Added Value Learning Innovation

Imelda Graham[1], Alan Bruce[2]

Universal Learning Systems, Ireland[1,2]

Abstract

Added Value is an Erasmus + Project that has conducted research among four partner countries into current teaching policy and practice, to support teachers of Mathematics and STEM subjects. The project is currently developing and piloting innovative tools among teachers in Poland, The Netherlands, Spain and Ireland. The project operates on the principle that teaching of Mathematics will be enhanced by using methodologies that emerge from the use of playful, fun and imaginative tools. The tools being piloted have utilised Design Thinking in their development, and the initial response to the call for participating schools, particularly in Poland, has revealed a hunger amongst teachers for such an approach. This paper argues that teaching methodologies need to recognise teachers and learners as co-constructors of learning, towards a heutagogical ethos supporting the principle of self-directed learning. The value of play to this ethos will be illustrate the concept that it offers an important tool to foster and support long-lasting positive dispositions to learning and creativity. Such dispositions are vital in developing an intrinsic and enduring motivation to learn among students of all ages, and will encourage creative thinking, not just among students and workers but for the benefit of society as the challenges and opportunities of the 21st century advance.

Keywords: *Innovation, Teaching, Play, Motivation, Learning.*

1. Introduction

The future of education can be enhanced by ensuring that educators meet the changing needs of learners. This paper argues that the move towards self-directed learning will be enhanced through the use of an innovative playful approach. This approach will enable learners to develop critical thinking skills within the structural framework of Design Thinking, equipping them to respond effectively to the rapid outside changes in their environment "The world has become increasingly interconnected and complex, and design thinking offers a means to grapple with all this change in a more human-centric manner" [1]

The Added Value (AV) Project [2] uses this approach in one field of education, Mathematics, which is traditionally perceived by learners as difficult. The AV project is to put mathematics in practical everyday contexts using the theme "Maths is Everywhere", and to make approaches grounded in mathematics (and associated STEM frameworks) accessible and meaningful to students and educators alike. Above all, the project seeks to empower students to believe that they can successfully learn mathematics using innovative methodologies.

In the workplace, there are demands for entrepreneurs and industry to use creativity and innovation. Major issues facing society, such as the climate crisis, also require innovative thinking. The development of critical skills, creative thinking, and a positive disposition towards lifelong learning can be fostered through using the opportunities afforded by play and innovative education.

2. Added Value and Learning Innovation

In the AV Project, mathematics teaching has been analysed over four distinct national education systems. Both differences and similarities have been identified. A number of common patterns emerged:

a) A general decline in standards of mathematical competence in almost all population groups, but particularly so in the case of females, those with specific learning needs and other groups of non-traditional learners.
b) despite significant improvement in the mathematics curriculum for early-years students, real problems emerge with transition to secondary level where there is an accelerating concentration on examinations and testing systems.
c) Significant competitive pressures have been identified which detract from the general aim of creating what the **Added Value** project team described as "Sustainable Mathematical Competence and Numerical Literacy".

The areas that pose the greatest challenge for teachers include:

- engaging children in problem solving and in the general processes of mathematics

- developing the mathematical understanding of children from diverse language backgrounds
- supporting children experiencing difficulty with mathematics

Factors which lie at the heart of this project include: overcoming the negative associations of mathematics as a 'difficult' subject, integrating mathematical competence into everyday life and instilling a sense of wonder and enthusiasm for the joy of learning in mathematics [3].

2.1 AV and Design Thinking

Design Thinking is "a process for creative problem solving" which can aid the educator and the learner to examine the innovative challenge of a problem through a useful structure. It sets out a simple process and can be used in an iterative manner [4]:

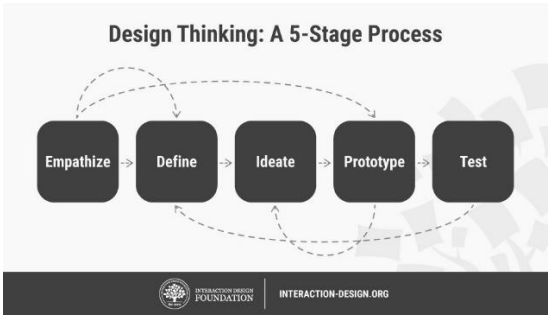

Figure 1, Design Thinking Process

Using Design Thinking in the AV project concurs with the aim of focusing on problem-solving and real-life applications of mathematics.

3. Play and Learning Innovation

> *Play in all its rich variety is one of the highest achievements of the human species, alongside language, culture and technology. Indeed, without play, none of these other achievements would be possible. [5]*

Creativity is inherent in young children, however "Creativity and innovative ideas peak in young children at around 90%, this declines as they progress through the education system down to as low as 10% [6]. Tim Brown illustrates how adults become less willing to express original creative ideas, conscious of possible ridicule by their peers [7]. Organisations, recognising the need for creativity, are seeking ways to overcome it by providing environments that are playful, applauding ideas and suggestions without fear. "Creative workplaces have space for relaxing and thinking; they can have symbols to remind staff to play. For example, PIXAR animators work in decorated huts and caves; Google headquarters have pink flamingoes, a giant dinosaur skeleton, space for volley ball and beach ball, their Swiss centre has slides and a fireman's pole" [7] The act of play shapes the brain: "Play supports novel neural connections and changes the architectural structure of brain regions through its own value and fabulations (pleasurable and 'as if' behaviour); 'the brain not only shapes play … play also shapes the brain. Play lights up the brain: the executive function (self-control) and the cerebral cortex [8]. Adults can become energised, motivated through play; they can increase their divergent thinking leading creative ideas. Human flourishing, according to Sir Ken Robinson [9] is organic, and needs the right conditions, those which nurture and feed people's spirits. Playful adults will understand when play will help them with divergent thinking to generate ideas and planning.

3.1 Characteristics and Benefits of Play

Play needs to be understood by educators. The key characteristics of play are that: **'**Play is freely chosen, personally directed, intrinsically motivated behaviour.' [10]. .Such activity allows us to test, to explore, to experience, to challenge within the boundaries that are agreed by the participants, we can say 'what if', 'can I', 'should we'. Play is the original 'virtual reality', wherein exploration of real-life challenges can occur in a safe environment. The elements of play, such as exploring, taking risks, testing are similar to core elements of learning, such as in the scientific method. For children, play helps them to mediate the world around them as well as their own mind and bodies. They can explore deeper meanings and gain understanding; play can enable children to test out new capabilities that emerge with physical growth. Adults can become energised, motivated through play; they can

increase their divergent thinking leading to new and creative ideas. Play builds trust, it will enhance co-operation and relationships in the workplace. Human flourishing, according to Sir Ken Robinson [6] is organic, and needs the right conditions, those which nurture and feed people's spirits. Playful adults will understand when play will help them with divergent thinking to generate ideas, plans, and when to switch to more convergent, solution-based mode.

4. Play in Innovative Learning Provision

Humans are designed to play throughout their lifetime. Lester [11] suggests that "Playing is not a specialised activity apart from the 'real' but a creative force or desire of life itself; a movement of becoming". The nature and modes of play may shift and change as we move through life. Hughes [12] taxonomy of play is founded on the principle that humans need to play under the categories he has identified in order to fully develop.

1. **Symbolic play** – play which allows control, gradual exploration and increased understanding without the risk of being out of depth.
2. **Rough and tumble play** – close encounter play which is less to do with fighting and more to do with touching, tickling, gauging relative strength. Involves discovering physical flexibility and the exhilaration of display as can be seen in sport.
3. **Socio-dramatic play** – the enactment of real and potential experiences of an intense personal, social, domestic or interpersonal nature.
4. **Social play** – play during which the rules and criteria for social engagement and interaction can be revealed, explored and amended, often fostering camaraderie and better team work.
5. **Creative play** – play which allows a new response, the transformation of information, awareness of new connections, allowing players to design, explore, try out new ideas and use their imagination.
6. **Communication play** – play using words, nuances or gestures.
7. **Dramatic play** – play which dramatises events in which the player is not a direct participator.
8. **Locomotor play** – movement in any or every direction for its own sake, and stretching one's capacity to movement.
9. **Deep play** – play which allows the player to encounter risky or even potentially life-threatening experiences, to develop survival skills and conquer fear, expanding their own personal boundaries.
10. **Exploratory play** – play to access factual information, engaging with an object or area and, either by manipulation or movement, assessing its properties, possibilities and content.
11. **Fantasy play** – where the player can make believe that they are totally different and rearrange the world to suit.
12. **Imaginative play** – play where the conventional rules which govern the physical world, do not apply.
13. **Mastery play** – control of the physical and affective ingredients of the environment,
14. **Object play** – play which uses infinite and interesting sequences of hand-eye manipulations and movements
15. **Role play** – play exploring ways of being.
16. **Recapitulative play -** such as exploring ancestry, history, rituals, stories, rhymes, fire and darkness, enabling people to access earlier evolutionary stages.

Using this taxonomy, educators can design the delivery of courses and training programmes in a creative and innovative manner, leading to results such as building prototypes for development of products, or using role play among medical teams to improve services.

5. Conclusion

The research undertaken by the Added Value partners confirmed that many blocks to engagement with the excitement and beauty of mathematics still remain. Many of these blocks connect to traditional conceptualizations of mathematics, rigid approaches to curriculum design, poor resources for teacher development and resistance to innovative deployment of digital technology resources. These concerns are present at European level and have heavily influenced thinking behind a range of initiatives designed to kindle interest in mathematics and allied initiatives under STEM [2]. Drawing on innovative, playful methodologies in education and training will enhance delivery of all content, maintaining the creative thinking of childhood into adulthood and lifelong learning

References

[1] Kelley, D. Design Thinking https://www.ideou.com/pages/design-thinking accessed 4th May 2019
[2] Bruce, A., Graham, I. "Added Value Research Report," Added Value Erasmus+, Project 2017-1-PLO1-KA201-038851 (2018)

[3] Bruce, A., Graham, I. “Added Value Research Report Executive Summary” Added Value Erasmus+, Project 2017-1-PLO1-KA201-038851 (2018)
[4] Teo Yu Siang, “Design Thinking – A Five Stage Process”, The Interaction Design Foundation, Denmark, https://www.interaction-design.org/literature/topics/design-thinking accessed 4th May 2019.
[5] Whitebread, David “The Importance of Play” University of Cambridge, Toy Industries (2012)
[6] Robinson, K. “Changing Education Paradigms” (2010a) http://www.ted.com/talks/ken_robinson_changing_education_paradigms accessed 4th May 2019
[7] Brown, Tim “Creativity and Play” Ted Talks Serious Play Conference, (2008) http://www.ted.com/talks/tim_brown_on_creativity_and_play accessed 3rd May 2019
[8] Brown, S. “Play as an organizing principle: clinical evidence and personal observations” In M. Bekoff and J. Byers (Eds.) *Animal Play: Evolutionary, Comparative and Ecological Perspectives*. Cambridge: Cambridge University Press (1998)
[9] Robinson, Ken “Bring on the Revolution” (2010b) http://www.ted.com/talks/sir_ken_robinson_bring_on_the_revolution#t-116167 accessed 2nd May 2019
[10] Pellis, S. and Pellis, V.” The Playful Brain: Venturing to the Limits of Neuroscience” Oxford: Oneworld Publications. (2009).
[11] Lester, S. ”Beyond the Right to Play” Conference Proceedings 'The Defining Feature of Childhood, Isle of Man Children's Centre September (2013).
[12] Hughes, B. “A Playworker’s Taxonomy of Play Types”, 2nd edition, London: PlayLink. (2002)