

Winston Churchill Fellowship Report

Researching quality provision of woodwork in early childhood education



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**Dates:**

April 2018 to September 2019

Key words:

Woodwork; Early Years education; Early Childhood Education; Making; Creativity; Active learning; Creative and critical thinking; Experiential learning; Hands on learning; Crafting; Learning through doing, Maker education; Makerspace; Tinkering; Sustainability.

Acknowledgements:

This research project would not have been possible without the generous funding and vision of the Winston Churchill Memorial trust. I am grateful for their guidance, advice and ongoing support.

I am indebted to the incredible generosity of the early years community I have met on my travels who have been so welcoming and generous with their time and knowledge. They were always so willing to share and take time to discuss in depth and facilitate the many visits to see current practice in pre-schools and schools. So much information was also gathered from many researchers and teachers online as it was not possible to meet everyone in person, but all of these important conversations have also greatly contributed to my findings.

Finally thank you to my family – this research took me away and I am very appreciative of your support and encouragement.

About Pete Moorhouse:

I am an early years creative consultant, researcher, writer and trainer.

I have worked in education for over 25 years as an artist educator and maker educator. My work in school is centred around developing children's creativity and my practice is inspired by Froebelian principles and practice from the Reggio Emilia approach in Italy.

I have been passionate for many years about woodwork provision in early childhood and the rich learning and development it provides young children.

I am the UK's leading authority on woodwork in Early Years education and have written several books and journal articles, including 'Learning Through Woodwork' (Routledge) and has delivered training to a great number of early years settings across the UK, both in nursery schools and within primary schools.

For me the Churchill fellowship provided the opportunity to further develop our best practice around woodwork provision by learning from outstanding successful examples around the world.

This research has provided a solid foundation of evidence from which I can further develop my delivery of woodwork within the early years sector as well as into KS1 and KS2 within primary education. It also provides more evidence with which to support my work influencing policy makers and curriculum developers.

I am an associate trainer for Early Education (London) and deliver training regularly both nationally and overseas as well as being an independent trainer working with many leading national educational charities and local authorities.

I am an honorary research fellow at the Graduate School of Education, University of Bristol researching creative and critical thinking in Early Years, regularly presenting research at international conferences and I have written many journal articles. As a result of the fellowship I have also now embarked on a new research project evaluating impact of woodwork in early childhood education.

I won the national award (2019) from the Creative Learning Guild for my work promoting woodwork and creativity in education. I am a Fellow of the Royal Society of Arts through which I also intend to work with more closely to promote hands-on learning in education as well as in collaboration with HundrED.



Executive Summary:

Aim of the research project:

The aim of this project was to learn from settings around the world providing high quality woodworking practice. I observed many settings in three continents providing rich opportunities for young children to learn and develop through their woodworking.

Woodwork once used to be firmly established in early childhood education within the United Kingdom but sadly it started to decline from the 1960's and then almost disappeared by the end of the 1990's. Today there is a surge of renewed interest in reintroducing woodwork - empowering young children to make and create with real tools as it also develops key 21stC skills. Woodwork is an extraordinary activity - being highly engaging and captivating for young children and also so rich in cross-curricular learning and development, creative and critical thinking, problem-solving and children's essential dispositions to learning such as resilience and persistence. It really develops a skill set that is increasingly important in education as we face new global challenges. Learning to use tools and thinking practically are increasingly important skills to support creativity and innovation.

There is a real need for teachers to learn from examples of established quality provision, to gain knowledge and confidence. It is important that this emerging interest is fully supported and encouraged through inspiring examples of best practice, useful information regarding health and safety and in-depth knowledge regarding both the theory and practice of woodwork, gathered from examples of schools that have been providing woodwork for many years around the world.

Through this research project I visited many nursery schools and primary schools in the different countries to observe and learn from their practice and approach. I focussed on the key aspects to learning and development and what factors help contribute to successful provision both within a setting and across the sector. My research in each country followed a similar pattern. Firstly visiting a number of settings providing woodwork for their young children and making observations on the children's engagement and associated learning. Secondly I met with early childhood advisers and policy makers to get a clearer standing of what value woodwork is attributed within the curriculum and how it is supported. Thirdly I met with academics and researchers who have been exploring this area of child development within their country.



Woodwork at Keade Nursery School, Tokyo, Japan

Summary of Key findings:

Learning and development:

The potential for learning and development through woodwork is extraordinary. It is one of the richest mediums that young children encounter. It is truly cross curricular encompassing all areas such as: physical development, language and communication, personal development, literacy, mathematical thinking, scientific knowledge and thinking, knowledge and understanding about the world, expressive arts, creative and critical thinking.

Woodwork deeply engages children for extended periods of time – much longer than other typical early childhood activities such as paint, clay or block play.

It draws in all children's curiosity. It especially regularly captivates children from more disadvantaged backgrounds who normally struggle to engage and participate in the classroom. It so often provides a key to unlock certain children's learning. Many settings invest in woodwork specifically to support children from disadvantaged backgrounds knowing how beneficial this can be.

Woodwork is universally popular with young children, across genders and all ethnic groups.

Later in the report I analyse in detail all aspects of learning and development associated with woodwork. (p.31)

Factors for successful provision within school:

- Key is the support of the SLT (senior leadership team/ headteacher /governing body)
- Informed teachers – CPD (continued professional development) training in skills and in the value of woodwork
- Having informed and supportive parents who understand the value
- Children being at the centre of their learning – child led exploration and experimentation as opposed to adult led provision
- Space to establish a woodworking area
- Having the most appropriate tools has a huge impact on quality of practice
- Resources - having a plentiful supply of wood and associated resources
- Funding - particularly for initial investment setup costs

Factors for successful provision within the sector/ locality/ region/ country:

- Positive guidance from inspectorate (OFSTED, Care Inspectorate etc)
- Positive balanced attitude to risk from national health and safety executive
- Pro-active legislation from Government health and safety audit (Common sense, common safety)
- Encouragement and investment from DoE, (STEM Scotland)
- Incorporated into curriculum guidelines
- Included in teacher training undergraduate and graduate programs
- LA provision of CPD training
- School budgets prioritised to host INSET staff training
- Greater number of trainers to be able to meet increasing demand.

Future development and implementation in UK:

This Churchill research provides the platform for the next stages in terms of delivering impact and scalability.

- Continuing research - The Big Bang Research Project – collecting data to provide empirical qualitative data on the value of woodwork. This work has now started with contributions from all over the world. - Started
- Delivering keynote addresses to National and LA education conferences - Ongoing
- Delivering CPD directly to schools and LAs - ongoing
- Educational Press/ Media Campaign - started
- National Press/ Media Campaign – to action
- Meeting with DoE and policy makers – to action
- Meet with providers of teacher training courses – to action
- Forming Early Childhood Woodwork association - started
- Making free training materials/ video tutorial. – to action
- Training more trainers of woodwork CPD

Beyond early childhood education

The focus of my research was on early childhood - ages 3 to 7. Throughout my travels I also observed a number of primary schools providing woodwork to all their year groups. In Nordic countries all primary school students have access to a specific workshop space within the school to learn practical making. It was wonderful to observe the progression and development of children as they built on previous years learning and continued to develop complexity and increasing skills within their making processes. I truly believe design and technology in primary school must include work with resistant materials. I plan to advocate for more provision within primary schools and also to develop more resources to enable this to be possible.

Context for non-early years educators

For those unfamiliar with working with early years children it may sound quite alarming to think of young children handling real tools at such a young age. It is actually astonishing just how competent and capable young children are at handling tools, working carefully and naturally making judgements to protect themselves. Teachers who have never done woodwork before are often a little apprehensive but anyone who has been providing woodwork is quickly reassured and witnesses high levels of engagement and competence from children. From my experience of delivering woodwork for over 20 years and the experience of many colleagues, woodwork is a low risk activity and we have encountered no significant accidents. We are, of course, not able to eliminate risk entirely and there will be the occasional cut or bruised thumb but these are essentially low-level injuries. It is important that we do provide opportunities to children to experience risk and challenge so that they are able to learn how to make their own decisions and judgements in order to be better able to protect themselves in future situations. This is an important aspect of child development and should not be underestimated. Of course health and safety must at all times be prioritised but the purpose of health and safety is to allow children to do things safely not to stop them experiencing opportunities. This approach is very much encouraged by the Health and Safety Executive OFSTED and Department for Education.



UK Context – issues/ benefits

Woodwork used to be firmly established in early childhood education but it has now been in rapid decline for many decades.

Woodwork was an integral part of early education throughout the UK right through until the 1960s. With the improving economy, culturally there was less emphasis on making and repairing with increasing opportunities to purchase new commercial products. Woodwork was seen by many as being old-fashioned and became less popular, with the result that some woodworking areas began to disappear. At the same time woodwork, as with all manual work, was seen by many as a subject that best suited 'non-academic' children, which again had an impact on its decline.

The real nail in the coffin was the demise that occurred in the 80s and 90s with an increasing focus on health and safety, largely due to concerns over an onerous litigation culture, which discouraged settings from doing any activities that were perceived as having any element of risk, which included work with resistant materials such as woodwork. This compensation culture originated in the United States and quickly spread around the world. This was at the expense of the wonderful opportunities and benefits offered by woodwork despite the low levels of risk when properly managed.

This all coincided with a decline of woodwork in primary and secondary schools. The majority of primary schools are currently not including work with resistant materials in their Design and Technology (D&T). In 1986 the secondary education curriculum shifted away from woodwork and metalwork to D&T, which placed a greater emphasis on design as this was seen to be more intellectually rigorous and useful. In 2004 D&T was no longer compulsory, and now D&T is no longer available as a GCSE option in over half of all secondary schools. The status of D&T diminished again not being an EBacc subject, and many schools, academies and MATs are

discontinuing to provide D&T. This decline is currently happening at an alarming rate.

The reality in the UK is that most school children will never use tools at all in their entire education. This is clearly a disservice to children as many jobs require the skilled use of tools.

The current situation and the changing tide

This has left many children with having no experience at all of working with tools in their entire education. This is clearly a disservice to children, with many being denied this opportunity unless they are fortunate to be able to learn these skills in the home environment. Many children will need practical skills to work as electricians, plumbers, technicians, carpenters, builders, dentists and mechanics etc. There are a vast number of jobs in which the ability to be competent with tools plays an important element, from creating prototypes in engineering and technology to using medical instruments in surgery or dentistry. Recently several universities have published reports about prospective students missing the practical skills set that provide a foundation for theory, skills that are particularly relevant to subjects such as engineering, product design and science. Practical skills with tools are also immensely useful to us all in our daily lives, be it doing DIY projects, undertaking hobbies or making repairs.

Recent statistics highlight that children's levels of physical development are in decline especially agility and dexterity. Children are increasingly engaged within the digital world - we have a generation now that have learnt to swipe before they can walk.

In the last decade reports from the government audit, health and safety executive and the Department for education have encouraged schools to embrace activities that include an element of risk and not to deny children opportunities. They emphasise the importance of embracing risk.

Currently there is renewed interest in providing woodwork for young children both in the early years education and in primary schools. For example the Scottish government is investing in STEM development in all education from early years to higher education.

There is also growing interest in terms of sustainability. Woodwork develops an understanding in children about making and repairing as opposed to current culture which is so much about consuming and disposing, with little sensitivity to the use and demands on the world's finite resources.

Global - Context for selected countries:

USA

There are only a relatively small number of settings offering woodwork within the United States but the ones that do, do it wholeheartedly and are fully committed to the enormous value of woodwork. The majority of settings that are providing woodwork fall within the private education sector which tends to be more flexible and innovative. The private education sector in the US is between 25-30%. Many schools within the United States shy away from any activity that includes any element of risk due to the onerous litigation culture within the United States. This appears to be the reason why provision is more often within the private sector - where parents have proactively chosen schools that provide these more innovative opportunities. The United States is also home to the innovative maker movement (c2005) - this is the collection of individuals that are working tirelessly to promote more hands-on making within society. The maker movement incorporates various aspects making; working with wood and a number of other materials, working with simple circuits and developing coding. It is about empowering young children to make and create as opposed to being passive consumers. The Maker Movement has contributed to a surge of interest in making in general – and is encouraged through community initiatives such as ‘hack spaces’ that promote interdisciplinary making and through a proliferation of online video tutorials covering all sorts of making projects. This is enthusing and engaging young people all over the world. The value of hands-on making is once again being appreciated, countering the current consumerist culture with curiosity-driven experiential learning.

There are a number of influential research projects in the USA including Agency by Design, Project Zero at Harvard University, Graduate School of Education researching Maker education.



Finland, Sweden, Denmark

In Nordic countries there has been a long tradition of woodwork in early education dating back to 1863 in Finland, the beginnings of Sloyd education in Scandinavia.

Inspired by Froebel, woodwork spread to Scandinavia through the sloyd education movement. The name sloyd (slöjd in Swedish) is derived from the term for creative handicraft. Due to the pioneering work of Uno Cygnaeus (1810-1888) it became mandatory to introduce craft into Finnish folk schools in 1866. Cygnaeus's intent was to develop children's practical knowledge and aesthetic sense and improve children's thinking. He saw his work as being a natural development of Froebel's kindergarten.

Sloyd aims to develop practical knowledge, the ability to solve practical problems through knowledge of different working processes, and to learn how to evaluate work and refine work through experimentation. Woodwork was at the forefront but other crafts such as paper folding and work with fabrics were also included. Working with the hands was thought to enhance cognitive development and give greater relevance to learning, and was seen to build confidence and instil a respect for the dignity of labour.

In 1872 sloyd was introduced to Sweden by Otto Salomon (1849-1907), who was a passionate advocate of woodwork and was strongly influenced by Cygnaeus and Froebel. In 1875 Otto Salomon started a School of Crafts at Nääs, near Gothenburg, where he worked to popularise the educational sloyd movement and trained teachers from all over the world. The Nääs School's special educational methods made sure all students who trained there gained a solid grounding in knowledge and theory of sloyd as well as learning practical skills. The Nääs School was extremely successful and it gained a far-reaching reputation, being attended by many hundreds of international teachers including a number of pioneering early English educators. At one time nineteen different nationalities took part in one of the courses. It continued to deliver training right through until the late 1960s. Solomon's book "The Teacher's Handbook of Sloyd" was translated into English in 1891. The sloyd movement was embraced across all the Scandinavian countries; Finland, Sweden, Denmark, Norway and Iceland, where the pedagogy still plays an important part in education today. It was a privilege to visit this facility which is now a museum.

In sloyd, Woodworking projects were designed to build incrementally on the child's growing skills. This was accomplished by making the projects grow in degree of difficulty over a period of time, through the introduction of complexity and through the gradual introduction of more difficult woodworking tools. There was seen to be development from the known to the unknown, easy to difficult, simple to complex and concrete to abstract.

Salomon in his book "The Theory of Educational Sloyd" stated a number of principles:

1. To instil a taste for and an appreciation of work in general
2. To create a respect for hard, honest, physical labour

3. To develop independence and self-reliance
4. To provide training in the habits of order, accuracy, cleanliness and neatness
5. To train the eye to see accurately and to appreciate the sense of beauty in form
6. To develop the sense of touch and to give general dexterity to the hands
7. To inculcate the habits of attention, industry, perseverance and patience
8. To promote the development of the body's physical powers
9. To acquire dexterity in the use of tools
10. To execute precise work and to produce useful products (Note 2.3)

Current situation in Nordic countries:

Woodwork used to form part of the practical skills teachers were taught during their teacher training. Over the last 30 years this has declined rapidly and completely stopped in many regions. This has corresponded to a decline in the amount of woodwork provision seen in kindergartens today. Fortunately there are a number of pre-schools that have continued throughout and have wonderful woodwork provision but the number providing this is in rapid decline. Within primary schools woodwork has continued to be provided in all Nordic countries and is very well supported to teacher training and ongoing funding.

The curriculum currently in university preschool education doesn't support woodwork - as there are only 10-15 hours of practical studies in technical craft during whole four years. Unfortunately, currently theoretical issues overshadow practical skills in our teacher education. Ossi Autio, Helsinki University

In Nordic countries the focus of their practical work was on the craft process. The entire craft process consists of the parts of design, planning, making and self assessment. *'The holistic process is the most important point in crafts teaching and learning, not the product. The craft product is only the by-product of the learning. The craft process with the children could be something like that: the common starting idea could be "moving object" and the teacher together with children discuss what kind of "moving objects" we could make (cars, trains, bikes, motorbikes, space rocket or something unprecedented). After that they design and make plans and when the plans are ready they start to making. And when the products are ready they discuss about the process; for example what was easy and what was difficult.'* Antti Hilmola, KT (PhD Educ.) Yliopistonlehtori, Finland.

The teacher training college in Naas trained a huge number of teachers both from Nordic countries and from around the world including the UK. 1875-1960





Example of children's woodwork from a Klövervallens förskola kindergarten in Malmo, Sweden.

Japan

In Japan a small number Kindergartens also took inspiration from Froebel which has resulted in some settings having embedded woodwork for several decades. As a nation Japan has a long tradition of mastery within the crafty industry, especially working with wood, and they have developed a strong sense of expertise and have developed exceptional fine woodworking tools over the past centuries. Fine woodworking skills are very much part of Japanese culture. This attention to detail is evident within the kindergartens providing woodwork today with children often working on quite intricate models with an attention to detail. Many of the tools that the children use in Japan are so suitable to young children making the tasks much more ergonomic and easy. Many of the tools used in Japan have spread globally and have been embraced in early childhood education such as in the United States with settings using the Shinto file, or in Scandinavia embracing the Japanese saw.



The woodwork studio at Keade nursery school, Tokyo, Japan.

New Zealand

New Zealand has a long tradition of embracing woodwork in early years education again with roots going back to the influence of Froebel and woodwork was embedded from about 1900 around the time that early childhood education was forced formally introduced the New Zealand. The department of education has encouraged this for many years and woodwork is recommended in nursery settings and forms part of their curriculum recommended guidance. In New Zealand the Ministry of Education names carpentry (Tarai rakau) as a valuable play activity that supports the principles and strands of the Te Whāriki curriculum.

The majority of settings have woodwork corner, a shed, or workshop area. As a nation New Zealand has a strong tradition of working with tools and they have very proactive attitude to risk encouraging people to take responsibility for themselves. The majority of settings in New Zealand have always being delivering woodwork provision to young children ever since the onset and were not deterred by the litigation culture during the 80s and 90s helped by much by the encouragement of the supportive curriculum policy.



The workshop area at Kids' Domain Early Learning Centre in Auckland, New Zealand



A woodwork area located in the kindergarten garden in New Zealand.

Summary of phase visits

Phase 1. Learning from practice in the USA

Visits/ Meetings:

Museum Education Services, New York Hall of Science

Sylvia Perez

Vice President of Education Services

New York Hall of Science

www.nysci.org

Portfolio School

NYC Nancy Otero Founding Director of Learning Design and Research

www.portfolio-school.com

Cambridge Friends School

Beth Ann Boelter-Dimock, Early Childhood Teacher, Cluster Coordinator

www.cfsmass.org

Acera School

Stefanie Friedhoff, Director of Partnerships & Outreach

AceraSchool.org

The Early Childhood Makerspace, Tufts University

Amanda Strawhacker

Eliot-Pearson Children's Lab School, Tufts University

Head teacher: Hanna Gebretensae, EdD

<http://ase.tufts.edu/epcs>

TikkunXDesign – Design Lab

JCDS. kinderSTEAM

Providence

Tiferet Sassona Rose

Parts and crafts, Makerspace

William Macfarlane

Somerville Boston

www.partsandcrafts.org

Learning Beautiful

Kimberley Smith

www.Learningbeautiful.com

Bank Street School, NYC

Emily Lindsay

www.bankstreet.edu

Blue School, NYC

Rob Gilson STEAM Specialist

<https://www.blueschool.org/>

Lincoln Nursery School
Nancy Fincke, Director, Lincoln Nursery School

Project Zero - Project Zero | Harvard Graduate School of Education
Shari_Tishman, Research associate
Edward P. Clapp, Ed.D. Research Associate, Principal Investigator, and Lecturer on Education
<http://www.pz.harvard.edu/>

Newtowne School
Boston
Hilary Odoj Executive Director, The Newtowne School
www.newtowneschool.org

UNH Child Study and Development Center
Sarah Jewell Leonard, M.Ed
Early Childhood Teacher

Charlestown Nursery School
Kelly Pellagrini
charlestownnurseryschool.org



Makerspace at the New York Hall of Science, New York City, USA

Phase 2: Learning from practice in New Zealand

Visits/ Meetings:

International Art in Early Childhood Conference – Victoria University of Wellington
Networking and meetings with academics
Including Margaret Carr, Wendy Lee, Helen May

Government Department of Education meeting - Hannah Boast | Senior Adviser,
Early Learning | Early Learning and Student Achievement - Wellington

Childspace
Robin Christie
Wellington
www.childspace.co.nz

Tots Corner Auckland
Lorraine Manuela
<https://totscorner.co.nz/>

Whanganui te kohanga reo Whanau
Mere Kawau

Makers Space at Talking Tree Hill
Waiheke Island, Auckland
Global Innovation HundrED
<https://hundred.org/en/innovations/talking-tree-hill-one-day-school>

Childspace Ngaio
Wellington
Jane Corrigan Centre Director
www.childspace.co.nz

New Shoots Children's Centre
Michelle Pratt
Director
<https://newshoots.co.nz/>

Lisa Mcglashan
Pre-school wood
<https://kidscarpentry.co.nz/>

Kids' Domain Early Learning Centre
Bridgette Towle Pedagogical Leader
Auckland

Phase 2: Learning from practice in Japan

Visits/ Meetings:

Keade Nursery School
Tokyo

Ejiri Hoikuen Day Nursery
Shizoka

Professor Mari Mori
Global Early Childhood Education and Care
Tsurukawa College, Tokyo



Phase 3 Learning from practice in Denmark

Visits/ Meetings:

Børneøen Bonsai
Director: Rikke Rosengren
www.rs-bonsai.dk

Carving wood with knives at
the bonsai kindergarten.
Copenhagen Denmark





Work with tools in the Forest school setting is common practice within Denmark

Phase 3 Learning from practice in Sweden

Visits/ Meetings:

Make and Learn - Nordic Research Conference in Sloyd, September 17-20, 2019

HDK – Högskolan för design och konsthantverk

Göteborgs universitet – Gothenburg University

Networking and meetings with academics

Meeting Lotta Hermansson Sloyd Educator

Study visit to Naas – teacher training college

Linda Linder

Ateljéista

Tredje Rummet- mötesplats för hållbar utveckling

Zbigniew Oblakowski

Förskollärare

Klövervallens förskola



Woodwork area set up as part of continuous provision which was common practice and in nursery schools in Finland

Learning from Finland

Visits/ Meetings:

Helsinki Education week - various events lectures, seminars during day and in evenings all week

Education Innovation Summit – Conference
City of Helsinki and HundrED

Finnish Kindergarten (Helsinki)
Bystugan och Stjärnan Helsingfors stad

Finn-Am Kindergarten
Angie Hamalainen, Head teacher, Toolo

Pihlaja, Pre-school Meilahti, Helsinki.
Elina Wallin



Woodwork activity in Pihlaja, Pre-school Meilahti, Helsinki. Finland.

Exchange

In the spirit of exchange and cooperation in each phase I delivered seminars, workshops and a keynote presentation.

- Woodwork in Early Childhood Education – workshop - Charlestowne, Boston USA
- Woodwork in Early Childhood Education - workshop - Auckland , New Zealand
- Seminar on Creativity – University of Victoria, Wellington New Zealand
- Learning by doing – Creativity and Making – Gothenburg University Conference keynote address
- The Value of woodwork, Workshop - Lerums kommun, Sweden
- Woodwork in Early Childhood Education, Workshop - Waiheke Island, Auckland

These provided a wonderful forum for in depth discussion on local practice



The distinct models of practice:

1. Makerspace (USA)
2. Studio Practice (Japan)
3. Continuous provision (Nordic, NZ)
4. Developed Kindergarten - Primary progression (USA)

The regions indicate practice where practice was most prevalent but it was not exclusive to the indicated countries with examples of all types of models within each country visited.

Makerspace

Maker provision arises from the movement dating back to 2005 to encourage and empower people to really engage with making and creating processes. Initially this started as an online movement with people sharing skills and techniques. Make Magazine became a central focal point to the movement and rapidly makerspaces emerged in predominantly urban areas throughout the United States, spaces where adults and young people could come together to make and create with a variety of materials. The digital element was always quite strong, but this was combined with a variety of materials for example wood, metal and plastics.

This movement very quickly spread to the educational sector. Now it is common within the United States to find Makerspaces/ tinkering labs / Fab labs/ or workshop spaces within all of the educational sectors, high schools, elementary schools and kindergartens. The Blue School in New York City had very much embedded maker spaces within their provision. Maker spaces are also commonly found in museums, community workshops and even libraries. I visited the New York Hall of science maker space, which is one of the leading examples in the United States, having thousands of participants a year and providing a wide array of online resources for other museums around the world. The community spaces were accessed in a number of ways, often being used by home schooled children during the day and for after-school provision in the evenings. Parts and crafts in Boston was an example that provided this facility.

There was a clear progression within makerspace provision with an increasing focus on more digital elements as children progressed through primary school and into high school. The workshop spaces in early childhood settings tended to focus more on analogue exploration such as work creating with tools, such as woodworking tools and the hot glue gun.

The researchers at Agency by Design, Project Zero at the Graduate school at Harvard university highlighted this aspect emphasising that there is a danger in introducing too much digital and coding literacy at a young age when it is not developmentally appropriate; when children would be much better developing core dispositions to making through self-initiated construction and problem solving.

There is a huge amount of information available online from various organisations that support maker education throughout the United States and it feels that the

movement has momentum, and will continue to play an important role within the education system. STEM / STEAM education is being prioritised within the United States particularly with the aim of developing the economy and developing an entrepreneurial mind set.



Makerspace at Portfolio School, New York City



Makerspace at The Blue School - New York City



Kindergarten maker space at the Blue School New York City, USA



Makerspace at Cambridge Friends School, Boston USA

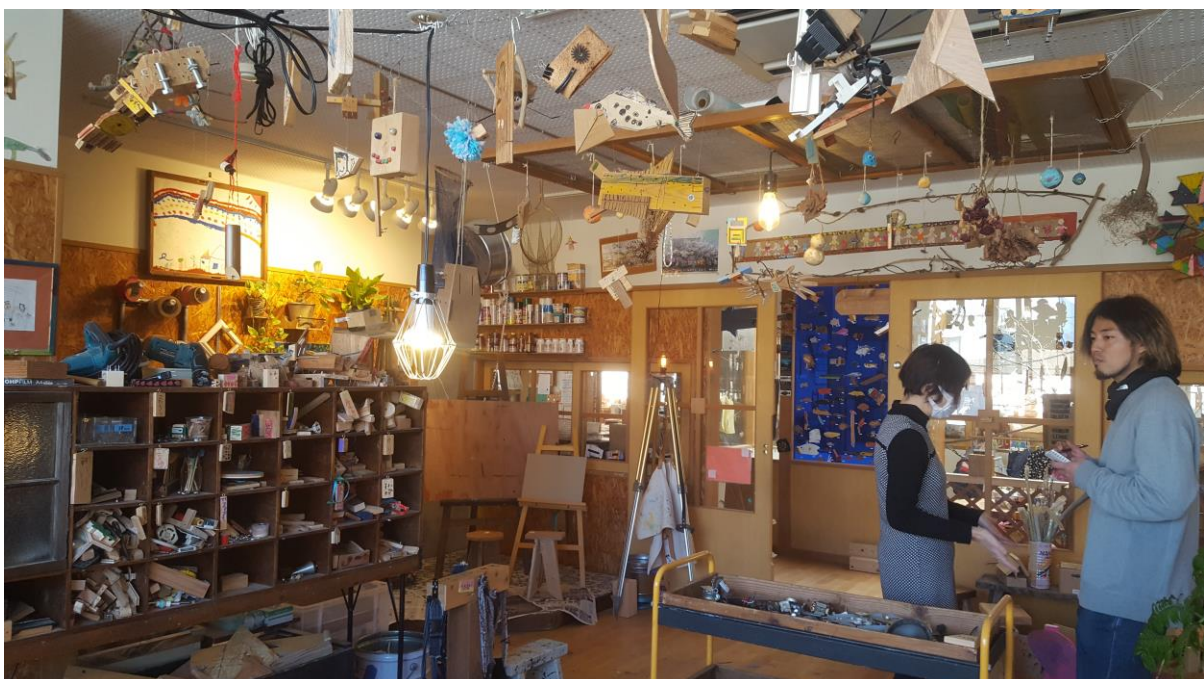
Studio practice

In this model there is a designated studio or workshop space where children participate in woodwork sessions usually for a designated set amount of time. This would usually be for approximately 2 hours. The studio spaces that I visited in Japan were indoor spaces suitable for a small group of children to work in. The spaces were well-equipped with workbenches and an array of tools. But most importantly the spaces were extremely well furnished with a large supply of possible materials and resources to work with. Boxes containing various shapes and sizes of wooden off-cuts, various lengths of wood, a variety of types of wood combined with a mixture of additional resources such as metal brackets, wire, string, leather, fabric and so on. These spaces seem to radiate a creative energy, providing inspiration and encouragement to children. There were many examples of previous work on the walls or hung from the ceiling, that celebrated the children's work, and these provided further inspiration for the young children.

The majority of the work produced within the studio was very much open ended, child initiated projects. On occasions they also introduced more specific projects such as all making a chair. In these projects the children were first encouraged to research and develop their own unique designs before embarking on the making process. The evaluation and reflection on their work also played an important part of their process.

The studio space was clearly very popular with children and they had a rota system put in place so all children would have equal access to the space. They evidenced no gender difference in terms of engagement and enjoyment of woodwork.

There are many advantages to having a bespoke woodwork studio space especially having it all set up and really ready to go as soon as children enter. It does necessitate an adult to be in the studio space to supervise but they managed to have a relatively large number of children working in the space at the same time approximately 8 to 10 children.



Continuous provision

In this model of provision the woodwork area is located to enable children to access it freely. In this sense the woodwork bench becomes part of the settings continuous provision. Continuous provision is where children are free to decide what and when they will do during their time at kindergarten rather than the adults making the decisions for them - this is clearly optimal as it puts the child at the centre of their learning. So in this sense the woodwork just contributed to the fabric of the classroom along with painting, the home corner, work with clay, block play etc. Initially children would be taught in small groups on how to use the tools safely with close adult supervision and then gradually they would be given more autonomy until the woodwork area just becomes a natural part of their continuous provision. There were certain rules put in place to facilitate the smooth running of the woodwork area such as limiting the number of children who could work in the woodwork area at a time, emphasising that all tools must remain within the woodwork area and that certain tools must only be used with close adult supervision such as the saw. This model of provision was most commonly provided within the Nordic countries and in New Zealand, with the difference being that generally within Nordic countries it was located indoors possibly due to the inclement weather and then in New Zealand it tended to be located in the outdoors, usually under a veranda.

The quality of practice within this continuous provision model did tend to vary from setting to setting. The factor that seemed to be most dominant was access to a wide variety of resources. One of the problems with woodwork provision is that children can actually join a lot of wood together quite quickly! And in this sense settings are constantly having to replenish resources which can come quite demanding task on an already hard-pressed workforce. So on occasions it was evident that this was difficult and the woodwork area was poorly resourced with just a few bits of wood and the resulting impact was the woodwork was stripped of its rich possibilities and was reduced to just hammering nails in wood.

Clearly every setting is different, having different cohorts of children, different staff ratios, different space available, sometimes with younger children within the same area, sometimes with high numbers of children with special educational needs - all of which will have an impact on the successful delivery of woodwork in continuous provision. There was not one common solution that worked for all settings it was very much about responding the possibilities, and confines of their own setting.

A workbench located within the classroom and Sweden as part of continuous provision





Woodwork set up as part of continuous provision in the kindergarten class at the Bank Street School in New York City

Developed Kindergarten - Primary progression

It was particularly exciting to observe settings where they had really developed their woodwork provision throughout the entire school - where provision ranged from preschool to the final year of primary school. In these examples children had had their initial introduction to woodwork in the preschool classroom, and then continued to develop and build on their knowledge as they progressed through the subsequent year groups. It was wonderful to see the increasing complexity of children's work. Again the most successful examples were where children had a high level of autonomy in their work making their own choices and decisions as opposed to more adult led projects. In adult led projects where every child for example follows specific instructions to make a specific bird box, all of that creativity and imagination is stripped out that the experience. Also with such tight instructions children often feel that they are getting it right or wrong and many children can feel that they are failing.

In the United Kingdom now with an increasing number of settings providing woodwork in early childhood settings, it is encouraging more primary schools to reflect on their lack of provision of work with resistant materials within the design and technology strand and start to develop their woodwork.

The Bank Street School in New York City and ACERA school in Boston were wonderful examples of how this progression can be developed and embedded throughout the school. The kindergarten classrooms had their own woodwork areas

that form part of continuous provision and there was also a specific woodwork shop which children attended in small groups as they progressed through elementary school. It was evidently clear how much this experience of practical working was valued by the school, children and parents.



The woodwork shop at the Bank Street School New York City which was accessed by all age groups throughout the elementary school



The woodwork shop at ACERA which was accessed by small groups from all classes throughout the elementary school



An example workshop area in an elementary school in Finland which would typically be found within all finish elementary schools.

Summary of the learning and development observed

Below I provide a summary of the key elements of learning and development that are associated with woodwork based on the observations I made across all three phases. The potential for learning and development through woodwork is extraordinary. It is one on the richest mediums that young children encounter. It is truly cross curricular encompassing all areas. Physical development, Language and communication, Personal development, Literacy, Mathematical thinking, scientific knowledge and thinking, Knowledge and understanding about the world, Expressive arts, creative and critical thinking.

Woodwork deeply engages children for extended periods of time – much longer than other typical early childhood activities such as paint, clay etc.

It draws in children's curiosity – and so often deeply captivates children from more disadvantaged backgrounds who normally struggle to engage and participate in the classroom. Is so often provides a key to unlock certain children's learning.

Woodwork is universally popular with young children, across genders and all ethnic groups.



Curiosity

Curiosity lies at the heart of children's learning – the spirit of enquiry. It provides the intrinsic motivation to explore. Babies are born curious with a drive to discover the world around them. In early childhood this curiosity drives children's desire to explore and play. It is the catalyst for motivation and engagement and it encourages making connections, noticing and wondering and the posing of new questions as children express their imaginations. Curiosity is a way of being and of seeing the world as full of wonder and possibility. Curiosity leads to the joy of discovering new things, exploring new knowledge, skills and places. Most early years children bring this disposition of curiosity with them as they experience working with wood. Some children do not show these high levels of curiosity due to certain early childhood experiences or deprivation so it is crucial that we do all we can to reignite and foster it to readdress disadvantage. Woodwork often proves to be a medium with the potential to do this. Curiosity is a fundamental disposition to woodwork, tinkering and making in general. Maintaining curiosity is crucial for life-long learning but sadly as many child progress through school they do not have the conditions or opportunity to do this. Curiosity is also the catalyst of engagement, and through observing children in all three phases it was abundantly clear that woodwork deeply engages children on a profound level.

Playing and exploring

“Play is the highest expression of human development in childhood for it alone is the free expression of the child’s soul” Friedrich Froebel

Woodwork could really be called wood-play, as it is all about playing with possibilities and exploration. In woodwork children explore what they can do with the tools, playing with possibilities. Curiosity is at the heart of their explorations as they test out, investigate and experiment. Initially many children are a little apprehensive about woodwork when faced with the challenge of using equipment that is new to them, but with the correct support and encouragement they invariably find it very easy. Being willing to have a go and not to be restricted by fears is an important attribute of embracing new experience. Regular woodwork sessions embed and build upon existing skills and as children expand their thinking and set themselves new challenges, their skill set and knowledge really develops. Across all phases the progression of skills and knowledge was clearly visible.



Kindergarten in Pihlaja,
Meilahti, Helsinki, Finland.

Active learning

Woodwork is learning by doing. When children are actively learning they show high concentration levels and are deeply engaged.

Ferre Laevers at Leuven University in Belgium designed an involvement scale as a way of monitoring children’s engagement. The scale runs from 1 to 5. Level 5 is

described as children showing sustained intense activity. Children should show some of the indicators of involvement such as concentration, creativity, energy and persistence (clearly all very present in woodwork) and the intensity should be continuous for an extended period (exceptional possibilities for this with woodwork). Children's involvement with woodwork is often consistently sustained at level 5 or above the scale as was seen in all countries visited.

In woodwork, children show extremely high levels of involvement with focused concentration and engagement. Using tools necessitates a certain level of concentration. With a strong desire to create something children will further focus and concentrate as they solve problems and refine their work. Children often show concentration levels rarely seen elsewhere but it is not just the depth of children's focus - they also remain engaged for extended periods of time. It is not unusual for children to work throughout a session at the woodwork table.

Children show great pride in their constructions as well as taking much satisfaction from the process. Woodwork can be seen as an activity that promotes agency, developing children's sense of who they are and their ability to act in any given environment.



Work produced at the Bank Street School New York City using coping saw and combining hinges to incorporate a kinetic element

Creativity and critical thinking

From observing practice in all countries it was clear that woodwork is exceptional of developing children's creative and critical thinking and I believe this is really at the heart of woodwork's appeal and success.

Curiosity and imagination lay the foundations for children's powerful thinking. Children begin to express their imagination, develop their own original ideas, and make their own choices of how to do things. ('I'm going to make a dinosaur with teeth'; 'I'm going to make a ladder to get to the moon'.) They think of possible ways to adapt their work and will use their imagination as they search through a box of off cuts looking for what shape will be most useful to suit their need. They create designs and develop and refine their work through creative thinking and critical thinking processes. Woodwork is extraordinary in the way that it can incorporate so many creative and critical thinking skills.

Children use their imagination in many ways as they develop ideas, choosing how best to work with the resources available and then coming up with different potential solutions to problems and applying these. Woodwork is unrivalled in the way that it provides opportunities for problem solving. Children will reason, analyse, choose options and reflect on their work. This deep cognitive involvement in their work is clearly apparent.

Their analytical reasoning skills are enhanced in many ways. There are many opportunities for strategizing and choosing appropriate solutions to problems: "How can I best join these pieces", "how could I make a ...", "How can I use the tool to...", "How can I get nail to stand up straight..." This will often involve speculation, intuition, testing haunches, and using trial and error. Children reflect on the work, both on the process and product reviewing what worked and what didn't and assessing if things could have been done differently. They can reflect on the process, tools, outcomes and safety aspects. Having children take photographs to document their work can aid this reflection. As children review they may also make links to other areas of learning.



A project centred around designing and making chairs of the kindergarten in Japan with five year olds.

Imagination

As the children become familiar with the tools and their possibilities their creative thinking and imagination really begin to emerge. When children develop their own ideas the resulting work is highly individual and shows enormous variety, incorporating many different ways of working. Some children take delight purely in the process as they experiment with different tools, but some explore narratives and create scenes. Others will explore simple concepts such as making wheels that actually turn. Much of the work is representational, for example spiky hedgehogs or flying lampposts, superpower helicopters, whilst others explore shape and form as they create abstract artworks.

Open-ended exploration

The most successful examples of woodwork were where children were allowed the freedom to follow their own interests and develop inquiry-based learning. Children should follow their own interests rather than having teachers initiate set activities where children follow set instructions to complete a particular project such as making bird boxes. When children are following their own interests and solving their own problems, refining and developing their own ideas, reflecting on and evaluating their work, this provides intrinsic motivation and high levels of engagement and enjoyment.

Extending thinking

The settings that I visited that produced the highest quality learning with those in which adults actively engaged to encourage and develop children's thinking. Encouraging children's creative critical thinking skills will enhance all areas of learning and develop their potential creativity. They will enhance life chances by helping with decision making and responding to opportunity and adversity. They develop our ability to see options and evaluate alternatives. I believe many of the thinking skills associated with creativity need to be carefully nurtured by active adult involvement in their deep thinking. Young children have a natural curiosity and desire to learn. They also have powerful imaginations with an almost limitless capacity to develop new ideas. But creative and critical thinking are skills that are emerging and need to be nurtured and extended as valuable skills that impact on all learning.

Personal, Social and Emotional Development

The majority of the teachers in the schools that I visited highlighted that actually the most important aspect of woodwork was often the fact that it really develop children's personal development particularly their dispositions towards learning. Working with wood is not about what the children make but what actually happens inside the child. Many educationalists have advocated that it has the potential to develop a sense of

self and how children feel about themselves. Otto Solamon, Naas Sweden, wrote about this extensively as well as the team at Harvard University's Project Zero.

Woodwork has a significant impact on well-being with children becoming more confident and with levels of self-esteem raised. As children become more skilled and competent, they gain confidence in their abilities and develop an identity as a maker. The processes encourage meta-cognition and self-regulation as well as pride in process and product. This develops a dispositional attitude which can impact on all areas of learning.

There are many important elements why woodwork is so effective in this area of child development:

Feeling valued

Children immediately feel valued and feel a sense of responsibility when given the opportunity to work with real tools. They feel valued by being respected and trusted. When children are engaged with real experiences it develops their sense of autonomy and they feel empowered. This has a visible impact on their self-esteem. The fact that they are taking responsibility in working with real tools also seems to be reflected in their desire to take their work seriously.



Kindergarten in Pihlaja, Meilahti, Helsinki, Finland.

Gaining new skills

With woodwork there are many skills to learn. There are many tools to learn how to use and techniques to master. We all feel good about ourselves as we learn new skills. This is no different with children - the acquisition of new skills is a significant boost to self-esteem. "I can do it all on my own!" says Kaya, with a big smile, after screwing into the wood.

Being motivated

Curiosity is a catalyst for motivation. Children are curious and inquisitive about how the tools work and what they can do, they are curious about wood and its possibilities, they are curious to discover how they can join and construct. Children show high levels of motivation, with a strong sense of purpose whether in becoming familiar with the drill or having a desire to complete their model or project.



Developing independence

Children become more independent as they exercise choice and make decisions. Woodwork is kept open-ended to encourage curiosity and self-motivation. Children are encouraged to be autonomous and use the majority of the tools and resources independently. Children are also encouraged to find their voice, to communicate their ideas, express opinions and to come up with their own solutions to problems. Woodwork lends itself to solitary play, and this enhances children's individual confidence to act on their own decisions. They also learn to self-manage and organise themselves within the woodworking area. Children are empowered, as they can shape the outcome and make an impact on the world.

Developing confidence

Children's confidence in their own ability grows as they master skills and techniques. During their constructions many challenges and questions spontaneously arise that provide opportunities for children to analyse and refine problems and discover solutions for them. This process reinforces children's capabilities as confident investigators, problem solvers and decision-makers. They develop a confident, can-do approach, and are not easily put off by setbacks. Children also gain confidence in asking for help, seeking support and guidance when they need it. As children progress, tackling more complex tasks, this will once again strengthen their confidence, as they build on previous learning.

Developing agency

Agency is choosing to act – the power to do something that has an impact. Children learn how things work and discover that they can shape the world around them by making. This imparts an optimistic “can-do” attitude and imbues children with a strong sense of agency – having a proactive disposition towards the world so they can impart their unique expression. Having a sense of agency empowers young children to feel capable, to believe that they have the ability to create - that they can make choices about what they can do and how they can impact on and change their world. Agency is clearly developed by children planning their own projects, discovering their own solutions, learning through solving problems as opposed to through didactic teaching. Through their sense of agency they will be developing an identity as a maker. The can-do, resourceful attitude associated with agency will extend into other areas and empower children that they can make changes and challenge structures and systems.

Developing persistence

Woodwork also develops children's persistence and perseverance. Many of the tasks involved take time and are not always easy. Things break, split and just don't always go to plan. Children seem to respond to the authentic nature of woodwork

and are motivated to persevere, rising to the challenge to work on difficult techniques and find solutions to problems. Sometimes woodwork can be frustrating but children often show sustained interest and a determination to keep going.

The obstacles and challenges can become an attraction of woodwork, with children becoming fascinated by testing out many possibilities and different solutions.

Persistence also often leads on to being resourceful, as children work around the lack of a certain material, or come up with an alternative method to enable them to keep working.

Children will persist physically: sawing through a large section, hammering in a big nail, drilling a deep hole; or cognitively: working out how to join mast to their boat, how best to make the propeller turn, or make their model balance standing up. Children will often work on projects and models for extended periods of time, returning to work in progress the next day or even over several sessions.

Persistence can lead on to doing things with care, putting your best effort in, persevering to find the best solution, striving for quality which will have an impact on how they feel about their work and the pride they take in their product. This attitude was very much encouraged within both Nordic countries and in Japan. This attention to craft is sometimes referred to as integrity. This will involve being patient, taking time, being resilient, persevering, paying attention to detail as well as showing some passion and dedication. Quality is an element that young children can understand and aspire to. It is further developed through the analytical reflective process.



Children's chair designed and made in the woodwork studio in Japan by a five-year-old

Taking risks

For many children woodwork will be a totally new experience. They learn that not knowing and being uncertain are part of the process of being an effective learner. Being willing to try new things provides a foundation for future learning.

As well as learning about how to manage physical risks in terms of safety children develop their emotional attitude to risk. They confront the fear of the unknown, the risk of failure, feeling incompetent or being embarrassed. Children learn, develop and grow by experiencing challenge and confronting their fears. Children need to take emotional risks. Are we prepared to try a new tool? Are we prepared to take the risk to try something new, to try new challenges which are outside our comfort zone? Are we prepared to learn new techniques? Are we prepared to make mistakes? Are we prepared to suggest creative ideas? Are we prepared to express these ideas in physical form? Are we unafraid to try things that have not been done before?

These characteristics depend on overall well-being, confidence and self-esteem and are so crucial for effective learning. We only fail when we stop trying. Our mistakes provide opportunities for us to learn, grow and develop. The role we play in nurturing and supporting children to become confident and resilient is so important. We need to be attentive, sensitive and encouraging.

Children also learn to manage the physical risk of working with tools, by experiencing this risk in a controlled environment. The biggest risk to children is that they do not get to experience risk, and so do not learn how to make judgements and so in turn become more prone to accidents. When children make judgements about potential risk when using tools they develop confidence and learn not to be overly timid.

Concentration and engagement

Children's tongues are often sticking out whilst woodworking! Current thinking in psychological research attributes this to high level concentration when a child is trying to complete a challenging task which involves both cognitive and fine motor skills. The tongue action is thought to either help us focus or provide a visual message to others not to disturb. Another neurological theory is that the hand and mouth nerves are located closely in the brain and one often interacts with the other.

Children show high levels of engagement, remaining focused on their work for extended periods of time, regularly in excess of an hour. Children's focus and persistence impacts on developing sustained concentration. There are two layers to their concentration and focus. Firstly there is the need to concentrate due to the nature of working with tools and secondly, as their models evolve, there is deep level thinking as they express their imagination and work out how best to join and resolve their desired project. Many teachers in all three phases reported that these extended periods of concentration have impacted on the general level of focus in the classroom.

Developing resilience

Woodwork can also be seen to strengthen children's resilience. Whilst woodworking there are many challenges and setbacks as things don't go to plan. The wood may split, a thumb get banged, or a wheel just keeps falling off! These mistakes are opportunities to learn. It only becomes a failure if you stop trying. With woodwork children are highly motivated and have a real desire to complete tasks, and they determinedly persist to resolve their work even when it requires considerable physical effort. Models can often break, and after the initial disappointment children will again resolve how to make their work more robust. This process helps them feel more in control and further builds resilience.

Developing social skills and collaboration

Woodwork can also be seen to help children cooperate with others. They learn to share and take turns, negotiate and support each other. When children discuss and plan projects together, their social skills develop as well as their understanding of how others think. They learn the value of sharing ideas and see how others solve problems and the value of providing feedback.

Mutual encouragement and support is often visible. It is also quite common for children to offer advice and spot when someone is having difficulty in achieving what they want to achieve. They encourage and assist. They will often notice that it would be helpful to lend an extra hand in a particular situation. They often become the teacher – and demonstrate a particular skill, technique or how to use a new tool. Children will also collaborate by finding and sharing resources even when working independently.

Collaboration is often cited as one of the crucial learning skills that is needed in our contemporary economy, so opportunities to develop and extend this should always be seized. I also believe we have a responsibility to share knowledge. It is part of being a learning community, so encouraging children to do this is clearly beneficial for all. In the wider maker community there is a wonderful ethos developing of co-operation, sharing of information and exchange of techniques. Co-operation fosters a culture of generosity, receiving help and support, of offering advice and assistance. Children learn that they can learn from everyone and give back to others.

In the Makerspace Playbook the collaborative element of making is summarised thus *'fostering the maker mindset is a fundamentally human project – to support the growth and development of another person, not just physically but mentally and emotionally. It should focus on the whole person because any truly creative enterprise requires all of us, not just part. It should also be rooted in the kind of sharing of knowledge and skills that humans do best face to face.'*

Self-regulation, self-care and awareness of others

Woodwork promotes self-regulation – the ability to monitor and control behaviour and emotion in order to meet the demands of the situation. Children will regulate their behaviour in many ways during a woodworking session for example after being distracted being able to regain focus or managing frustration when struggling to complete a task.

Aggressive behaviour is a rare occurrence at the workbench. With children being deeply absorbed in their work and feeling empowered by using real tools they feel confident and strong without confronting or disturbing others. When children feel competent and fulfilled they rarely argue or interfere with each other.

Children also develop their sense of responsibility and self-care as they understand the need to use potentially dangerous tools safely. Children are taking risks in a controlled environment, assessing risk themselves and making judgements, learning how to keep themselves safe.

Children develop an understanding of the importance of taking responsibility for their own bodies and the safety of others. This strengthens self-awareness as children assess potential dangers, and it fosters a sense of responsibility for their own actions. In working with wood there clearly needs to be some rules. They need to know tools can hurt them. They learn to understand the need for boundaries to protect themselves and keep others safe from potential harm, for example being aware that they need to keep their fingers clear when hammering hard and that they need to wear safety glasses to protect their eyes.

Children develop their increasing understanding of how rules and boundaries help them to work together safely. They grow to understand the need to work within certain limits and treat tools with respect. Children who typically have difficulty managing their behaviour are also often so keen to have their turn that they are careful to adhere to the rules and boundaries.

Pride in their achievements

Children get immense personal satisfaction from woodwork, as can be clearly be seen from their facial expressions. Not only do they very much enjoy the process, taking pleasure in gaining more complex skills and resolving their work, the physicality of working with wood, sawing and noisy banging but their satisfaction in their accomplishment and resulting creations is clearly visible to anyone observing. The excitement as they share them with parents and those important to them and I regularly have children or parents tell me years later that they still have their model at home! The delight, satisfaction and pride in their own creations is clearly visible. The combination of these elements again helps build self-esteem and confidence.



Wooden guitars is created by children in Sweden

Physical development

In all countries we are currently seeing a decline in children's physical abilities due to less physical activity and an increasing amount of time spent on screens. In all three phases practitioners emphasised just how important Woodwork was in countering this by developing children's agility and dexterity. Woodwork provides many opportunities for physical development as children learn to handle tools safely and with increasing control.

Woodwork helps children to:

- Develop hand-eye coordination
- Learn to handle tools safely with increasing control
- Refine balance to develop the poise and stance
- Develop agility and dexterity, manipulative skills, and muscular strength
- Develop fine motor skills and gross motor skills
- Develop rich range of movements
- Develop precision and accuracy

- Develop their core strength
- Develop spatial awareness and associated positional language
- Develop understanding of physical space and needs of others
- Develop awareness through the senses

Hand-eye coordination is intrinsic to woodwork and children gain increasing control over their bodies as they develop agility and dexterity, manipulative skills, and muscular strength. They refine their balance as they develop the poise and stance required to operate the tools in the most effective way. Proprioception and kinaesthesia are also developed with the children's increasing ability to sense position and develop awareness of motion. Lower arm, wrist and hand control are all developed. This manual dexterity is beneficial in so many ways, for example learning to use cutlery, kitchen utensils, scissors or supporting early mark-making with pens and paint brushes.

Woodwork incorporates fine motor skills (holding a nail, screwing) and gross motor skills (hammering, sawing). There are many different types of movement such as pushing/ pulling (saw, file) and rotating (screwdriver, drill, wrench, vice) and levering (claw hammer, Japanese nail puller) and rubbing (sandpaper). Hand-eye coordination is developed for example whilst hammering or threading a nut on a bolt. One handed tools (screwdriver, wrench) and two handed tools (hand drill) are experienced. Using tools develops children's spatial awareness and associated positional language.

Woodwork encourages precision, for example when keeping a nail upright or cutting along a desired line. It also requires using a variety of degrees of force, for example, gentle initial hammering, then more robust hammering to drive the nail into the wood. With sawing, children will refine their action to get just the right pressure to get a smooth and steady cut.

As children become more familiar with the tools they become more adept, adjusting their position and stance to use their muscles more effectively. They learn to adjust their posture when sawing, positioning the left leg forward and the right leg back to be more efficient, enhancing their control and strength (vice versa for left handed children).

Children's core strength is developed as they use the various tools, such as hammering, rotating the screwdriver or sawing. The delight on a child's face when they have persevered cutting through a section of wood is a wonder to behold: a real mixture of pride and surprise that they could actually make it happen.

Communication and language

Woodwork stimulates communication and language development. There are countless opportunities for dialogue, and language is extended as children acquire and practise vocabulary. I couldn't always understand what was being said but the enthusiasm for discussion and communication was abundantly clear.

Language

Language develops as children learn the names of the different tools and materials. They will learn vocabulary relating to the processes involved and through discussing health and safety.

Initial discussions can be had about the nature of wood. What is it? Where it comes from? What is made of wood? What is wood like? These conversations will contribute to extending their vocabulary. Relevant vocabulary will develop in all areas of learning from mathematical thinking to problem solving. As children create and reflect on their work it will develop their ability to express and describe their creative and critical thinking.

Make time for children to talk about their work, talking about how they worked safely and the processes involved. This can also be done with a larger group and can be an effective way to share learning and exchange ideas. It gives children opportunity to reflect on their work and articulate this confidently. New technical and descriptive vocabulary can also be introduced to enable the children to talk about their work in more depth. Vocabulary and dialogue also evolve from subsequent play as children develop narratives involving their plane, robot or hedgehog.

Children in their early years will have very different starting levels of language. Language has such a strong impact on all learning that it is crucial to ensure that we really encourage language development and make time to really focus on children with less language ability by making time for sustained conversations to explore ideas.

Communication

In project development children will express ideas, discuss, reflect and modify their plans as they evolve. Natural conversation occurs among adults and children in the woodwork area. Children will use different forms of expression to clarify their thinking, ideas and understanding. They will share skills and processes with each other, negotiate as they share and take turns, or help each other with solving problems or sharing previous experiences.



Wooden moose by preschool child in Sweden

Mathematics

All the mathematical concepts that children need to develop in the early years could be developed at the woodwork bench. Much of the mathematical learning that takes place is coincidental, occurring as children resolve practical problems. It is a natural, authentic way for children to develop their mathematical knowledge and understanding.

There are endless opportunities to explore numeracy and shape, space and measure. Many mathematical concepts are involved, including matching, classification, counting, measuring, proportion, comparison, size, weight and balance, and two and three dimensional shapes.



Numeracy

Woodwork will encourage the spontaneous use of number names and number language. Children will be able to represent numbers with objects (for example, the number of nails or screws). This encourages them to match number and quantity. Counting quantity, for example the number of sections of wood used, gives opportunities to work towards exploring numbers up to 20 and concepts such as one more and one less. There are opportunities to sort the various types of materials being used. Children can count out from a larger quantity, for example counting 6 nails from a tub full of hundreds of nails.

There are opportunities for speculation and estimation and then for checking by counting. Numbers can be associated with length, for example with the use of the tape measure. Basic mathematical concepts such as adding and subtracting come into play as wood is joined or screws removed. There are opportunities to explore concepts such as halving and doubling by cutting wood in two or joining to equal sections. There are also many opportunities for mathematical problem-solving as the children work out how to use the resources effectively to express their imagination, for example working out how deep to drill a hole.

Shape, space and measure

Woodwork also provides many opportunities to explore shape, space and measure. Woodwork encourages three-dimensional thinking as children work with shape and create arrangements, developing an understanding of the properties of shapes, angles and spatial relationships. They notice sides, corners, edges, round, square, oblong, rectangle, circle, triangle. Their understanding develops as they identify, name and describe these shapes and properties.

There are many opportunities to explore and compare size: big, small, little, large, short, long, thin, wide, thick, and narrow, and these concepts can be further explored with the use of a basic measure. Concepts of weight and height are discussed: heavy/light; tall/short; high/low. Line can be explored: straight/curved; sides/corner; flat/angle; surface/edge. Children encounter spatial thinking in terms of orientation and position: upright/vertical; horizontal/sloping; under/above; behind/next to. There are many opportunities to categorise, sort and compare according to the shape and size.

Estimating is often involved in woodwork, for example, thinking about the best length of nail to use to join two sections of wood together. Understanding of measurement can be supported by using a variety of measuring devices and using different units, including non-standard units. The more opportunities children have to measure for a real purpose the better. This is learning in context.

Understanding the world

Children's understanding of the world, knowledge of how things work and their scientific thinking are all developed in a multitude of different ways through

woodwork. Certain knowledge will be specific to wood and other materials used and some knowledge will also be in relation to the use of tools.

- Knowledge and understanding of wood and trees
- Properties of materials
- Wood products and people who work with wood
- Technology
- Cause and effect
- STEM
- Deconstruction

Knowledge and understanding of wood and trees

Many settings developed children's familiarity with wood and trees helping them make sense of the world. Trees are essential to life on our planet, and children are fascinated to learn about the many types, and their different uses and how they grow. Even young children can begin to appreciate the interconnectedness of life and our dependence on the oxygen released into the atmosphere by trees and other plants. Learning about animals that live in trees or trees that provide fruit and nuts. Explore how trees grow starting with a seed or sapling. Explore the seasons and life-cycles of trees.

Children were often taken into the woods to investigate trees- the trunk, bark, branches, leaves and roots, and describe the textures – rough, knobbly, smooth and smells (such as the sweet smell of cedar). Discovering shapes and patterns, making bark rubbings, building a small fire, using branches to make dens. All of these will contribute to building their knowledge. Children observed the wind moving trees, listened to the sounds of crunching leaves, snapping twigs and listening to the wind swaying leaves and branches. As an aid to observation children used a camera to capture images of trees.

Leaves were sometimes investigated on a light box, examining the vein structures and colours. Prints were made with leaves (print leaf patterns using a hammer block with muslin/white fabric and paint).



Preschool children in Denmark regularly work with knives carving wood in the woodland environment

Properties of materials

Children can investigate wood as a material researching its many properties. For example: wood burns (fires to keep warm, to cook on, charcoal), wood floats (boats, 'pooh sticks'). Learning often takes wonderful tangents and digressions as children follow their insatiable curiosity. Exploring floating could lead to making boats, which may lead to exploring sails and wind.

Technology

Woodwork is simple technology. Technology ("science of craft", from Greek) is the collection of techniques and processes used in the production of goods. Technology is about making things, putting ideas into practice, discovering the possibilities and limitations of materials and tools, and being creative to overcome problems. At the heart of technology is exploration - exploring cause and effect, just as a young toddler explores this through heuristic play.

It is easy to think of technology as solely referring to high-tech electronic devices and computer equipment, but simple tools are in fact a basic technology and have also played a significant part in developing the sophisticated technological world of today.

Children gain a scientific and technological understanding of tools and how they work, for example, by experiencing that the movement and weight of the hammer forces the nail into the wood, or seeing how the claw hammer or Japanese nail-puller work as levers that can slowly lever nails out of the wood, or seeing how turning the crank handle of a drill rotates the drill bit. Children may make connections with other tools they have seen, such as an egg whisk. This develops their understanding of technology and the underlying scientific concepts.

Cause and effect

Children learn about scientific principles through cause and effect, discovering what causes things to happen. Seeing that a nail has split a piece of wood or that a section of wood attached with one nail may move whereas two nails it is fixed firmly. They will witness how turning the crank rotates the drill bit. How the drill bit heats up with friction. How the spirals on a screw help it go into the wood. How rubbing with sandpaper creates dust and warms the wood. How a clamp or vice applies force to hold things steady. They can discover how to best to allow a wheel to rotate on its axil. How to correct the angle of a leaning nail. How to remove a nail by using a lever. Movement is explored as children work with the various tools, for example they will be exploring pushing and pulling or rotational movement through twisting and turning.

As their experience of working with tools and wood evolves they will be furthering their scientific understanding, expanding their knowledge, and developing a sense of what tools are the most suitable for a desired task and what type of wood or additional materials would work best. They will quickly discover if a section of wood is too hard or how a very thin section of wood easily splits.

Science, Technology, Engineering and Maths (STEM)

Many of the schools visited highlighted the importance of woodwork to support STEM or STEAM especially within the United States. Many schools use STEM, a way of teaching that provides an integrated approach across the disciplines of science, technology, engineering and maths – as each area reinforces the others. Again woodwork can be seen as an ideal medium for this cross-curricular learning, as children develop their understanding of wheels, axels and levers, for example. To really enable children to understand STEM concepts we need to provide authentic real experiences, not abstract alternatives. Many schools are not currently providing children with the STEM learning experiences that they desperately need, and woodwork, as it offers many avenues of exploration and investigation, can directly link to all STEM subjects. Through hands-on learning children are much more likely to develop an interest in and pursue STEM subjects –thus once again woodwork could be seen as being beneficial to the economic narrative.

Deconstruction

Deconstruction (such as disassembling a tricycle for example) deepens children's understanding of how things are made. Many of the schools in New Zealand have a specific area for deconstruction there was also commonly done in the Japanese studios. As children break the object down into parts, they can investigate each component and discover how they were assembled, building knowledge of how things are manufactured. They will discover how elements interact. They can think about the purpose of each component and the complexity of what is needed to make an appliance function.

Deconstruction encourages children to slow down and observe, to look deeper, to be curious and question. Looking – close and mindful observation is crucial and to do this we need sustained time to notice the details, the complexities and the design. Thoughtful observation will initiate investigations, with the potential to open up many new lines of enquiry. They may become fascinated by the fact that a speaker is magnetic and go on to explore magnetism, they may be curious about the coloured wires and go on to investigate further by making a simple circuit. Seeing how cogs work together may draw children's interest to explore rotational movement. Every time we have deconstructed an appliance it has led on to other rich lines of enquiry.

Children will also develop a heightened sensitivity to design, and will develop a critical eye, allowing them to tinker with or ponder on how objects or systems could be improved or redesigned, as opposed to more passive 'consumer disengagement'.

Expressive arts and design

Woodwork provides children with a wonderful medium through which they can express their imagination through art and design.

Creative expression

Woodwork allows children to express their creativity and imagination in another medium. Initial emphasis is on developing skills and experimenting with possibilities. Children then go on to express their imagination in a variety of creative ways by producing work that they personally find interesting. The nature of woodwork is very open-ended, allowing children many possibilities to express themselves in new and unique ways. The resulting work varies enormously, ranging from symbolic and representational to abstract to work containing narrative. Abstract work is sometimes in relief as children use sections of wood to create a picture but mostly they create more three-dimensional sculptural work.



Design and construction

Design and practical skills are combined in the woodwork process. Design involves defining the task, making a plan of action, deciding how to proceed, and refining and responding accordingly as the work evolves. The practical skills or craft transform the designs into things. These processes go back and forth as work is often fluid and evolving as children adapt, refine and change it as it progress. Older children may also wish to draw some initial designs to help articulate their ideas.

The processes involved in woodwork develop children's knowledge of construction. In woodwork they will inevitably join and construct in a variety of different ways. They discover that wood sections with flat edges are easier to connect than angled pieces.

They discover how to make joins strong and robust, or work out how to make their model stand up on its own. As they construct children are designers, architects, builders and sculptors.

Set tasks

The best examples were open ended not where children undertake set projects whereby all the children create the same object. Children should not make from pre-cut kits (such as bird house kits) or make models simply by copying an example model. The secret to children remaining really engaged in woodwork is that they are following their own interests and solving their own problems to create their work. When children are set specific projects such as making bird boxes or key holders, many will lose interest and others will be frustrated by having to follow narrow instructions as these projects do not allow them to work at their own ability level. Set projects inevitably have more emphasis on the product than on the process. All exploration becomes more meaningful when it has been initiated and is led by the children.

Open-ended enquiry

Woodwork provides a wonderful way to support open-ended learning and self-initiated enquiry – essentially play! Have a wide range of resources available to allow plenty of possibilities and options for tinkering. Provide a mixture of additional materials to combine with wood, such as bits of fabric, buttons and beads, string and so forth. It is a delight to see the resulting pieces of work all being so individual and unique. Children can further develop their models by painting or by gluing on other elements.

Throughout the process children will be using their imagination as they search for the most suitable shapes and combinations in a box of off cuts to express their ideas, seeing possibilities in an odd offcut such as “This could make a good trunk for my elephant!”

Other expressive explorations may emerge, for example as children stamp patterns on wood, printing with blocks wrapped in string, mix sawdust with paint to create a textural paint, or create artwork with shavings.



Talking tree school outdoor maker space, New Zealand

Collaborative work

Several of the schools visited also encouraged collaborative work on specific projects. Co-operation is needed as children discuss ideas, and resolve problems together and refine their design. These ideas can evolve from previous learning, chance events, current interests or a problem posed by children. Collaborative work can also be planned and initiated by teachers but in a very flexible and inclusive way, allowing children to have as much control as possible of the process. We can always tell if this type of project is working by observing the levels of engagement and if children are absorbed. The adult role can be very much about providing the necessary resources, posing questions to open up thinking, sharing knowledge and skills and partnering the children in exploring their imagination and creative forms.

Craft sense

Woodwork is a wonderful medium for developing 'craft sense' which was a central part of the woodworking practice within the Nordic countries. Craft sense is about *making* and then evaluating the production process. Envisioning is central to the process; what might happen? How would it have been if we had tried a different approach? Children set their own goals, explore ideas about how to realise these, then plan, experiment, implement and evaluate. Through reflection children add new knowledge to their cognitive schemata. The heart of developing craft sense is to tune into this process and make time for evaluation of all processes involved. A camera can be a useful tool to support this analysis. Visualisation of the learning processes embeds learning. Reflecting back on the images later can stimulate dialogue and children can order the images according to the process they followed. Deep level focus and involvement, metacognition and self-regulation are integral to developing craft sense. Another important aspect is *transfer* in which children use previous knowledge gained for planning new projects, then once again monitoring and adjusting actions in responding to the new challenges arising from the new project. Attention is also directed towards children expressing what they need to

learn to accomplish a certain project which again develops their skills of metacognition.

Literacy

There are many books available in all languages which enable children to read and listen to stories about wood. There are books about the uses of wood, carpentry and different people that work with wood, types of trees and forestry. There are also a number of songs that can relate to woodworking. In the resources section there are some examples of books and songs.

Children could make their own books about what they have made, including photographs, labelled drawings and writing. Older children may wish to extend narratives incorporated with their model with creative writing. Young children can use their emerging mark-making skills to express design ideas and develop plans. There are also opportunities for mark-making on the models as an additional element.

The fine motor manipulative skills acquired through woodworking will also help develop children's fine motor control needed for handwriting. The finger, wrist and arm control gained all contribute to children's emerging mark-making and subsequent writing skills.

Sustainability

Many of the schools visited highlighted the importance of woodwork for developing children's understanding of sustainability. Woodwork builds children's ability to design and make. It develops the ability to repair. Both of these attributes are important tools to counteract characteristics of our consumer society, through making and repairing rather than consuming and disposing.

By just passively consuming children are removed from design. Through making and deconstruction, children discover how things are made, see the elements of design and develop a sensitivity to material, its functional possibilities and the designed elements of an object.

There are also many opportunities for children to gain environmental understanding and learn to respect the natural world. Early years children are developing their fundamental attitudes and values, so any opportunity to embed thinking around sustainability should be embraced.

Understanding where wood comes from is another important aspect: seeing the beauty of wood and how long trees take to grow can help children respect and understand the value of wood as a material and the need for us to take responsibility for our shared environment. The majority of wood used will be recycled, using offcuts. It is great to be able to utilise and repurpose waste materials.

Key aspects to effective practical hands on making practice

Recommendations for UK (and other counties):

Factors for successful provision within school:

Key is the support of the SLT (senior leadership team, head teachers, governing body)

It is crucial that teachers have the support of their senior leadership team. The headteacher needs to understand the value of experiential learning and especially handling tools through woodwork. As heads are taking the ultimate responsibility at the school they have to feel confident in the abilities of the teachers to provide the safe provision of woodwork, and to ensure teachers understand the health and safety measures that need to be put in place.

Informed teachers – CPD training in practical skills and understanding value of woodwork

Many teachers will have had very little experience of working with tools themselves. It is crucial that teachers are given training in Woodwork. This training should encompass both the theory of woodwork focusing on the learning and development and also on the practical skills and knowledge needed such as the most appropriate tools how to set up a woodworking area and of course focusing on the health and safety that needs to be put in place and how to undertake a risk assessment. Ideally this training would be part of teachers teaching training graduate program however in the current situation this is highly unlikely and training is most likely to be delivered through continuous professional development either bought in by the school as inset training or delivered by the local authority. The models of training varied in schools visited with the majority relying on in-house training, developed from either online sources or educational publications. The most successful model of training had been in Nordic countries when it was formally part of the teacher training.

Children being at the centre of their learning – child led exploration and experimentation

The most successful examples of children's engagement with woodwork were when the children were following their own lines of enquiry and curiosity. This was predominantly the model embraced by the vast majority of settings visited. It's undoubtedly makes a huge difference for children to be the protagonists in their own learning, and in this way they will be creating their own problems but because they are making what they want to make they have the intrinsic motivation to resolve their work by finding solutions to the problems they encounter. In this sense woodwork

becomes all about creativity with children developing their creative thinking skills and their critical thinking skills. Wood becomes another medium with which children can express their imagination. When I encountered more adult directed projects much of the creativity was lost and also the children's enthusiasm and engagement was diminished.

Of course initially there needs to be a significant input from the adult in terms of how to use the tools safely and appropriately. Teachers were seen to providing freedom with guidance. As soon as the children become competent with the tools they can then work more independently on their own lines of enquiry exploration and discovery.

There seem to be an increase in adult led projects as children progressed through elementary school perhaps reflecting the ethos of primary education in the respective countries, with the decreasing value of capturing children's curiosity.

Space for the woodwork area

Having a specific space for woodworking certainly facilitates the fluid provision of woodwork. Woodwork areas looked different in different countries but the most successful examples were where there was a permanent woodworking area set up. This varied from country to country as to whether it was indoors or outdoors, the most significant factor here being the climate or whether there was an under-covered area outdoors. The most common set up was a specific room that was dedicated to woodwork, a woodwork workshop or studio where children took turns to access all the equipment and resources. All of the schools I visited in the United States had a specific room given different names ranging from workshop, makerspace, tinkering lab etc. in Japan similarly they have specific room set aside for woodwork. In the Nordic countries and New Zealand the Woodwork provision tended to be included as part of continuous provision within the setting and would be located in the corner of the classroom or under a veranda for example. Having a woodwork area continually available obviously very much supported continuous provision.

Having the most appropriate tools has a huge impact on practice

From the many visits it became clear that the type of tools available and their ease-of-use made a big impact on the resulting engagement of the children. The most important factor was sourcing tools that children could use independently. In this sense they needed to be ergonomic, child sized and fit for purpose. The choice of tools did tend to reflect what was commonly used within wider society and there were differences from country to country. It was commonly felt that children only required a limited number of tools to accomplish quite complex work. The commonly used tools were hammer screwdriver saw and the hand drill. These were supplemented with other tools such as a file (rasp), palm drill, sand paper, etc.

Most countries were quite careful about the choice of tools in terms of safety. In New Zealand I did encounter a slightly more relaxed attitude to risk, such as young children using power tools and at times I felt this potentially could lead to a significant accident.

The tools available in Japan were particularly well-suited to young children and have even had been embedded in many of the other parts of the world I visited. Japanese saws that cut on the pull stroke are so much easier for young children to use successfully than standard Western cross cut saws. The Japanese nail puller is an ergonomic tool for removing nails so much easier than with a claw hammer. The Japanese practice of gluing sandpaper to a board makes sanding so much easier for young children. The Japanese Shinto file is a wonderful for filing wood as it does not clog the same way that a rasp does. The workbenches that will commonly available New Zealand had a great design feature having wheels at one end that could facilitate the easy manoeuvring of the workbench which is often a problem as they are so heavy.

Resources

The most successful examples of woodworking are when the children have access to a wide range of materials which allowed them a multitude of possibilities and encouraged more complex problem solving and to create complex models.

The majority of settings were not dogmatic about the need of woodwork to remain exclusively about wood. They encouraged the use of multimedia materials including elements such as string, fabric, leather, wire, corks, bottle tops etc.

In terms of wood again the most successful provision was when there was a wide variety of shapes and sizes of softwood, which across all countries was usually pine - the most readily available softwood. The majority of schools also tended to use a mixture of other wood that they managed to source such as plywood or MDF. Settings that introduce wood to very young children such as three and four-year-olds would often initially have a short phase of using balsa wood to allow the children to gain confidence using the tools with this relatively soft wood. All countries took advantage to use as much recycled material as possible whether this being wood or the other additional resources.

Funding

It was clear that woodwork does require a certain amount of investment. Initially there has to be investment in the toolkit and on the workbench and then there are ongoing operating costs in terms of the consumables such as nails and screws and sandpaper etc. Some schools tended to have a significant budget from which to be able to purchase the lengths of pine meaning that they always had a plentiful supply of softwood available. Buying newly sawn wood this has the advantage that they can be more specific about the grade/softness of the wood and also that it has a cleaner surface having less splinters. But the majority of schools in all countries sourced most of their recycled wood themselves in a variety of ways including asking the parents to bring in donations of off-cuts of wood.

Once the initial costs of getting started with taken into account (and these realistically can be spread over many years as the workbench and tools will last many years) then the ongoing costs are not much more than the many other early childhood activities such as painting.

In Japan one thing stood out to me which was the fact that the wood presented to children was cut up into quite small sections which allowed their wood supplies to

stretch much further and also had the impact that the children's work tended to be much finer and more detailed working with the smaller sections of wood.

Factors for successful provision within the sector/ locality/ region/ country:

Positive guidance form inspectorate (OFSTED, Care Inspectorate etc)

In all countries early years education is monitored and inspected regularly. This results in the schools being graded as to the quality of their provision. It is clear that having an Inspectorate that is positive about the provision of woodwork does make a big difference in terms of the schools confidence to provide woodwork. In New Zealand schools would be pulled up by the inspector if there woodwork area was not set up well-resourced and in use!

Positive balanced attitude to risk from health and safety executive

Schools are given confidence by the individual countries health and safety executive giving positive guidance for the use of tools in early education.

Pro-active legislation form Government health and safety audit (Common sense, common safety)

Again having legislation in place of the governmental level that encourages common sense attitude to health and safety is important especially to allay the fears of schools in terms of litigation culture.

Encouragement and investment from DoE, (STEM Scotland)

Priorities set by the Department for Education will have a significant impact. So having the Department for Education that values and gives importance to practical work is crucial especially in these days of school readiness where reading and numeracy are prioritised above everything despite all the empirical evidence suggesting that children need to develop their dispositions and attitudes to learning before content. It was clear that proactive approach of the Education Ministry in New Zealand has a positive impact on the quality of their provision.

Incorporated into curriculum guidelines

Schools are most directly influenced by their curriculum guidelines, especially in relation to being inspected, so it is crucial that the curriculum specifically cites the importance of work with tools and especially work with resistant materials such as woodwork. Being specifically recommended clearly encourages settings and gives them confidence to provide woodwork as again was seen in the case of the Te Whariki curriculum in New Zealand.

Included in teacher training graduate programs

By far the best way to embed woodwork throughout early childhood education is to have all teachers trained in woodwork during their teacher training. This would clearly have the biggest impact. In Sweden and other Nordic countries until very recently this was the case and it had a massive impact on provision throughout the country. It used to be part of many teachers training here in the UK but slowly disappeared during the 60s and 70s.

It would be wonderful if this could be once again a part of teacher training but I feel the reality is that this is not so realistic, at least in the short term. With so many different providers offering different qualifications for early childhood teachers, and combined with the fact that many lecturers themselves have little experience of woodwork this initiative would take a huge amount of investment and prioritisation. Which, given in current times, we are struggling to get the basics right I think it may well be some time before this could even really be discussed.

Local authority provision of CPD

This is the most viable cost effective option for teachers to learn about best practice in woodwork provision and to understand the learning and development associated with woodwork. Teachers would attend woodwork continuous professional development training hosted by the LA. This certainly could happen at a one day training event hosted by the local authority where specific teachers, or design and technology leads could attend and then share knowledge back with the school.

School budgets to host INSET staff training

Another possible option is for schools to have an in-service day training dedicated to woodwork. This format is actually the most successful, and has the most significant impact on practice as all the teachers in the school get to hear the same message, and it tends to generate a certain enthusiasm and energy within the school to really get started with woodwork and provide the rich opportunity to their children. This was the training method most regularly used within the private sector within the United States.

Greater number of trainers

It is an issue, and this was the same across all countries, that there are very few people offering any sort of woodwork CPD training. This is something that needs to be developed and prioritised. The current situation leaves many schools having to rely on online and written guidance.

Future development and implementation in UK:

This Churchill project provides the platform for the next stages in terms delivering impact and scalability.

1. **Continuing research - The Big Bang Research Project – collecting data to provide empirical qualitative data on the value of woodwork. Ongoing**

I have set up The Big Bang Research Project organised through the University of Bristol, specifically to evaluate the impact of woodwork on children's learning and development both in the UK and around the world. This data is gathered through a survey document which is completed and then the data is analysed. This work has now started with contributions from all over the world. I envisage continuing to gather data for at least another year. This will form the basis for providing empirical evidence which can be used to inform policy makers.

<https://irresistible-learning.co.uk/woodwork/the-big-bang-research-project/>

2. **Delivering keynote addresses to National and LA education conferences – Ongoing**

As part of my work as an early years educational creative consultant I regularly deliver keynote addresses to conferences organised by national early childhood education organisations, local authorities, multi academy trusts and school consortiums. These provide a great way of spreading the message about the potential of woodwork and enthusing schools to think about embedding woodwork within the setting. This is something that I will continue to do and sharing my experiences gathered during the Winston Churchill research will provide more expertise to my presentations. Through the conference presentations, conference workshops and seminars, many teachers will benefit first hand hearing about my experiences and seeing examples of best practice around the world.

3. **Delivering CPD directly to schools and LAs - ongoing**

I regularly deliver woodwork teacher training to schools and local authorities throughout the UK. I will be continuing to do this at an increased frequency and again experiences gathered will have a significant impact to the quality of training delivered

4. Educational Press - ongoing

I have written many articles for educational research Journal's and also education magazines. These have so far managed to reach a wide audience from within the early childhood community and this is something I would like to continue with and to contribute regularly

5. National Press/ Media Campaign – to action

This is one of the next stages. It is important to reach a wider audience and I would like to contribute articles to national newspapers and to be interviewed on national radio and television to really raise the profile and generate more debate around the importance of hands on learning with tools. Presenting a TED talk on the subject could potentially be another way to reach a wider audience.

6. Meeting with DoE and policy makers – to action

I would like to meet with representatives from the Department for Education to talk about the importance and the value of woodwork in early education and how this can be best encouraged through the specific content of the curriculum.

7. Meet with providers of teacher training courses – to action

I am not sure how best to action this as there are several different bodies delivering early years teacher training. I think in the first instance it may be best to work with a couple of specific teacher training courses to embed woodwork training within this course and then see how it can be best rolled out to other universities and colleges.

8. Forming Early Childhood Woodwork association – started

I have formed the Early Childhood Woodwork Association which is a body to support the development of woodwork provision within the UK. This is in the early stages, and in the near future, we hope to be registered a charitable association that can receive funding. As part of this project I intend to work with two exemplar schools that can showcase woodwork provision to visiting teachers. One of these will be sited in nursery school and the other in primary school.

<https://earlychildhoodwoodwork.org/>

9. Making free training materials/ video tutorial – to action

In relation to the fact that there are not enough trainers I would like to work together with the Early childhood Woodwork Association to make a series of training videos that can be made freely available online for anyone to access either UK or around the world. Funding will be required for this initiative. I also intend to have more material translated to support practice in other countries. This has been done in Welsh and German.

10. Training more woodwork trainers –to action

It would be great to train more trainers to be able to deliver woodwork training for the local authorities or directly to schools. Again it is not so easy to source independent trainers as the market for CPD training is diminishing with decreased professional training budgets from schools.

Beyond Early Childhood:

Primary

Throughout my travels I also observed a number of primary schools providing woodwork to their children. It was wonderful to observe the progression and development children as they built on previous years learning continued to develop complexity increasing skill within their making processes. I truly believe design and technology in primary school must include work with resistant materials. Today very few schools do any work with resistant materials and design and technology is so often doing things such as making electric circuit with a shoe box or designing things on paper rather than putting things into practice in using practical skills and going through the whole design thinking – making - evaluation process. I feel we are failing the generation of children by not providing these practical skills when so many people will need practical skills in their future work lives. The excitement, passion and energy generated by schools where they have really embedded hands-on practical learning within their school curriculum is palpable. This will be a later phase of my work to really develop woodwork so that it once again can be developed within primary school settings. In the first instance I plan to write a book about woodwork in primary school to start generating interest and help teachers get started.

In Nordic countries all primary school students have access to a specific workshop space within the school to learn practical making both with hard materials such as wood and metal in soft material is such as fabric. It is a mandatory part of curriculum in all Nordic countries. It's hardly a surprise that so much innovative design emerges from Scandinavia.



Woodwork project making go-karts by 10-year-old children at the Blue School - New York City.



Children making marble runs United States





Children at Talking Tree Hill, New Zealand working in the outdoor makerspace



A bookbox made by primary children in NYC Elementary woodwork class in Japan

Secondary

Sadly the situation within the secondary schools within the United Kingdom sector is dire. Design and technology, along with art and design and music are no longer required subjects. Design and technology requires a larger budget than most departments due to the workshop space, specialised equipment, resources and a technician. This makes it an easy way for schools to save money, by cutting the provision and thus compromising pupil's education. The government on one hand is emphasising the fact that we need more young people to go into manufacturing and engineering but if they don't have the knowledge and experience of practical working this is certainly not going to help the situation. Many universities are highlighting the fact that they have highly academic applicants but have no practical knowledge or sense.

The current situation is that less than half the schools in the country even offer design and technology is a GCSE option. And almost weekly there is another school that has stopped providing design and technology. I strongly feel that this is a very short-sighted approach, and in terms of developing the country's potential for entrepreneurship, innovation and manufacturing we desperately need to be encouraging the future designers and creators.

I will support others involved with the campaign to value D&T in secondary education

Final words

This fellowship has been a wonderful opportunity to learn from settings around the world. The impact of this project has already started, and it is wonderful to see the growing enthusiasm for woodwork right across the United Kingdom within the early years sector.

We have seen how working with real tools offers children new experiences and encompasses all areas of learning and development. Woodwork allows children to become the innovators, makers, sculptors, tinkerers, engineers and architects of tomorrow. The experience of working with wood leaves a deep memory. Once having learnt how to work with tools they become a part of children's DNA. It also develops the characteristics of effective learning – providing a tool kit for life through developing dispositions such as resilience, perseverance, problem solving and risk taking.

Woodwork is a learning opportunity that should be available to all children. To make this possible my key recommendations need to be acted upon. The most crucial aspects are the development of knowledge and understanding of woodwork – both the theory and practice.

- Informed and supportive SLT (senior leadership team/ headteacher /governing body)
- Informed teachers – CPD (continued professional development) training in skills and in the value of woodwork
- Informed and supportive parents who understand the value
- Pedagogy with children at the centre of their learning – child led exploration and experimentation as opposed to adult led provision

It is also important to have a supportive and encouraging national educational framework.

- Positive guidance from inspectorate (OFSTED, Care Inspectorate etc)
- Positive balanced attitude to risk from national health and safety executive
- Pro-active legislation from Government health and safety audit (Common sense, common safety)
- Encouragement and investment from DoE, (STEM Scotland)
- Incorporated into curriculum guidelines
- Included in teacher training undergraduate and graduate programs
- LA provision of CPD training
- School budgets prioritised to host INSET staff training
- Greater number of trainers to be able to meet increasing demand.

And my final recommendation is that there needs to be a clear strategy for the future development and implementation within UK. This Churchill research project provides the platform for the next stages in terms of delivering impact and scalability and many of these are now underway with the result that many more children are now experiencing the wonder of woodwork throughout the UK. My key recommendations for moving forward are:

- Continuing research - The Big Bang Research Project – collecting data to provide empirical qualitative data on the value of woodwork. This work has now started with contributions from UK and overseas. - Started
- Delivering keynote addresses to National and LA education conferences - Ongoing
- Delivering CPD directly to schools and LAs - ongoing
- Educational Press/ Media Campaign - started
- National Press/ Media Campaign – to action
- Meeting with DoE and policy makers – to action
- Meet with providers of teacher training courses – to action
- Forming Early Childhood Woodwork association - started
- Making free training materials/ video tutorial. – to action
- Training more trainers of woodwork CPD – to action

It would be wonderful if every child could experience the magic of woodwork. As a practitioner, it is a joy to see children so deeply focussed on an activity, witnessing their growing confidence, their persistence with challenge and their resilience in the face of failures. It is a delight to watch their creativity, observe their problem solving and see their pride in their achievements.

As children make with wood they are learning skills that will empower them to shape their world. Let's provide all children with this valuable opportunity.

Big bang

Small hands

BIG ideas!

I welcome feedback and suggestions and also collaboration – so do make contact – its personal connections that build our learning community
studio@petemoorhouse.co.uk

Appendix1

Selected practical ideas:

Arms of the vices are removed when the Workbench is not in use to avoid the potential of trapped fingers with children playing in the vice



The Japanese Shinto files work very effectively avoiding clogging



Many settings used scroll saws or fret saws starting with children from five years onwards. These are common in the United States and in Japan



The hot glue gun was found in every setting in New Zealand and provided a useful way children to be able to join certain things were not possible with other tools



Many settings took advantage of using debris from their deconstruction projects. This example is from Tokyo Japan



Japanese technique of gluing sandpaper towards make sanding easy for young children

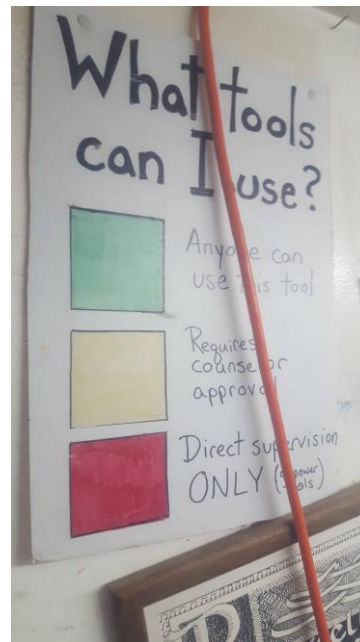


Japanese saws that cut on the pull stroke by far the easiest for children to use



Having a wide variety of additional resources allows more possibilities and facilitates creativity

A clear system indicating
what tools children can
accessed independently
in an elementary school
in the United States



Resources/ links/ books:

Anderson, Chris (2012) *Makers: The New Industrial Revolution*, New York: Crown Business.

Arieti, Silvano (1976) *Creativity: The Magic Synthesis*, New York: Basic Books.

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Woodwork – giving children the skills to shape their lives

.....and I will continue to hammer this message home! - Pete Moorhouse – January 2020