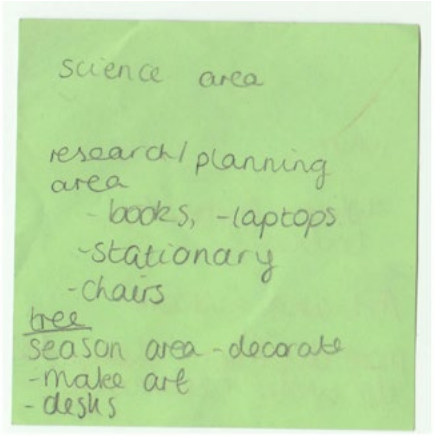
"Work together - a communicator"

The craving for "play" and "fun" in a space were the most referred factors from students. This therefore is the core of what the makerspace should embody. This should come through their agency, their involvement with the materials they use, the enjoyment in learning. This gives us valuable feedback on the next steps of the development of the makerspace area. Having personally been influenced by the importance of learning through play prior to this study, I have had to be aware of my own bias, and this became apparent with the reflection of how we use language during the map making experiments. Nonetheless, whether these ideals were originally interpreted by myself, the staff or the students it has formed and shaped how we materialise the space, through the experiments we have collectively worked on over the time of the project.

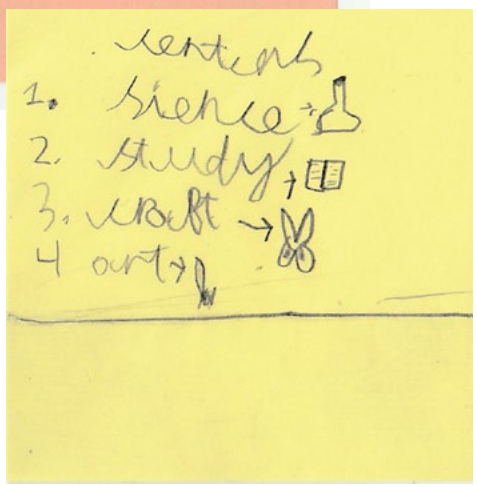
Furthermore, the student reactions provided this insight into the validity of space being more than the objects in it, often students requesting a relaxing or quiet area; the space was valuable for having that space in the first place. Mihaly Csikzentmihalyl, a psychologist who researched the nature of creativity and "flow" cites, "creating a harmonious, meaningful environment in space and time helps you to become personally creative" Csikzentmihalyl (1996) pg 146. "Harmony" here could connote a balance of both mental and physical states. Preceding this project I researched the students' preferences on working spaces, these two factors; the mental and physical, were prevalent aspects through the interviews (undertaken in September 2018). Often noting a space for stimulus yet peace at the same time.



"A place to be creative, we all have fun, work together"

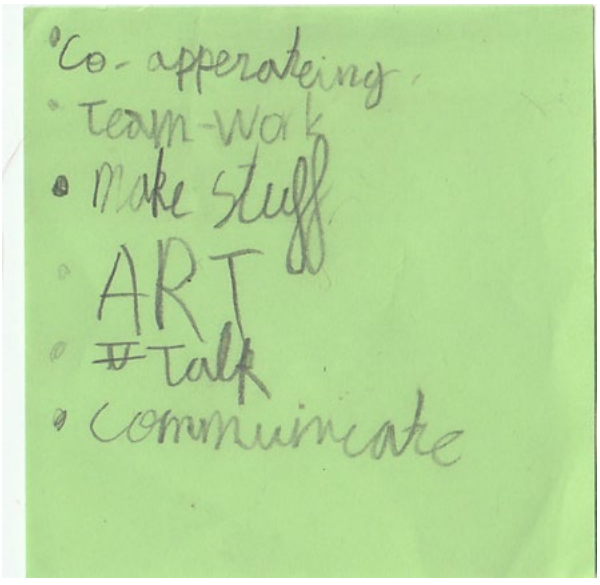


"Science area, research/ planning area - books, laptops - stationary - chairs Tree, season area - decorate, make art, desks"

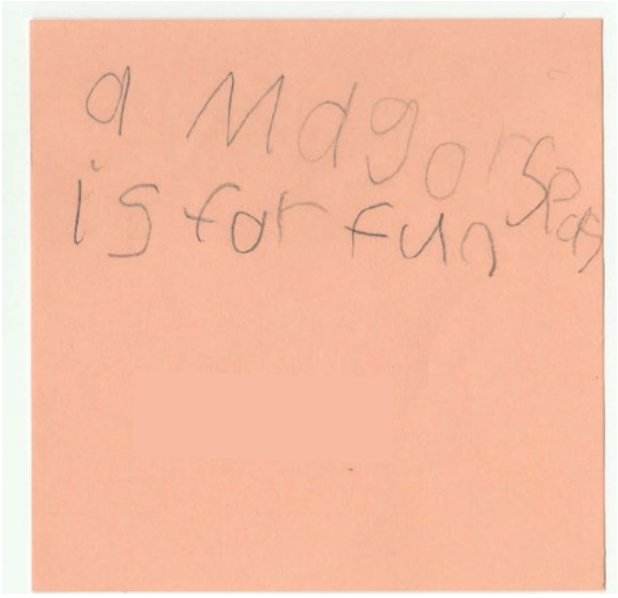


"Stations:

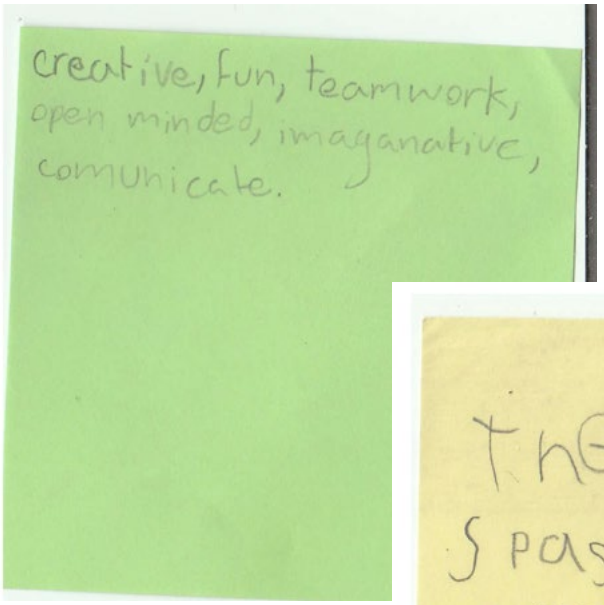
1. Science
2. Study
3. Craft
4. Art"



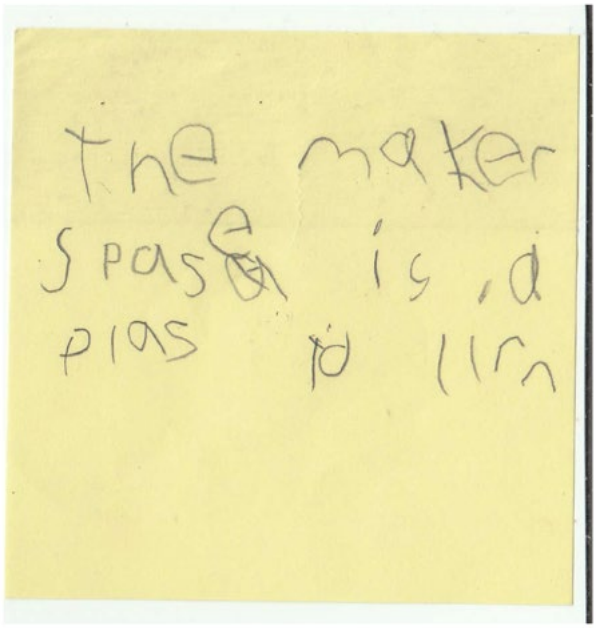
"Co-operating, team-work, make stuff, ART, talk, communicate"



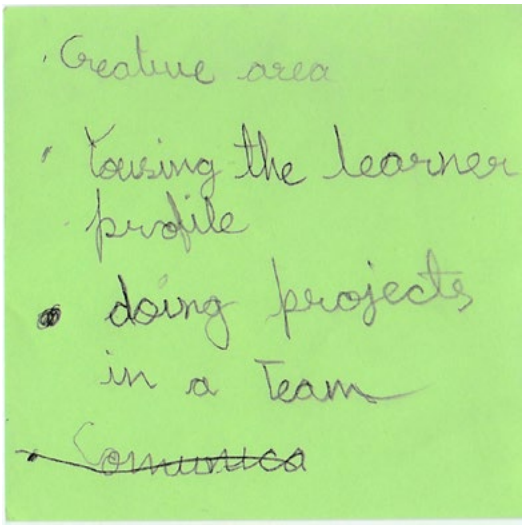
"A makerspace is for fun"



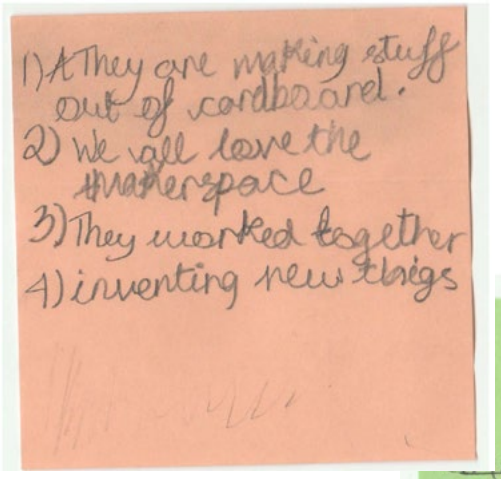
"Creative, fun, teamwork, open-minded, imaginative, communicate"



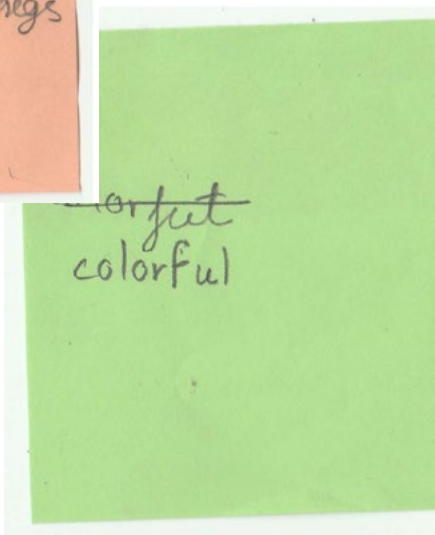
"The makerspace is a place to learn"



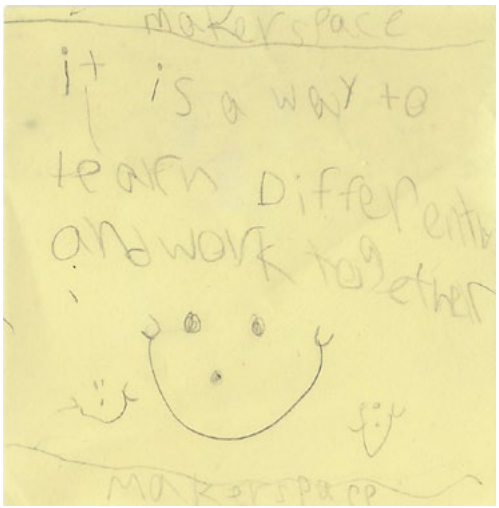
"Creative area, using the learner profile, doing projects in a team"



"1. They are making stuff out of cardboard 2. We all love the makerspace 3. They worked together 4. inventing new things"



"Colorful"



"Makerspace it is a way to learn different and work together"

Concluding

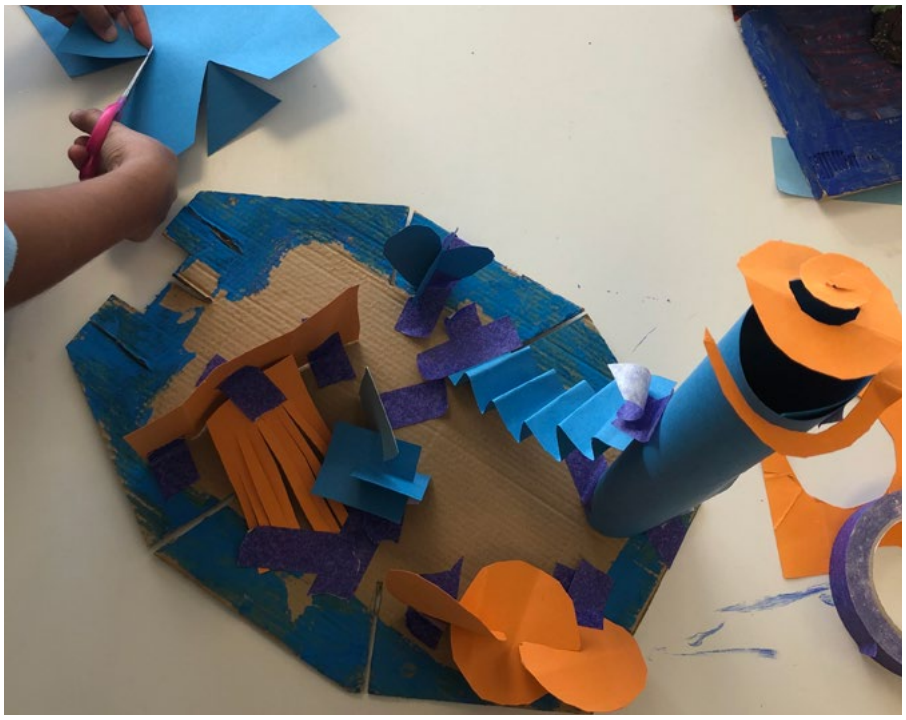


Figure right

Due to COVID 19 students no longer have access to the makerspace. We continue to make in the space of the classroom.

Referring back to the anecdote I shared at the beginning, presenting a metaphor or an intention of looking outside of the students' box; proposed a story of student engagement with their surroundings, searching for practises which were embodied and playful, learning through collaborative methods and using the makerspace as a setting for this to emerge.

What unfolds in the study is how we form codependency on a space to learn, or perhaps a structure. Our community is based through and represented in this space. It uncovered limitations in the definition of our roles (student, teaching assistant, teacher, managers) and providing a balance of personal agency and shared agency, due to being challenged by the expectations of a fatigued system of a top-down approach. Power dynamics are always present. Nonetheless the process of coming together is not at all futile whilst pushing glass ceilings and bubbles. Wherever there are restrictions or areas of constraint there is a way to push and pull through micro movements to provoke the comfort of these positions.

By opening the project to students, it starts to question our space through a different perspective and from there small chains of reaction materialise and grow into a larger entity. This enabled student agency to form, though the process was slow it became a starting place for this to grow. Therefore the process of making a makerspace became a tool to provide new ways of working together.

In George Rupp's "Beyond Individualism" (2015) the challenge of inclusive community surmises "to value both the individual and the community allows - and many require - openness to the universal. "Inclusive communities" is the deliberately restrained way that I have framed this openness to and advancement to universality." Whilst collaborating with others does not always cause for homogeneity, however as Rupp implies an advancement to universality. This is how our individual and combined agency interplay in the setting of an international school. Whilst capitalist structures yield for an individualistic approach, tailored to grouping and marketing for the individual, this instills a divided onset, alienating culture. Looking at the in-between spaces, the liminal; is accepting the grey areas and the unknown which the current cultural environment quickly resumes to obscure, with clear and marginalised space.

With the surfacing of COVID-19 the project and makerspace itself was called into question due to new spatial regulation and its relevance to the school. However, with a world pandemic a reflective response will undeniably materialise; the point is that space and who has a determining factor of its ownership is should be inquired, yet we are rarely given a pause to contemplate this.

The space entered into a further state of uncertainty after these new circumstances. This provides us with answers that space must be open to adaptability to reflect socio-economic and cultural demands. The privilege in this study was bringing students, teachers, together as a moment

to question our environment but to also act upon this collectively. The makerspace gave us an invited platform to discover and experiment, constructing meaning into a shared space, to critically think and reflect upon the grounds we were in.

In other words, we saw first-hand how drastically and quickly the space we inhabit produces new ways of being and learning. Lefebvre explains this spatial production as following: 'Knowledge and information are created with the emergent production of space, and they are not the property of individuals or the products of their skills or aptitudes.' (Lefebvre 1991)

The shifting physical and digital spaces of COVID-19 helped to shed light on what formal education spaces have to learn from informal ones and vice versa. The shift of education into a home setting provided deliberations and transformations that were specific to each family and their physical dwelling. If the student was learning through making at home it was dependent on the individual's environment — their available resources and cultural, familial influences. It was conditional, and squeezed in alongside the schedules and routines wherever it could fit. Often, competing and co-existing alongside parents who were working from home or potentially experiencing job insecurity as a result of the economic impacts of the pandemic. The space was not always fit for purpose.

Ideally, the opportunity to make should be accessible to all and not necessarily a privilege of those who have parents with space and time for it, or indeed who see it as a 'priority' alongside more traditional elements of academic performance. Here, it is important to note that making can be formed in a multitude of ways and means, as explored and spotlighted throughout the study. Many exciting prospects surfaced from this new environment of studying from home, including increased digital literacy and access. What would the meaning of "making" be through this culture of learning online? What are the risks inherent here? The meaning of a makerspace will indeed continue to change and provide further avenues for inquiry.

Through the different lenses of constructing and deconstructing, I found a way to analyse and research that brought me not only closer but also brought a new methodology which gave me focus. It became a valuable practise to aid me in adapting my role through the exchanges with the students and teachers while reflecting on my role as a teaching assistant and researcher. Without the constructivist/ constructionist, deconstructing elements, my approach would have been less determined.

Reflecting on the staff responses outlined, the need for a more integrative approach to forming the makerspace. To continue with the project, healthy and collective agency is an imperative factor. To ensure longevity and put these ideals into action requires more opportunities for teachers and students to communicate together on the setup and growth of the makerspace. The student reactions were a great tool for gaining these insights. Furthermore, there was plenty of enthusiasm and positive reactions from staff and students yet this is not enough to ensure that the makerspace thrives.

Alongside praise and enthusiasm for the project, there was also a level of skepticism. Teacher input suggested that projects of this nature sometimes struggle to progress at the school, due to a lack of structural and operational support to keep them going. For example new alterations in curriculum strategies, new policies or any adaptation to the learning experience are challenged to withhold and grow. Some staff members have noted that this comes down to the fact the school is "young", and all of the schemes we wish to integrate into the classroom are therefore 'new' and thus, somewhat 'risky'. Caution is required whilst we navigate how to tailor to our context and shape the school's culture but it must not come at the cost of creativity and opportunity.

This links closely with the concept of the liminal; the school being in a state of uncertainty and new beginnings. Just like the students, teachers and support staff similarly doubt the path forward when trialling new systems and ways of working. However, with everything being "new" we can afford to pose critical questions about how we use our space, and to question the status quo. For other educational institutions or creative settings, where "new" isn't an option, this idea of the liminal is ways to envision and access this way of approaching change, and of being resilient in the face of the unknown.

I am grateful for the way the project was structured to give me time to examine and reflect upon my own practice. Being given the time to explore my own biases, beliefs, values and convictions has shaped my practice in many ways.

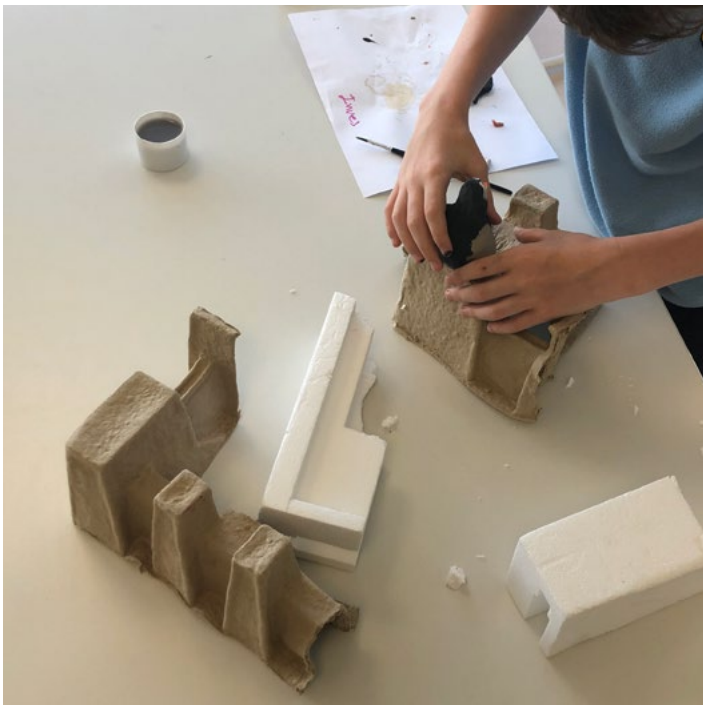
In particular, remaining critical and creative amidst the flux that is inherent in every single space we enter as students, educators and as human beings, especially when we hold the responsibility as co-designers. The liminal perspective brought some much needed guidance here, as did theories behind the works of Miryam Espinosa-Dulanto (2013) ***Liminal Spaces and Call for Praxis(ing) work***. They elaborate: "We further position narrativity as a social, communicative process that is inherently dialogic (Bakhtin, 1986). Rather than representing only the inner state of the narrator, meaning is always coconstructed in the liminal space between participants (Turner, 1980). Meaning, thus, lies in the interface between stories, not in the mind of the words of any sole participant in society (Harter, Japp, & Beck, 2005, p. 9)"

Encountering the ways in which language shaped perception of students was a particularly unexpected, powerful and enlightening part of this process of trial, error and exploration. This could be a reflection of the situatioin of an international school and varied dialect, however I argue this can be applicable to many educational settings. Practicing embodied activities in the makerspace can help shift us to new forms of communication.

Along the way, new potentials and ways of working with my colleagues and students as a collective were opened up, as we worked hard to ensure a new spotlight and prominence was given to the student voice. This created a great deal of personal and professional satisfaction for me, as I myself transition from student to educator, and grapple with the many theoretical and practical challenges of the field.

I remain convinced of the great value that makerspaces present potential exploratory spaces that can tailor to educational frameworks. Through practical application, I have learnt many important lessons about the realities of implementing progressive learning concepts in traditional school environments. Particularly the way in which we must all roll up our sleeves in order to address the messy nature of "newness" and collaboration, especially in an era when the lines between virtual and physical spaces are becoming increasingly blurred.

With the future outlook in an unprecedented state of flux it is tasking to tap into planning with foresight with gusto. However, I wish to persevere with my lines of inquiry in the endeavours of a makerspace, even if this makerspace transforms into a completely different entitiy intended.



"Learning is less about acquiring or transmitting information...than it is about collectively designing a world that is worth living in."

(Edith Akerman ***Invent to Learn*** pg 12)

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