LEGO® Learning Institute

THE *FUTURE* OF LEARNING

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In April 2013, the LEGO Learning Institute integrated into the LEGO Foundation.

All work of the LEGO Learning Institute is now published exclusively under the LEGO Foundation name.

The LEGO Foundation

Foreword

The LEGO® Learning Institute is a network of international academic experts, funded by the LEGO Foundation. Its purpose is to build greater public understanding of play, learning, creativity and child development. Beyond being publicly available, the research findings help translate the company motto of “only the best is good enough” into all LEGO products and experiences – each designed to “inspire and develop the builders of tomorrow” (the company mission) and develop creativity and learning ability in children of all ages.

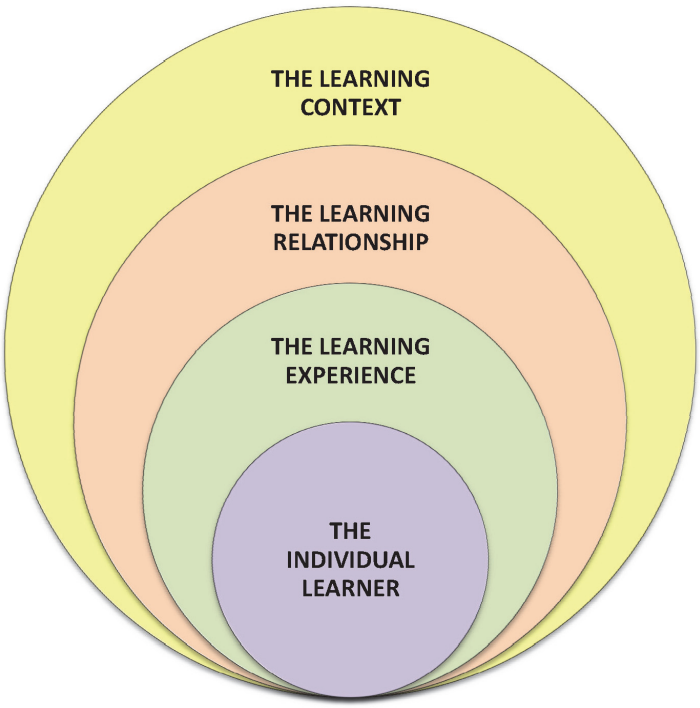
Previous work by the Institute includes Defining Systematic Creativity (2008), Systematic Creativity in the Digital Realm (2009), The LEGO® System for Learning (2010) and The Future of Play (2010). The reports can be found at “learninginstitute.lego.com”.

Introduction

Learning is not a specialised realm of human functioning such as cognition or perception, but rather involves the entire individual – thinking, feeling, perceiving and behaving. As David Kolb has said:

> Learning is the major process of human adaptation. This concept is much broader than that commonly associated with the school classroom. It occurs in all human settings, from schools to the workplace, from the research laboratory to the management boardroom, in personal relationships and the aisles of the local grocery. It encompasses all life stages, from childhood to adolescence, to middle and old age. Therefore it encompasses other, more limited adaptive concepts such as creativity, problem solving, decision making, and attitude change that focus heavily on one or another of the basic concepts of adaptation (Kolb, 2006).

To understand learning in its fullest sense, in this report we will consider the learner first as an individual, and second in the terms of the learning experience – how our experience of the world through multiple senses affects our capacity to learn and remember. Our focus then widens to include, third, the learner's networks and relationships, and fourth, the broader learning context and environment.



In this expansionist view, each of the 'layers' of this 'onion' help us to consider the future of learning. We will look at how current and future events are likely to influence the role and meaning of learning, and ultimately contrast this understanding with the realm of the LEGO System to determine the implications for what indeed will be the 'best' when it comes to learning in the future.

Executive Summary

Learning can be understood as a process where knowledge is created through the transformation of experience. It can be fruitful to think of the learner – from a very early age – as a 'scientist', actively searching for meaning in experience. Learning begins at the start of life, but is a lifelong process, and involves the entire individual – thinking, feeling, perceiving and behaving.

In this report we consider the 'skill', 'will' and 'thrill' of learning. Learners need to be able to reflect upon their own abilities, be aware of their own competences, and work out the best ways to learn new things (the skill). They need the motivation that comes from new experiences and new ways to exchange ideas (the will). Lastly, learning should be enjoyable and rewarding (the thrill).

This means that we have to consider metacognition – thinking about thinking – which is what really improves our skill. We have to look at studies of motivation in learning, and how learning can be supported by people, tools, and environments to really bring out the will. Also we have to understand how the brain processes information, and delivers stimulation and reward, in order to connect learning with the thrill.

Metacognition is central to an individual's ability to learn. By knowing our own strengths and weaknesses, being able to form plans and strategies for learning and evaluate their effectiveness, we become much more powerful learners. The development of self-regulation – being aware of and controlling our own thinking, while it is happening – enables children from any background to become much more successful learners.

Learners are often held back not by a lack of intellect, but a lack of confidence. Our 'self-efficacy beliefs' – internal judgements of what we might be capable of – can determine what projects we feel able to start, which projects we can complete, and which skills we can develop along the way. Education and informal learning tools should aim to build up self-belief and perseverance, encourage learners to take risks, and show that mistakes or 'failures' are just opportunities to learn on the journey towards mastery.

Research suggests that believing that you can do things means that you are much more likely to be able to do them. This is significant because it shows that the future of learning has to involve support for self-esteem.

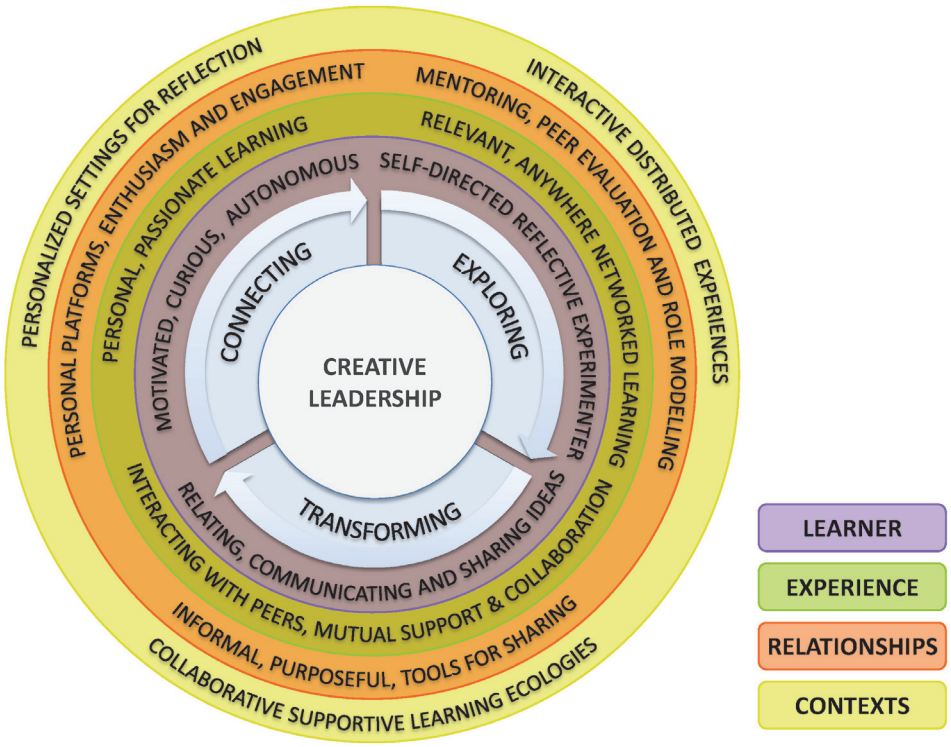
Individual learning skills and self-belief are crucially important, but these operate in partnership with the learner's interactive relationships with individuals, objects, and media. Research on 'multimodality' – the use of multiple different types of communication and interaction – shows that a well-designed learning experience, which stimulates more than one sense (for instance sight and sound, or sight and touch) can really help the learner to understand and identify the key meanings of the material.

Despite the importance of individual orientations to knowledge, learning is, crucially, a social process. Today, this means not just face-to-face learning, but also using online networks – and finding valuable ways to connect the two. Through the internet we can connect with people who share our passions, and who are often willing to share knowledge and support other learners. Free online learning resources and communities have revolutionised the learning possibilities for many people by enabling connections to resources, people, and tools.

Relationships are really important to learning. Supportive others, such as peers or teachers, online or offline, can 'scaffold' learning, helping a learner to develop until they get to the point where scaffolding is not needed. Just knowing that others would be available to help is really encouraging, and the active interest of others strongly enhances learning.

Online platforms can support self-efficacy beliefs, in particular by providing opportunities for mastery experiences – a recognition of one's own agency and ability in the world. Peers online can be a great source of support and inspiration. Online platforms tend to offer multimodal ways of learning, and enable learners to experiment, tinker, and explore, following their own curiosity, which is a powerful mode of learning.

Learning in the real world remains vital. We learn continuously, in everyday life, and that learning is shaped by the context in which it happens. Furthermore, schools are particular physical places where children to go to learn and should be carefully designed to support a range of customisable, multimodal learning experiences. The school experience becomes part of a system of learning which can include after-school clubs, hobbies and informal learning, reaching across all aspects of life. This network of learning situations can be developed and linked through digital tools.



All of the arguments come together in a model, which highlights crucial dimensions of the future of learning. It shows a process in which the creative reflective learner identifies a question or problem linked to their own interests (connecting), experiments with solutions (exploring), and implements these in new situations (transforming). This leads to new connections, explorations, and transformations. The process is illustrated within a number of changing dimensions: that of the learner themselves; the learning experience; the relationships; and the contexts.

At the centre of the model is creative leadership, which is about knowing one's own abilities, and knowing when and how to draw upon the support of others. It positions creativity as the most central aspect of learning: having the confidence to try new things, experiment with the world, and share the results to bring out value for others.

Finally, the LEGO System in the future of learning is considered. To 'Learn Well', alongside 'Play Well', in the 21st century, involves a number of themes that are already at the heart of the LEGO System. The word 'LEGO' is already used as a metaphor when modular and customisable kinds of education are discussed. However, the LEGO System represents more than this: it is about building meanings together, in a social process; about serendipity and innovation when different elements come together; and about sharing creative ideas through play.

The LEGO System offers a common language, recognised around the world, which brings people together and helps to create shared understandings. The LEGO brick drives informal learning, sparking a cycle of play, investigation, innovation, and learning, which leads to more play, investigation, innovation, and learning. This links the simplest connection of bricks in LEGO DUPLO through to the imaginative engineering applications of LEGO Mindstorms, or representations of business scenarios in LEGO Serious Play, as well as the wealth of LEGO fan ideas, which can be seen online.

'Play well' and 'learn well' are therefore two sides of the same enterprise. We learn through playing and if our learning opportunities are well designed, we can play while learning within a network where learners support each other and feel confident that they can build and re-build, continuously learning ways to unlock their potential.

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Chapter 1:
The Individual Learner

Chapter 1

The Individual Learner

Introduction

Human beings are born to be curious, experimenting, and always learning. In supportive environments, we strive to acquire knowledge, master new skills, and apply our talents. However in some circumstances the human spirit of exploration and learning can be diminished or repressed. Meaningful learning is not inevitable: it relies on a set of qualities and contexts that are essential for learning to occur.

David Kolb has argued that learning should be seen as a continuous process throughout life, which binds together various everyday activities including problem solving, decision making, creativity and research. He writes:

> Learning conceived holistically includes adaptive activities that vary in their extension through time and space. Typically an immediate reaction to a limited situation is not thought of as learning but as performance. Similarly at the other extreme, we do not commonly think of long-term adaptations to one's total life situation as learning, but as development. Yet performance, learning and development when viewed from the perspectives of experiential learning theory, form a continuum of adaptive postures to the environment, varying only in their degree of extension in time and space. Performance is limited to short-term adaptations to immediate circumstance, learning encompasses somewhat longer-term mastery of generic classes of situations, and development encompasses lifelong adaptations to one's total life situation. (Kolb, 1984)

Learning can therefore be defined as the process whereby knowledge is created through the transformation of experience (Kolb, 1984). This approach emphasizes the process of adaptation, and that knowledge is continuously being created and recreated – rather than being a set of 'contents' to be transmitted to learners.

The related theory of self-determination additionally emphasizes the personal motivations, which influence an individual's commitment and enthusiasm for learning, and the social environmental factors behind these aspects of development. Deci and Ryan (2000) argue that:

> Human beings can be proactive and engaged or, alternatively, passive and alienated, largely as a function of the social conditions in which they develop and function. Accordingly, research guided by self-determination theory has focused on the social–contextual conditions that facilitate versus forestall the natural processes of self-motivation and healthy psychological development. Specifically, factors have been examined that enhance versus undermine intrinsic motivation, self-regulation, and well-being. (Deci & Ryan, 2000)

Bradford (1964, in Kolb, 1984) suggested that "individuals learn to the extent that they expose their needs, values and behaviour patterns so that perceptions and reactions can be exchanged. Behaviour thus becomes the currency for transaction [...] the amount each invests helps to determine the return." Kolb adds that this view of learning makes it an active, self-directed process that can be applied not only in the group setting, but in everyday life.

Just how individuals are driven to expose their needs, values and behaviour patterns – or refrain from doing so – becomes essential in understanding the differences in how and why individuals learn. It also helps identify qualities of a learning experience that encourages full engagement with the learning opportunities at hand. "The fact that human nature [...] can be either active or passive, constructive or indolent, suggests more than mere dispositional differences and is a function of more than just biological endowments."(Deci & Ryan, 2000).

The processes of motivation and learning are thus essentially social in origin and depend on the transformation of the individual learning process from being guided externally – 'other-regulated' – to becoming increasingly guided by the self, or 'self-regulated', as originally identified in the writings of Vygotsky (1962, 1978). According to this model, the cognitive processes of planning, monitoring, strategic regulation, evaluation, and so on, are first experienced by the child in social interaction with adults or more experienced peers. These are gradually appropriated or 'internalized', primarily through developing language and representational abilities, until they can be exercised by the child independently of external guidance.

The skill, will and thrill of learning

To understand the complex factors involved in learning and growth, the notions of 'skill', 'will' and 'thrill' are a useful shorthand. 'Skill' refers to how we think about our own abilities and competence, which in turn influences our propensity to take on new activities and challenges that will translate into learning. 'Will' refers to what motivates and drives us to seek out new and different experiences to learn from. 'Thrill' refers to how the brain's reward mechanisms work and affect the brain's capacity to process and store new information, and translate it to learning.

1. The skills of learning

Self-determination theory suggests that three primary needs govern individuals' growth tendencies. These needs require specific supports from one's social environment for the individual to experience growth. They are the needs for *competence* (Harter, 1978; White, 1963), *relatedness* (Baumeister & Leary, 1995; Reis, 1994), and *autonomy* (deCharms, 1968; Deci, 1975). Competence refers to being effective in dealing with the environment in which a person finds themselves (White, 1959), relatedness to the universal desire to interact, be connected to, and experience caring for others (Baumeister, Leary 1995) and autonomy to the universal urge to be in charge of one's own life and act in harmony with one's integrated self (Deci and Vansteenkiste, 2004). Being in charge of one's life does not mean to be independent of others, but to feel empowered to influence its direction.

Beyond the three needs, an underlying foundation of enablers can be found, identified by Bandura in his *Social Foundations of Thought and Action: A Social Cognitive Theory* (1986). These five enablers are influential not only in determining our ability to influence the outcome of our actions and our competence, but also in learning. These are the ability to *symbolize*, employ *forethought*, *learn vicariously* (by observing others), *self-regulate* and *self-reflect*. These five enablers are arguably at the heart of our ability to attain competence.

To be able to *symbolize* means we can

> draw meaning from [our] environment, construct guides for action, solve problems cognitively, support forethoughtful courses of action, gain new knowledge by reflective thought, and communicate with others at any distance in time and space. For Bandura, symbols are the vehicle of thought, and it is by symbolising [our] experiences that [we] can provide [our] lives with structure, meaning, and continuity. Symbolising also enables people to store the information requires to guide future behaviours. It is through this process that they are able to model observed behaviour. (Pajares, 2002)

Forethought enables us to plan courses of action and anticipate outcomes, including set goals and challenges that motivate us. We do not only learn from our own experience, but by observing what others do. This *vicarious learning* enables us to learn without going through the trial and error process ourselves. Our

observations are symbolically coded and become a guide for future action. The ability to *self-regulate* our behaviour depends on how accurately and consistently we are able to observe and monitor our own actions, how we judge and attribute these, and how we react to our own behaviour. This self-assessment can be affected by our self-concept, self-esteem, and values.

What makes us distinctly human, according to Bandura (1986), is our capacity to *self-reflect*, to make sense of our experiences, explore how we think about things and what self-beliefs we harbour, evaluate our own behaviour and change our thinking and behaviour accordingly.

1.1 The role of metacognition

Metacognition is 'thinking about thinking', or reflection about how we learn or know about things. The role of thinking in the learning process has become an influential and rapidly expanding body of research, inspired by the early work of Flavell (1979) and Brown (1987), who explored the 'metacognitive' aspects of development. Initial studies of the development of young children's memory abilities by Flavell, Brown and others, showed that children often possessed some information, a particular strategy, or a way of undertaking a particular task, but failed to use this knowledge, or 'produce' the strategy when it would have been useful or appropriate to do so. Thus failure to perform successfully on a task arose not from a simple cognitive limitation, but from a lack of 'metacognitive' awareness or skill.

The growing body of research into metacognitive skills identifies the elements that play a part in successful learning, but also how individuals can better understand their own progress and challenges in learning, and change approach accordingly. *Self-regulation* is an especially important metacognitive skill. This refers to the development of self-awareness and control of our own mental processing – in other words, being aware of what we are thinking while we are thinking it. This has proved to be a skill central to children's subsequent success as learners, independent of intelligence and socio-economic background.

To understand the significance of self-regulatory skills on learning, particularly in school, it is worth considering the nature of the cognitive processes involved. Firstly, there are two different kinds of learning: one which might be termed 'incidental' learning; and the other deliberate or 'intentional' learning, such as that we engage in within educational settings. We all effortlessly learn and remember an enormous amount of information 'incidentally' in our everyday lives, but to learn and remember something intentionally requires effort and involves us in a range of 'metacognitive' activities such as planning, selecting cognitive strategies and evaluating our own learning.

The second distinction is that between cognitive activities, which are practiced and well understood (and which, consequently, are increasingly automatic) and those required when the task involves problem-solving and being creative. In his influential 'triarchic' theory of human intelligence, Sternberg (1999) defines 'Successful Intelligence' as "the ability to balance the needs to adapt to, shape and select environments in

order to attain success, however one defines it, within one's socio-cultural context." Successfully intelligent people, according to Sternberg, are able to identify their own patterns of strength and weakness, and to capitalise on their strengths and compensate for, or correct their weaknesses.

Sternberg's triarchic theory illustrates the workings of the mind as a series of components that fall under three categories: *meta components, performance components* and *knowledge-acquisition components*. This relates back to the initial analyses of Flavell and colleagues, where it was recognised that children might have relevant knowledge, be aware of and capable of executing, a relevant strategy, but might fail to use or produce these appropriately in relation to any particular task. As metacognitive skills ('meta components') develop, Sternberg argues, children become increasingly able to recognise when they lack relevant information and need to acquire it (via 'knowledge acquisition components') and which approach or 'strategy' will be most effective in relation to any particular task or problem. The actual cognitive activity of carrying out the task or solving the problem is executed by the 'performance components,' but decisions about which of these to use are guided by the meta components, which Sternberg itemises as follows:

> Meta components are higher-order processes used to plan what one is going to do, to monitor it while one is doing it, and to evaluate it after it is done. These meta components include (A) recognising the existence of a problem, (B) deciding on the nature of the problem confronting one, (C) selecting a set of lower order processes to solve the problem, (D) selecting a strategy into which to combine these components, (E) selecting a mental representation on which the components and strategy can act, (F) allocating ones mental resources, (G) monitoring one's problem-solving capacity while it is happening, and (H) evaluating one's problem-solving after it is done. Consider some examples of these higher order processes. Deciding on the nature of the problem plays a prominent role in intelligence. For example, with young children as well as older adults their difficulty in problem-solving often lies not in actually solving the given problem, but in figuring out just what the problem is that needs to be solved. (Sternberg in Rowe, 1991)

An important skill of learning and intelligence is the ability to cope with the unknown or unexpected. "Often, new tasks and situations are the ones that most require us to exercise our intelligence. Coping with novelty can take different forms. Sometimes, the novelty is understanding a new task or situation. Other times, the novelty is knowing what to do in a new kind of task or situation" (Sternberg, 2008). While meta components are used to plan, monitor, and evaluate courses of action, the performance components are used to do the actual problem solving and implement procedures and strategies. In Sternberg's words metacomponents and performance components are mutually dependent: meta components make decisions about what to do, but do not actually do it, whereas performance components execute a problem-solving strategy, but do not decide what strategy to use in the first place. Thus successful problem-solving requires both meta components and performance components.

Sternberg asserts that whilst the basic processes underlying his triarchic theory are the same, different contexts and different tasks require different kinds of intelligence:

a. Analytical abilities encompass analysing, evaluating, critiquing, and comparing and contrasting things.
b. Creative abilities are involved in creating, exploring, discovering, inventing, imagining and supposing. Performance on creative tasks is evaluated for novelty, quality and task-appropriateness and has been found to be relatively domain-specific and only with modest correlations with analytical measures.
c. Practical abilities are involved in applying, using, implementing and putting into practice ideas and tend not to be correlated with analytical abilities, but can even be negatively correlated with them.
(Sternberg, 1999)

Sternberg argues that individuals who had been 'better matched' to their triarchic pattern of abilities when taught, outperformed participants who were largely mismatched. Evidence seems to support the view that, initially, children's metacognitive skills are rather domain-specific, but through metacognitive development, the ability to transfer skills learnt in one area of ability can be increasingly adapted for use more generally. So, for example, Weinert & Schneider (1999) in a longitudinal study of memory development in 3-12 year olds, found that, while children within this age group developed a range of memory 'performance' skills and strategies that they could apply to particular types of memory task, it was not until towards the end of this age range that they began to be able to transfer skills learnt in one context to other types of memory problem.

Transfer of this kind, from tasks within one area of ability – in this case, memory – can be characterised as 'near' transfer. It has to be recognised that 'far' transfer across widely different areas of knowledge or expertise, is often not achieved, even amongst adults. This is borne out in Sternberg's findings about the lack of relationship between analytical, creative and practical abilities. It might be surmised, however, that the ability for far transfer of metacognitive skills might be a particular characteristic of high-performing individuals.

2. The will to learn

At the heart of the will to learn is motivation, and while external factors such as reward systems, grades, evaluations, or fear may compel people to take action, just as frequently motivations seemingly rising from within – from interests, curiosity, care or abiding values – spur people on their journey to master a specific domain. The interplay between the extrinsic forces acting on people and the intrinsic motives and needs inherent in human nature is the main territory of Self-Determination Theory.

The theory represents a broad framework for the study of human motivation and personality and more importantly, how social and cultural factors facilitate or undermine people's sense of volition and initiative, in addition to their well-being and the quality of their performance. Akin to others in a family of holistic psychological theories including those of Jean Piaget and Carl Rogers, the Self-Determination Theory (SDT) views people as active organisms with inherent and deeply evolved tendencies toward psychological growth and development.

The theory includes a set of ideas about human motivation and optimal functioning – the 'will' element to learning (Ryan, 2009). These emphasise the importance of autonomy and competence to intrinsic motivation; and suggest that individuals are more likely to internalize and integrate a practice or value if they experience choice with respect to it, efficacy in engaging in it, and connection with those who convey it. The theory has been much debated, in particular the claim that extrinsic rewards can have a powerful effect on motivation, but damage intrinsic motivation. The celebration of autonomous behaviour at the heart of the theory has also raised questions about its applicability across cultures.

Deci and Ryan (2000) argue Self Determination Theory reflects "the adaptive design of the human organism to engage in interesting activities, to exercise capacities, to pursue connectedness in social groups, and to integrate... interpersonal experiences into a relative unity". They further argue that natural processes such as intrinsic motivation, integration of extrinsic regulations, and movement toward well-being operate optimally only to the extent that the needs of competence, relatedness and autonomy are addressed, or, alternatively, to the extent that the individual has sufficient inner resources to find or construct the necessary fulfilment of those needs. Conversely, when hindered by adverse conditions – specifically when one's context is excessively controlling, overchallenging, or rejecting – other alternative, often defensive or self-protective processes will take over. Examples of such processes include for instance the tendency to withdraw concern for others and focus on oneself, and in more extreme cases, to engage in psychological withdrawal or antisocial activity to compensate for unfulfilled needs.

> Finding an activity either interesting (intrinsic motivation) or important (well-internalized extrinsic motivation) is influenced by prior experiences of need satisfaction versus thwarting, but doing what one finds interesting or important does not have the explicit intent of satisfying the basic needs in the immediate situation. A man who, in the evening, sits at the keyboard and begins to play a piece of

> music, may become lost in its beauty and experience great pleasure. He would not experience the pleasure if coerced to play, or if he felt unable to master the music. Thus, need satisfaction, which in this case means experiences of autonomy and competence, is necessary for the enjoyment of the activity, but his explicit purpose in playing the music is not likely to be need satisfaction. He would be doing what interests him, and he would experience spontaneous pleasure as long as the activity was self-organizing and the task appropriately challenging. (Deci & Ryan, 2000)

In a more popular version of motivation theory, Daniel Pink (2010) has argued Autonomy, Mastery and Purpose to be essential for engaging in creative activities. Motivation driven by extrinsic factors, according to this view, limits the ability to look at the periphery and see new opportunities to a problem and is thus only relevant for more short-term traditional performance tasks. To this extent, Pink's theory relates well to SDT's understandings of the roles of autonomy (which would incorporate Pink's Autonomy and Purpose) and competence (or Mastery). The role of relatedness as described in SDT theory, however, is not addressed in Pink's more limited approach.

2.1 Flow and self-determination

Flow theory (Csikszentmihalyi, 1975), like Self-Determination Theory, began with a focus on intrinsic motivation. Csikszentmihalyi defines Flow as the experience of total absorption in an activity and the non-self-conscious enjoyment of it, where an individuals' capacity is balanced with the demands and challenges of the activity at hand. A Flow experience is said to be autotelic, which means that the purpose of the activity is the activity itself, similar to definitions of intrinsic motivation. Deci (1975) and Csikszentmihalyi have both suggested that intrinsically motivated behavior requires optimal challenge. Too much challenge relative to a person's skills leads to anxiety and disengagement, whereas too little leads to boredom and alienation. Both theories also highlight the inherent satisfaction or enjoyment that accompanies efficacious action. Enjoying the feeling of competence when engaging in challenging activities stands in contrast to other theories arguing that individuals value challenging activities only in so far as they contribute to obtaining incentives or other desired outcomes.

As Self-Determination Theory has expanded both in terms of breadth and depth, new processes and phenomena integral to personality growth, effective functioning, and wellness have surfaced. For example, SDT research has focused on the role of *mindfulness* as a foundation for autonomous regulation of behavior, leading to both refined measurement and theorizing about awareness. Some research within SDT has more closely examined the forms personal *passions* can take, with individuals being obsessive or harmonious as a function of internalization processes.

2.2 Our own capabilities to attain competence

Central to our behaviour, how we think about ourselves and even how we respond to environmental factors are *self-efficacy* beliefs. Self-efficacy judgments, whether accurate or faulty, influence choice of activities and environmental settings. People usually avoid activities that they believe exceed their coping capabilities, but they undertake and perform assuredly those that they judge themselves capable of managing (Bandura, 1977). Judgements about self-efficacy also determine how much effort people will expend and how long they will persist in the face of obstacles or aversive experiences. When beset with difficulties people who entertain serious doubts about their capabilities slacken their efforts or give up altogether, whereas those who have a strong sense of efficacy exert greater effort to master the challenges (Bandura & Schunk, 1981; Brown & Inouye, 1978; Schunk, 1981; Weinberg, Gould, & Jackson, 1979). High perseverance usually produces high performance attainments (Bandura, 1977).

Bandura asserts that “people’s level of motivation, affective states, and actions are based more on what they believe than on what is objectively true” (Bandura, 1997: 2). Self-efficacy beliefs are themselves critical determinants of how well knowledge and skill are acquired in the first place. “As a consequence, people’s accomplishments are generally better predicted by their self-efficacy beliefs than by their previous attainments, knowledge, or skills” (Pajares, 2002).

However, self-efficacy beliefs should not be confused with judgements about the consequences that our behaviour will produce. Self-efficacy influences the choices people make and the courses of action that they pursue.

> People with strong sense of personal competence approach difficult tasks as challenges to be mastered rather than as threats to be avoided. They have greater intrinsic interest and deep engrossment in activities, and they heighten and sustain their efforts in the face of failure. Moreover, they more quickly recover their sense of efficacy after failures and setbacks, and attribute failure to insufficient effort or deficient knowledge and skills that are acquirable. (Pajares, 2002)

Self-efficacy beliefs also influence an individual’s *thought patterns and emotional reactions.* High self-efficacy helps create feelings of serenity in approaching difficult tasks and activities, whereas individuals with low self-efficacy may believe that things are tougher than they really are, and thus experience anxiety, stress, depression and a narrow vision of how best to solve a problem. As a consequence, self-efficacy beliefs can become a self-fulfilling prophecy in that we accomplish what we believe we are capable of. The perseverance associated with high self-efficacy will assist us in achieving increased performance, which raises our sense of efficacy further, whereas giving up, associated with low self-efficacy, will assist us in failure, further confirming our belief in our own inability, lowering confidence and morale.

A number of factors influence the role of self-efficacy in human behaviour and even though self-efficacy is a strong predictor of performance, there are a number of instances where exceptions occur. Disincentives or performance constraints, a lack of resources, or social constraints can all contribute to preventing even highly skilled and self-effacious people from choosing to behave according to their beliefs and abilities. More importantly, regardless of whether these obstacles may be real or imaginary, they may adversely affect an individual's notion of self-efficacy in the face of a challenging task. This fact speaks to the role of environment and support in strengthening and building self-efficacy.

2.3 Building self-efficacy

Self-efficacy beliefs are dynamic and can be strengthened over time in four different ways: through a *mastery experience*, *vicarious experience* of observing others, through *social persuasion* and through *somatic and emotional states*.

The most influential source for developing self-efficacy beliefs is a mastery experience. We engage in activities, interpret the result of our actions, base our beliefs about our capabilities on the interpretations of the results, and act accordingly. Outcomes interpreted as successful raise self-efficacy, and failures lower it. Importantly, those with low self-efficacy often discount their successes rather than change their self-belief. Mastery experiences are thus only raw data, and the interpretation of such experiences is central to developing self-efficacy.

Beyond interpreting the results of our actions, self-efficacy can be built from observing role models perform actions. Although weaker than a mastery experience, the greater the similarity of the role model to the observer, the more sensitive we are to the learning to the point that a failure by the role model can undermine the observers' beliefs about their own capability to succeed.

Self-efficacy beliefs can also be created and shaped as a result of social persuasion from others. When people around us seem to expect us to do well, this can support improved performance. Unfortunately, however, negative appraisals often have more impact than positive ones, so self-efficacy beliefs can easily be weakened.

Lastly, people judge their confidence by the emotional state that they experience when contemplating an action. Thus feelings of anxiety, stress, arousal and mood states influence the anticipated success or failure of the outcome. Depressed individuals lower their efficacy beliefs regardless of the nature of the task, yet conversely, because individuals have the capability to alter their own thinking or feeling, enhanced self-efficacy beliefs can influence the physiological states themselves. Thus how we select, integrate, interpret and recall information influences our judgements of self-efficacy.

2.4 The influences of self-efficacy

Bandura (1977) recognised that human functioning is a product of the interactions between personal, behavioural and environmental influences. This has a significant implication for learning in how people interpret the results of their own behaviour and alters their environments and the personal factors they possess, which, in turn, inform and alter subsequent behaviour. He asserts that people are both the "producers as well as products of social systems" (Bandura, 2001), and that three cornerstones influence this development. They are *environmental influences*, where Bandura suggests that economic conditions, socioeconomic status and educational and familial structures do not affect human behaviour directly, but affect people's aspirations, self-efficacy beliefs, personal standards, emotional states and other self-regulatory influences. Then there are *personal factors* in the form of cognition, emotion, desire and biological events. Lastly there is *behaviour*, which refers to the actions of an individual in conjunction with their environment – which includes other people as well as the physical environment. It is the response of the individual to various stimuli or inputs, whether internal or external, conscious or subconscious, overt or covert, and voluntary or involuntary. Bandura stresses that introspection and how individuals interpret the outcomes of their actions has a significant effect on their subsequent behaviour.

Due to the reciprocal nature of these cornerstones, therapy and counselling efforts can thus be directed at any one of them, and are likely to be most effective if embracing all three. Pajares (2002) gives the example of a school: "Using social cognitive theory as a framework, teachers can work to improve their students' emotional states and to correct their faulty self-beliefs and habits of thinking (personal factors), improve their academic skills and self-regulatory practices (behaviour), and alter the school and class room structures that may work to undermine student success (environmental factors)".

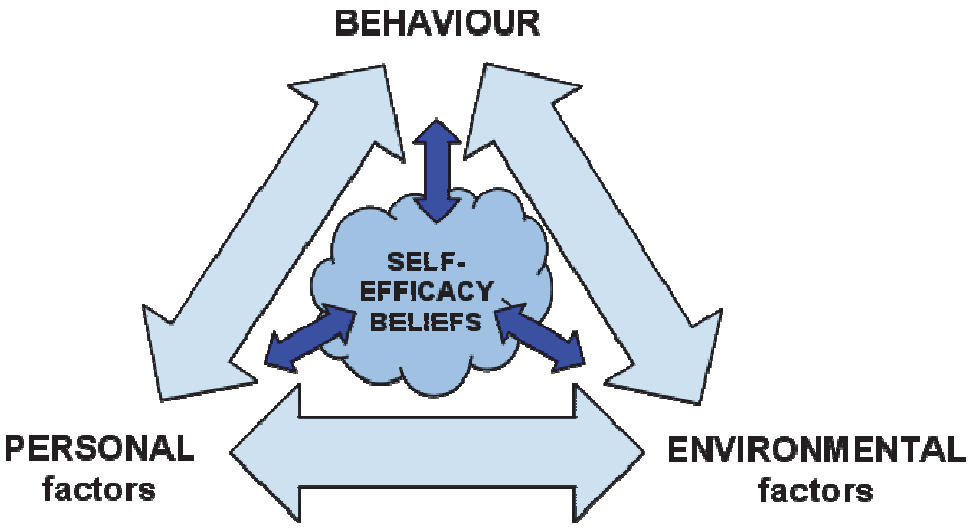


Figure 1.1: Social cognition theory with humans as a product of interactions.

3. The thrill to learn

As we have seen, learning can be a rewarding experience. Whenever we achieve a new goal, master a complicated problem or learn a novel skill, we experience feelings of self-efficacy. These experiences are especially rewarding when the motivation originates from the learner – when it is intrinsic. Importantly, the human brain has a special system that signals the presence of reward. Neurons in this system, which is centred on two structures in the brainstem, fire predominantly in two situations: (i) whenever we expect to obtain a reward and (ii) when we get a reward that we did not expect, i.e. when we experience a positive surprise. However, the system also carries information about negative surprises: every reward neuron has a certain baseline activity, and in situations when we expect to get a reward but it doesn't materialise, these neurons decrease their activity below the baseline signal.

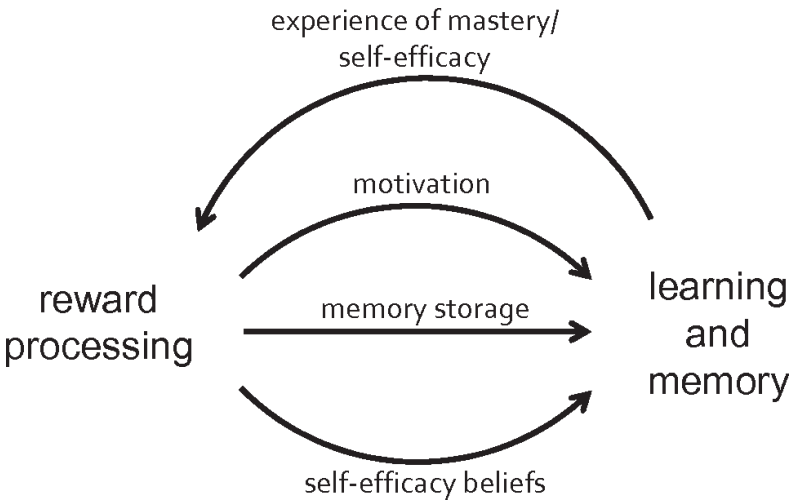


Figure 1.2: Dynamic interactions between the reward system and processes of learning and memory.

Why should we care about mechanisms of reward in a study of the future of learning? As shown in figure 1.2, rewarding experiences can increase the motivation of the learner. Moreover, such experiences help to build up our self efficacy beliefs, which are key to a child's ability to engage in challenging activities in the future. There is however, a third, more direct way in which reward experiences affect learning and memory: The reward system in the brain is tightly connected to the hippocampus, a brain structure that is critical for learning and memory. First, the hippocampus enables us to form novel associations, to recombine existing knowledge and to integrate novel information into existing knowledge structures. Second, the hippocampus has been shown to replay learning experiences multiple times (i.e. during sleep), which helps us make memories last. And finally, the hippocampus is also crucial for retrieving stored information, not only for the purpose of bringing back some distant memory, but also to generate predictions about the future.

Out of those three hippocampal functions, it appears that the *memory storage process* is particularly influenced by reward. Numerous behavioural studies have shown that people remember information better when it was accompanied by a rewarding experience. In addition, reward not only augments activity in the

hippocampus, but it also leads to an increased communication between the reward system and the hippocampus. These changes seem to form a mechanism that improves the efficiency with which novel information is stored in hippocampal circuits.

Finally, as we have suggested above, internal rewards seem to work better than others. In adults, monetary rewards have been shown to decrease activation in the reward system, which can undermine the motivation to engage in certain tasks. Similarly, since intrinsically motivated activity is more rewarding in and of itself, children learn more from this sort of activity, and they retain that learning better. In contrast, when adults enforce external standards and replace the internal reward system with one that depends upon outside forces to supply all of the rewards (such as gifts, or excessive praise), children begin to feel successful only if someone else rewards them for accomplishments. They can lose intrinsic motivation, and may only feel success when someone else judges them as successful. In such situations, children may not develop feelings of self-worth, and will judge their own value by someone else's standards.

4. Summary

The above explains why the skills of learning in the form of metacognitive or self-regulatory processes are likely to be particularly significant when attempting to intentionally learn, and when we are required to solve problems or to be creative. Bruner (1972) argued that it is these higher-order cognitive skills, which he referred to as ‘flexibility of thought’, that make us uniquely human and require the support of the extended period of human childhood, and the playful activities in which children engage in during this period.

Moreover, mastery of any domain is closely linked to motivation and satisfying the needs of competence, relatedness and autonomy. How we think about our own abilities and skills has a fundamental impact on attaining competence, including our abilities to symbolise, apply forethought, engage in vicarious learning, self-regulation and self-reflection. As a consequence, self-efficacy beliefs can become a self-fulfilling prophesy in that we accomplish what we believe we are capable of.

Beyond self-efficacy, we have also shown that motivation and the brain’s own reward mechanisms collude in helping us on our path as successful learners. Learning, as we noted at the beginning, primarily occurs within the individual, and knowledge is created through the transformation of experience. The complex interplay of the skill, will and thrill of learning influences our ability to observe ourselves in the midst of a learning process and adapt our approaches to suit the situation at hand and ultimately, extend successful learning experiences to form a foundation for reaching full human potential. Learning is therefore a lifelong process, and involves the entire individual – thinking, feeling, perceiving and behaving. As Kolb asserted, learning is *the* major process of human adaptation.

Chapter 2:
The Learning Experience

Chapter 2

The Learning Experience

Introduction

Building on the ‘skill’, ‘will’ and ‘thrill’ of learning in chapter 1, we begin to understand the underlying cognitive processes, behaviour and psychology that work either as a help or a hindrance to our ability to learn. When considering learning as the process whereby knowledge is created through the transformation of experience (Kolb, 2006), we recognize that learning itself relies on a series of inter-dependent processes for constructing meaning from individual experiences and context, including play. This view, borne out of social constructionism and cognitive traditions, emphasizes the primary role of the individual in learning, but also the common responsibility to focus on interventions, tools and media, which develops individual potential and personalized learning experiences. As we will see in this chapter, individuals carry the potential for learning and building their own cognitive tools, but their capacity to learn is strongly influenced by their interactive relationships with objects, individuals and media.

1. How humans learn

1.1 Active construction of meaning and the importance of contexts

Behaviourist models of learning originally placed the learner in a passive role entirely dependent upon external rewards or 'reinforcement' to establish simple associations and guide learning. The subsequent 'cognitive revolution' in developmental psychology stimulated by the research and constructivist theories of Jean Piaget replaced this concept of the passive learner, with a model of the child as an active learner, or a young 'scientist', actively searching for meaning in their experience.

There is a fundamental tension in Piaget's work, between his largely 'maturational' view of development (i.e. children develop along a set pathway, pre-determined by their biology), a legacy of his background as a biologist, and his subsequent theoretical view that children actively construct their own understandings, based on their experience. This model of the child as an individual learner in interaction with the purely *physical* environment does not sufficiently recognise the *social* nature of learning, and the important role of social interaction and language in children's developing abilities as learners, and can lead to significantly under-estimating the capabilities of young children.

Moreover, it is now clearly established that human adults' thinking is equally reliant on social cues, and that we all find abstract reasoning problems much more difficult than ones placed in a socially meaningful context or scenario. The more socially contextualised version of a problem that requires abstract reasoning is nearly always found to be much easier although logically it is an identical problem.

Research by Donaldson, Watson & Johnson-Laird and many others demonstrate that children do not passively receive the information we provide for them. They are engaged continually in a process of active interpretation and transformation of new experiences and the information derived from them. If we want to help young children make sense of their educational and other experiences we must ensure that we place new tasks in contexts familiar and meaningful to children.

Recent findings (Cook, Goodman & Schultz, 2011) suggest that when presented with ambiguous information, children tested each possibility in turn in order to find out — much like the way in which scientists devise their experiments to test individual variables separately. Furthermore the findings suggest that children make decisions on the basis of the potential for gaining new information. The authors concede that the study doesn't establish whether "children understood the importance of isolating variables initially or whether they inferred its importance in the course of the experiment." But the cognitive scientists claim, however, that the results begin to "bridge the gap between scientific inquiry and child's play" (Ibid, 2011).

1.2 Fundamental ways of learning

Over the last two or three decades, a range of research techniques, such as habituation (which relies on infants' becoming bored with a stimulus after a while, and more excited when a novel stimulus is presented), eye-tracking, computer modelling, and neuroscientific techniques have helped to uncover an impressive range of processes by which the human brain learns. The findings have also shown that many of these processes are present and fully functioning at birth, or mature very quickly during the first 4-5 years of life, as the brain's synaptic connections between neurons in the cerebral cortex increase. Goswami (2008) has provided an extensive review of the many experiments which have shown the very early emergence of this range of basic learning processes. In a recent overview, Whitebread (2012) has described them as follows:

Statistical or inductive learning

One such process which seems to be there from birth is referred to as statistical or inductive learning. This is the process by which we identify patterns and regularities in the stream of experience, and is fundamental to a very large proportion of human learning. It might be seen as a much more sophisticated and active form of association learning, of the kind explored by the Behaviourists. It clearly underpins the ways in which the human visual system learns, in particular how young children learn language with such rapidity and ease, form concepts and detect categories from experience, and are able to understand causal relationships between events.

Neuroscientific work on memory has established that semantic information is stored in the cerebral cortex through a process whereby neurons establish increasingly stronger connections between themselves. Thus the patterns learnt through these processes of statistical or inductive learning appear to be physically held in networks of interconnected neurons.

Learning by analogy

Closely related to these statistical or inductive processes, whereby patterns are actively constructed from experience, are processes of learning by analogy. This is an entirely active form of learning, whereby a pattern identified and learnt in one context is used to make sense of a new experience or new information related to a separate context.

This ability, sometimes referred to as the 'transfer' of learning, or 'generalisation', is of enormous significance in explaining human adaptability to new situations, and human capability in regard to novel problem-solving. The vast changes in human civilisation and technology, since our ancestors lived as nomadic hunter-gatherers, would not have been possible without the ability to learn by analogy. Contrary to Piaget's conclusion that analogy is a complex form of reasoning which does not develop until later in development, Goswami (1992) was one of the first to demonstrate that it is,

indeed, present in young children. She showed that children as young as 4 years old could reason analogically, provided that they understood the basic relationships involved. Chen et al. (1997), however, went further and managed to demonstrate basic analogical learning in children as young as 10 and 13 months. Their task involved learning a sequence of moves in order to retrieve an attractive doll (remove a barrier, pull a sheet with a string lying on it, then pull the string to move the doll). At these ages the children required an adult to model the basic series of moves, but once learnt, they could then apply it (the 13 month olds rather more flexibly than the 10 month olds) to other similar tasks. (Whitebread, 2012)

Imitation

The role of the adult in modelling the required moves in the study by Chen and colleagues, however, reveals the final important component in human learning, namely our unique ability and propensity to deliberately teach one another and to engage in behaviours perfectly adapted to support learning, particularly in young children. In its simplest form, this involves processes of imitation. Whitebread (2012) explains the research establishing this as an important mode of human learning as follows:

> We now know, chiefly through the work of American developmental psychologists Andrew Meltzoff and Keith Moore (Meltzoff & Moore, 1999), that young children are astonishingly adept at learning through imitating others from a very early age. In a paper published in the late 1970s, Meltzoff and Moore reported video data showing clear evidence of babies of 12 to 21 days old imitating both facial and manual gestures presented by adults. As is always the case with evolved behaviours, humans not only show the ability to imitate, but brain mechanisms have also evolved to reward this activity. We derive enormous pleasure, as children, and as adults, from imitating one another and being imitated. Imitative behaviour is often associated with playfulness and laughter; it is no accident, for example, that it is the basis of much adult comedy and satire, as well many children's games.
>
> Furthermore, as an enhanced tool for learning, imitation can be either immediate, (i.e. carried out while the to-be-copied behaviour is still available) or deferred (i.e. performed on a subsequent occasion). Deferred imitation appears to be unique to humans as it crucially depends upon our ability to mentally represent objects and events in memory and appears from a surprisingly early age, and develops rapidly in very young children. Meltzoff (1988) identified deferred imitation in children as young as 9 months old and demonstrated that they could reproduce novel actions up to 24 hours later (when presented with the same toy). Later work has shown that by 18 months this can be delayed up to two weeks, and by 24 months children are capable of showing deferred imitation after delays of 2-4 months. These are enormously valuable findings which inform our understanding of the development of young children's representational abilities, and their ability to hold mental representations in long-term memory. (Whitebread, 2012)

2. Metacognitive Processes of Learning

2.1 The structure and characteristics of metacognitive processes

These processes of statistical, inductive, analogical and imitation learning are involved in the construction of concepts and the development of basic skills. However, as mentioned in Chapter 1, the development of the 'higher psychological processes' such as problem-solving, decision-making and creativity are highly dependent on human social interaction. Furthermore, their development depend on a child's developing abilities to perceive and interpret sensory information, and ability to mentally represent ideas, processes and events symbolically, primarily through language.

Episodes of social interaction support the development of both the sensory and symbolic capabilities, and provide a context for these capabilities to be employed. This in turn develops metacognitive skills, enhancing the child's development as a learner. Figure 2.1 sets out a model of the processes by which the mature learner perceives and manages information from the environment.

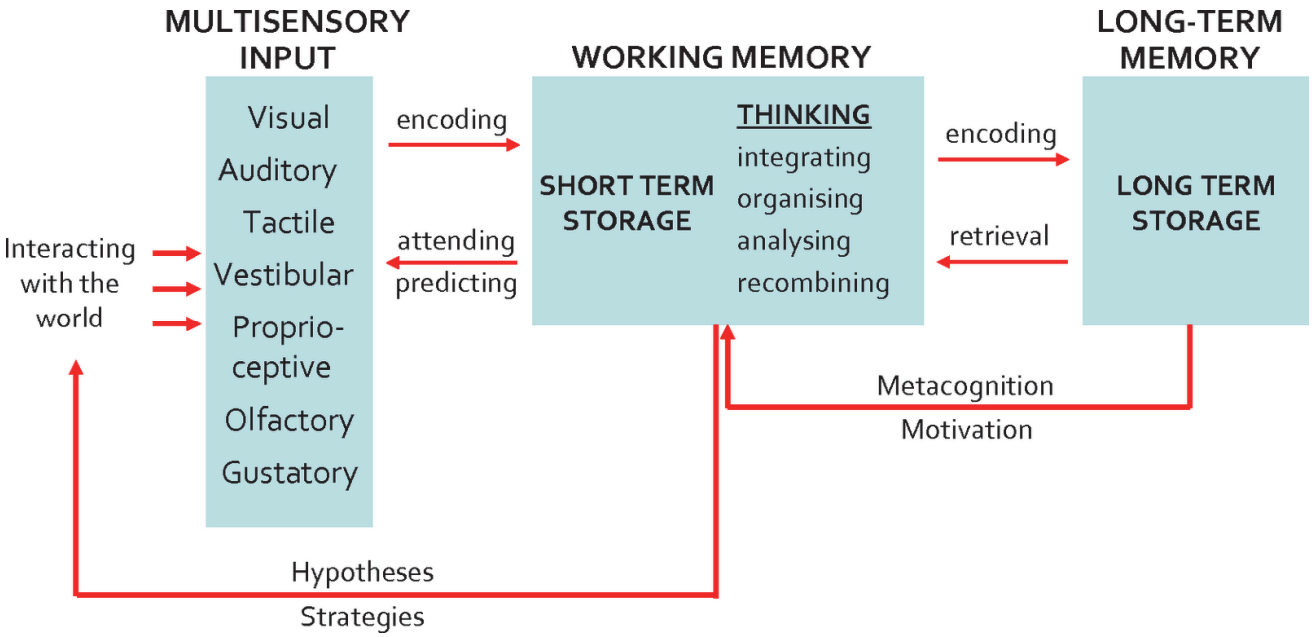


Figure 2.1 A constructivist model of human learning, incorporating metacognitive and multimodal aspects.

As illustrated in Figure 2.1, information is perceived and selectively attended to through all our senses. This information is then held in short-term working memory while it is processed. Some information is acted upon immediately, and some transferred to long-term memory. Information held in long-term memory, including motivational dispositions to the particular task or context, the 'metacognitive knowledge' about the task, and our related abilities, combine to influence the manner in which the information is processed. This also affects the ways in which further information from the environment is selectively attended to and encoded, including the predictions made about the environment, and the hypotheses and strategies deployed in relation to the task or situation with which we are interacting.

The efficiency, with which the constructivist model of human learning operates and develops, is highly dependent on the development of metacognitive skills. Brown (1987) constructed a model of metacognition, which consisted of three inter-related elements, each influencing the process of learning, as follows:

> 'metacognitive experience': the monitoring or self-awareness of mental processing, and reflections upon it (for example, when attempting to carry out a mental calculation, and realising that it is too difficult as we cannot hold all the numbers in our heads while also carrying out the task)
>
> 'metacognitive knowledge': the knowledge which is gradually accumulated, as a consequence of metacognitive experience, about one's own mental processing, tasks and cognitive strategies for dealing with tasks (for example, when we recall that this has happened before, and that we have been more successful in the past when we wrote the numbers down)
>
> 'metacognitive control': the deployment of mental strategies, which are developed and used increasingly appropriately in relation to tasks based on our metacognitive knowledge and monitoring of progress. (For example, when we decide, based on our current experience of difficulty, and our knowledge of a more successful strategy, to write down the numbers, and then to carry out a known procedure for the required calculation)

In subsequent research, how each of these metacognitive skills develop, including how they interact, has been extensively studied in children and adults. At the same time, how the social processes behind children's metacognitive skills are enhanced have also been explored. Much of this work has focused on the characteristics of interactions, which most effectively support or 'scaffold' children's development of self-regulatory abilities. Finally, recent findings have shown that the processes of self-regulation cannot be understood without also considering the emotional, social and motivational aspects. These significantly influence the manner in which individuals approach and manage tasks, and consequently influence children's development as learners (Baumeister & Vohs, 2004)

2.2 The development of meta-cognition

From the very earliest months, young children systematically establish abilities ultimately allowing them to gain full awareness of and control over all aspects of their cognitive, emotional, motivational and social functioning (Bronson, 2000). Much work has focused on the fundamental mental processes or 'executive functions' for managing information effectively, and for gaining effective control over mental processing. Four sets of key executive functions, present from birth, are the foundations upon which all higher mental processes are constructed (Garon, Bryson & Smith 2008):

- attention: focusing on relevant rather than irrelevant information
- working memory: holding information in mind while updating and manipulating it
- inhibitory control: stopping an initial, 'prepotent', automatic or perceptually attractive response and replacing it by another
- cognitive flexibility: switching from one mental set or task rules, to a different set, or rules – often referred to as 'set shifting'

Improvements in the capabilities of young children in each of these areas can be seen throughout the preschool years, with individual differences also emerging early. For example, the classic 'marshmallow test' - in which 4-6 year olds are offered a marshmallow, or other delicious confectionery and are told they can eat that one now or, if they wait until the experimenter returns, they can have two - has been shown to be highly predictive of later academic success and emotional well-being. (Those who could defer gratification went on to be more successful).

By the time children start school, these basic functions have already been developed sufficiently to support emergent self-regulatory abilities. Observational studies of pre-school children in the UK (Whitebread et al, 2009), for example, have provided evidence of 3-5 year olds engaging in a number of self-monitoring activities, including self-commentary, reviewing and keeping track of progress, rating effort and level of difficulty, checking behaviours and detecting errors, and evaluating the strategies used. Among control behaviours observed were included various planning processes, changing strategies as a result of previous monitoring, applying a previously learnt strategy to a new task or situation, repeating a strategy to check the accuracy of the outcome and using gestures to support cognitive activity.

In very young children, however, the emerging metacognitive and self-regulatory behaviours are quite context dependent. Superficial features of a task can easily mislead them to think that a task will be easier or more difficult than it actually is and, generally, young children tend to be wildly optimistic about their own abilities. The development and increasing sophistication of metacognitive abilities increases throughout childhood and into adulthood. Processes of monitoring and control, and the accumulation of metacognitive knowledge increase separately throughout childhood (Whitebread & Pino Pasternak 2010).

Furthermore, the integration into a smoothly functioning overall system of behavioural control is a process which continues well into adulthood, and is never fully completed in many adults. Common problems typically arise because information about the individual's own abilities, appropriate strategies, or information available, is, nevertheless, not used when decisions are made about how to proceed with the task. As a consequence, simple monitoring or the extent of metacognitive knowledge are in themselves poor predictors of performance. Only the skill with which appropriate strategies are used, based on effective monitoring and use of metacognitive knowledge, reliably predicts performance outcomes.

2.3 Supporting metacognitive learning

The crucial nature of metacognitive and self-regulatory abilities for development and learning has been documented by Dignath et al (2008). Three key points emerged from these studies:

1. The importance of discussing the processes of thinking and learning.
2. The importance of a supportive, reflective style of learning.
3. Various kind of playful experiences provide the ideal and supportive environment.

1. Discussing the processes of thinking and learning

It is crucial that the processes of thinking and learning are explicitly discussed. A number of studies with children have shown, for example, that even when a newly introduced strategy has been successfully used, and resulted in clearly improved performance, many children will not attribute their new-found success to the use of the new strategy unless this is explicitly discussed.

2. A supportive, reflective style of learning

It has been increasingly recognised that the teaching of metacognitive skills can be powerfully reinforced by a reflective learning environment. A recent project on self-regulation in young children (Whitebread et al 2005), for example, identified four underlying characteristics of effective pedagogies that support development of metacognitive and self-regulatory abilities in pre-school children. The characteristics were:

- adult-child interactions showing emotional warmth and fostering feelings of emotional security (Self Determination Theory (SDT) would call this 'relatedness')
- practices encouraging children's feelings of control (SDT: 'autonomy')
- activities, which provided children with appropriate cognitive challenge, sensitively and contingently supported or 'scaffolded' so that children experienced feelings of self-efficacy (SDT: 'competence')
- extensive opportunities for the planning of learning activities, for discussions and reviews of learning and learning processes (see point one above).

3. Supporting playful experiences

There is now ample evidence that various kinds of playful experiences provide an ideal and powerfully supportive environment for development of metacognitive and self-regulatory abilities in children, and arguably also for adults. There are two clear mechanisms for how play context supports the development of self-regulation.

First, certain types of play specifically and directly set challenges, which require considerable self-regulation. In socio-dramatic play, Vygotsky argued, children have to exert their greatest self-control, as they have to stay in role and are required to perform in accordance with the cultural expectations of the role. This is supported by a range of research mostly focusing on attentional and emotional self-regulation (Elias & Berk, 2002; Berk, Mann & Ogan, 2006).

Second, playful contexts support development of language as a tool for self-regulation, an important metacognitive skill. Vygotsky argued that play is crucial to the development of symbolic representation, including language. Play is recognised as the first medium through which children explore the use of symbol systems, most obviously through pretence. Play becomes a transition from what Vygotsky describes as the 'purely situational constraints of early childhood' to the adult capability for abstract thought (Vygotsky, 1978: 98).

An area of research clearly supportive of this contention relates to the production of ‘private speech’ by children, and adults, when they are undertaking a challenging task. Extensive evidence shows that such self-commentary performs a range of self-regulatory functions, providing a transitional stage for children between ‘other-regulation’ of a task by an adult, and the ability to regulate their activity by internalised thought. Play involving construction or other problem-solving and creative activities appears to provide a context in which private speech is particularly well-used by children and adults to support self-regulatory processes.

3. Multimodal Learning

Multimodal learning is learning with a range of inputs across multiple senses. If you want to teach a child to discriminate between a variety of bird species, you could assume that training with pictures or video clips of the bird types, labelled with the name of the species, would give the child the required information. However, mastering perceptual skills is often slow and requires effort, and even relatively simple tasks of detecting a subtle visual stimulus can require a month or more of training to reach optimum performance levels (Shams and Seitz, 2008).

However, many studies have shown that providing information via multiple sensory channels (i.e. vision, hearing, touch) can substantially improve learning success – in our example, the bird songs are another feature that could be provided to help the child distinguish the different species. Intriguingly, even if you later tested the child's knowledge with pictures only – in the absence of any sound – training with auditory visual stimuli can still be beneficial. Traditionally, researchers of perception would have predicted that if the task to be learned is visual, then sound features would not be very helpful for learning, and could even be disruptive to learning by distracting attention away from visual features. Recent research however, clearly shows that the opposite is true (Shams and Seitz, 2008).

Our brains have evolved to learn and operate in natural environments that more often than not provide information via multiple senses in parallel. While the human brain has long been viewed as dealing with different sensory modalities in separate and independent processing streams, research into multisensory integration has shown that interactions between the senses are the rule rather than the exception (Alais et al., 2010). Specifically, multisensory interactions are ubiquitous in the nervous system and occur at virtual all stages of perceptual processing. As a consequence, learning from a single modality does not exploit learning mechanisms that have evolved to produce optimal behaviour in the naturally multisensory environment. Many researchers therefore argue that multisensory training protocols, as opposed to unisensory ones, can better approximate natural settings and, therefore, produce greater and more efficient learning. However, the extent to which this facilitation occurs depends upon appropriate relations – congruence between the information coming into each of the senses.

3.1 How do our brains deal with multisensory information?

In many regions of the human brain, researchers have found evidence for multisensory integration. For example, nerve cells in the posterior parietal cortex – situated in the back of the brain – respond when a child sees an object, say a bird, in a particular position relative to himself (i.e. 45 degrees to the right). Given that different neurons fire maximally for different positions, a population of thousands of neurons can easily represent the entire space that surrounds the child. Importantly, many of these neurons will also fire when the child *hears* the sound from the same position, which shows that their sensitivity to both auditory and visual spatial cues. Similar findings have been observed in other regions and for different combinations of sensory modalities – for example, a region in the so-called parahippocampal gyrus represents the spatial layouts of enclosed spaces (say a model of a room), independent of whether the model is explored with the hand (without seeing it) or whether it is apprehended from seeing a photograph of it (Wolbers et al., 2011).

While multisensory properties were initially believed to be restricted to so-called 'higher order association areas' of the brain known to integrate various types of information, we now know that this assumption is incorrect. For example, neurons in the occipital cortex, which receives direct input from the eyes and which was traditionally believed to be only responsible for the processing of visual information, can also respond to auditory or even tactile stimulation (Alais et al., 2010). Taken together, these findings clearly show that our brains are optimised to integrate information from various sensory modalities and that this integration occurs simultaneously at multiple processing stages.

With many neuronal populations being sensitive to different sensory modalities, the obvious question is what happens when multiple types of sensory information are present at the same time, i.e. when the child both sees and hears the bird? In many regions, neurons then show responses that are much stronger than responses to each modality alone. In other words, providing information via multiple senses can strengthen neural responses, which is thought to be one way in which learning can benefit from multisensory experiences (see section on the benefits of multisensory learning). This so-called *superadditivity* of neuronal responses is especially strong when the sensory information is weak – for example, when the child can only faintly see the bird due to fog – suggesting that the brain attempts to maximize the amount of information it extracts from the different sensory modalities.

In many everyday situations, however, the different senses may not be equally reliable. For example, when the child can only vaguely see the bird due to fog but can clearly hear its shrieks, it would make sense for the brain to pay more attention to the sounds. Indeed, many studies have now shown that our brains weigh different cues according to how reliable we think they are. In other words, the child would mainly focus on the shrieks when asked to guess the bird's position, even though it would not completely discard the visual information. Many studies have shown that this type of cue integration behaviour is optimal in most situations.

One of the most important lessons to be learned from research into multisensory integration concerns the development of multisensory response properties. Specifically, given that multisensory integration appears to be beneficial for learning, one would imagine that neurons in the newborn child were already able to integrate multiple senses. However, while studies with human babies addressing this issue have yet to be conducted, animal findings have demonstrated that multisensory cells are *either absent at birth or are unable to integrate multiple senses* (Alais et al., 2010). In addition, multisensory stimulation provides a redundancy that is crucial for extracting information that would not be possible based on unisensory stimulation alone in early infancy. For example, 5-month-old infants can discriminate visually presented rhythms only if they were habituated with auditory–visual presentations of the rhythm and not when habituated with visual-only or auditory - only presentations of rhythm (Bahrick and Lickliter, 2000). Taken together, these findings strongly suggest that the developing brain needs to constantly receive correlated input from multiple senses to build-up and calibrate its multisensory response properties.

3.2 When and why is multisensory learning beneficial?

Interacting with the world through multiple senses generates representations of the world and the objects therein that are rich and multifaceted. The richer these representations are, the easier it will be for us to imagine new ways to use an object or a material. In other words, learning through multiple senses can lay the foundation for our thinking to be flexible, which is an important prerequisite for creativity. But what process is responsible for making our representations rich and multifaceted?

Coming from a brain centred perspective, Shams & Seitz (Shams and Seitz, 2008) discuss three potential mechanisms which could explain why multisensory experiences enhance learning (see Figure 2.2):

1. Given that neural responses in early sensory areas (i.e. visual areas) are modulated by input from other modalities, multisensory experiences can directly alter these early sensory representations (lower left panel).
2. Most early sensory areas share direct or indirect neural connections. As a consequence, multisensory learning experiences could strengthen these connections, with the effect that retrieval of each type of information is made easier (lower middle panel).
3. Given that higher order association areas integrate information from multiple early sensory areas, providing multisensory learning experiences could alter and improve the representations in these higher order areas (lower right panel).

While the available evidence suggests that the benefits of multimodal learning are probably mediated by all three mechanisms in parallel, further benefits should not be ignored. For example, multimodal learning situations often provide direct experiences that correspond to the way especially young children think about the world. This obviates the need to represent information in some abstract format, which often helps learners grasp complex material. Secondly, presenting information via more than one sensory channel can

reduce cognitive load, because information from different modalities can be more easily chunked into short-term memory and used to build long-term representations. Finally, several studies have reported that students often enjoy physical interactions with learning materials (Hamza-Lup and Adams, 2008), suggesting that motivational effects also contribute to delivering the beneficial effects.

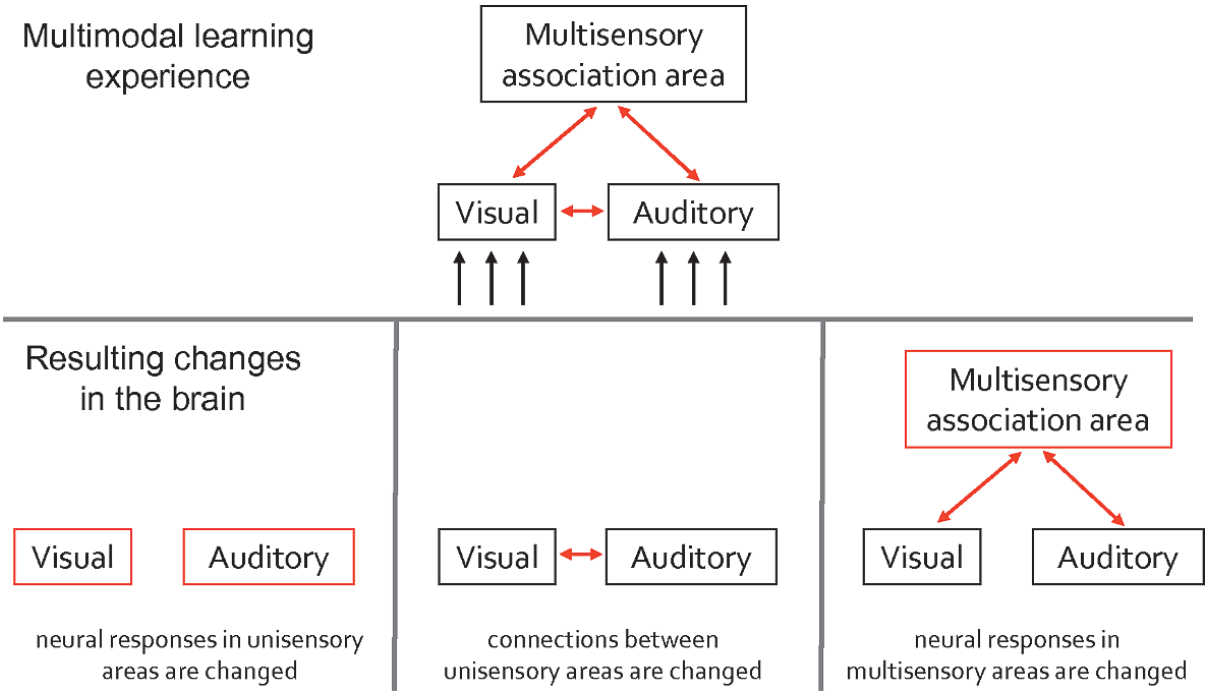


Figure 2.2: How multimodal learning could alter representations in the brain

Upper panel: When learning is based on auditory and visual information, a larger set of processing structures are activated. Specifically, both the early sensory structures are recruited and higher order multisensory regions. Lower panels: The multimodal learning experience could change the brain in three possible ways. Changes are shown in red. See text for details.

Taken together, such findings may suggest that multimodality is always beneficial, but this general statement needs to be qualified. Research on multimedia learning has demonstrated that the benefits of presenting information via multiple channels is most pronounced when the learning material (i) is presented in an interactive fashion (i.e. allowing the learner to make simulations, generate predictions etc.) and (ii) requires complex transfer skills (i.e. evaluation, synthesis etc.) and not simply storage of new knowledge. Secondly, studies conducted by the American psychologist Richard E. Mayer have shown that in certain situations, multimodality can even be detrimental to the learning process. Whenever we learn, the information we are presented with activates pre-existing knowledge that is related to the new material. Normally this process is beneficial as it speeds up the storage process of the new material (Tse et al., 2007). However, in a series of elegant experiments on multimedia learning about the formation of thunder and lightning (Mayer et al., 2001), Mayer showed that when additional auditory information was not precisely related to the learning material but merely served to enhance interest or motivation of the learner, learning outcomes were actually

worse (compared to presenting only visual information). This effect is probably due to the activation of an inappropriate schema by the auditory information, which in turn could bias the learner to store many irrelevant bits of information.

3.3 Multisensory educational methods

Educators and clinicians have long believed that multisensory training can enhance learning. A simple advantage of multisensory training appears to be that it can engage individuals with different learning styles (i.e. visual vs. verbal learners). However, it is worth noting that the there is a dearth of controlled studies testing for the efficiency of using different teaching methods for different learners, hence any claims that particular (multimodal) teaching methods are optimal for certain types of learners is premature at present.

Nevertheless, the success of various multisensory learning approaches attests to the power of engaging multiple senses. For example, Maria Montessori started her movement some ninety years ago, and most subject areas in a Montessori school use a mixture of visual, auditory, tactile and kinaesthetic approaches. In addition, several modern language instruction techniques have coalesced into a method called Multisensory Structural Language Education, which uses visual, auditory, tactile-kinaesthetic and articulatory modalities for teaching (Birsh, 1999).

With the advent of technology in the classroom, a growing research area in multimedia educational techniques strongly parallels perceptual research of multisensory facilitation. The principle of ‘dual coding’ (Clark and Paivio, 1991) indicates that information entering the system through multiple processing channels helps circumvent the limited processing capabilities of each individual channel and, thus, greater total information can be processed when spread between multiple senses.

Related research indicates that multimodal processing reduces cognitive load because information from different modalities can be more easily chunked into short-term memory and used to build long-term representations. The ‘Cognitive Theory of Multimedia Learning’ by Richard E. Mayer (Mayer et al., 2001) builds upon this idea through studies of classroom materials; animations that are co-presented with narrations facilitate learning of facts and concepts. Altogether, these findings indicate that research on the mechanisms of multisensory facilitation can have important benefits in pedagogy.

4. Summary

The view of the child as an active learner, or a young 'scientist', actively searching for meaning in their experience emerges from the findings that the fundamental processes by which children construct meaning appear to be actively present from birth. These are the ability to identify patterns and rules from experience, to learn by processes of imitation, and to generalise and transfer them by processes of analogy.

Individual differences arise mostly from the extent to which children have the skill and will to monitor their own performance and use this information to develop more well-matched and sophisticated mental strategies in relation to the range of tasks with which they are presented. This 'learning how to learn' occurs through the processes of metacognition and self-regulation, which involves attention, working memory, inhibitory control and cognitive flexibility.

From a multimodal point of view learning by analogy depends on identifying the key components of a learning task/rule/situation so that they can be applied in a novel context. The more senses are stimulated during learning, the higher the likelihood that these components are reliably identified. Learning by imitation involves a mapping of visual input (i.e. others actions) onto one's own motor system, presumably via the mirror neuron system (direct coupling of visual and motor commands) and executing novel movements or movement sequences under visual control (direct coupling of visual and proprioceptive input)

Multisensory learning has received much attention and has led to the attempt to identify individual sensory preferences to learning, and subsequently define individual 'learning styles', based on the notion that most people prefer an identifiable method of interacting with, taking in, and processing stimuli and information. However, the approach has been extensively criticised, as there is no evidence that identifying a student's learning style produces better learning outcomes (Pashler et al, 2009), and the notion that each individual has just one discrete 'learning style', used in all situations, is highly questionable.

Chapter 3:
Learning Relationships

Chapter 3

Learning Relationships

Introduction

Learning occurs in relationships. Learning is often social, and develops through interactions between human beings. It can also happen through dealing with objects, or texts, which may or may not have been produced by other people with the intention of fostering learning. In complicated everyday life, learning most often develops through a complex, but largely disorganised mesh of relationships between people, texts and objects, some of which are proximate and physical, and some of which are digital and potentially global. This chapter describes how the social relationships between people, objects and communities create the conditions for learning.

1. Learning is social

Social psychology has established that people learn socially valuable skills through social relationships. Group dynamics can therefore affect how individuals learn to be social actors, and will influence their level of self-confidence in social interaction. Albert Bandura, who later would develop the concept of self-efficacy, pioneered the social learning approach, which suggests that behaviour is often learned through imitation and modelling. Where behavioural learning theories suggested that environment shaped behaviour, and the cognitive learning approach asserted that individual psychological factors were most significant, social learning theory argues that the combination of environment, individual psychology, and other people's responses, in dynamic relationship with memories and motivations, will influence development and learning.

Bandura later refined his focus on self-concept theory and attribution theory, which would become components of the overall model of self-efficacy, discussed in chapter one. Self-concept theory describes the dynamic view of the self held by each individual, based on experiences and evaluations of those experiences. For instance, if a person desires a particular goal and manages to orchestrate themselves, other people, and events so that the goal is achieved, their self-concept might shift to indicate their greater sense of competence in that particular sphere.

Attribution theory is also significant as it concerns the attribution of causes of positive or negative events. If, for example, a desired goal is thought to have been achieved by pure luck, or because somebody else intervened to make it happen, then this may have a neutral or negative impact on self-concept. If an individual attributes their success to their own skills and competence – especially if these abilities are felt to be stable and controllable – then this is likely to have a positive effect on self-concept.

This model of continuous, dynamic adjustment of the self-concept has similarities with the model of self-identity proposed by sociologist Anthony Giddens. Giddens's model is attractive, because it unites social psychology, social theory and philosophy. At its root is Giddens's theory of structuration, which asserts that social life is more than a set of relatively random individual acts, and not simply determined by grand social forces, where the individual has no power at all (as sociologists from Durkheim in the 1890s to Bourdieu in the 1980s have implied). Social life, therefore, cannot be studied by looking exclusively at either the micro or macro levels. Instead, Giddens suggests, human agency and social structure are in a relationship with each other, and it is the acts repeated by individual agents, which reproduces the structure. This means that there *is* a social structure – traditions, institutions, moral codes, and established ways of doing things – but also that these can be changed when people start to ignore them, replace them, or reproduce them differently (Gauntlett, 2008).

The enormously powerful, but intangible 'social forces' described by the founding fathers of sociology are, according to this account, fundamentally just the everyday *expectations* of other social actors. We learn what these expectations are, and develop a sense of self in relation to them (but not necessarily in agreement with them). As Giddens put it, 'Society only has form, and that form only has effects on people, in so far as structure is produced and reproduced in what people do' (Giddens & Pierson, 1998: 77).

This affects learning, as well as all other elements of social development, because we develop a learning self in relation to this context. Furthermore, as we live in what Giddens calls a 'post-traditional' world, roles and responsibilities are not handed to us, but have to be negotiated, selected and developed. Individuals are today engaged in a 'reflexive project of the self', and such powerful self-concepts as pride and self-esteem are based on 'confidence in the integrity and value of the narrative of self-identity' (Giddens, 1991: 66). The notion of the reflexive project of the self has been empirically explored in a LEGO Serious Play research project, in which individuals were asked to build metaphorical representations of their self-identities (Gauntlett, 2007, 2008). The study found that participants did indeed have a sense of personal identity as a

dynamic narrative which could be worked on and amended, and that this was a commonly accepted part of everyday life.

Learning has therefore fundamentally changed in the post-traditional world, as the cultivation of one's own identity, including one's own learning, is now an individual, self-managed project. Whilst other individuals (peers, parents, teachers) and whole systems (the legally-backed education system) may seek to influence this learning, it is nevertheless increasingly seen as a task to be conceived, managed and executed individually. In earlier times, this would have been relatively difficult to do, due to challenges in accessing the social dimension of learning; but today, the internet enables social connections for learning, linking people in different countries across a very broad range of topics.

1.1 Vygotsky, scaffolding, and the zone of proximal development

While Piaget had emphasised the importance of the child interacting with the physical environment, as we saw in chapter two, more recent research inspired by the work of his Russian contemporary, Lev Vygotsky, has shown that there is a much more central role for the adult, and, indeed, for other children, in the processes of learning. This role is not as an instructor delivering knowledge, however, but rather as a 'scaffolder' (a metaphor suggested by Jerome Bruner and colleagues; Wood et al, 1976) supporting, encouraging and extending the child's own active construction of meaning and understanding.

Based on observational studies of mothers and young children in experimental contexts, this group of researchers developed a characterisation of scaffolding which supports and develops many of the ideas emerging from other studies of early interactions, as reviewed above.

A good scaffolder does the following:

1. Engages the interest of the child.
2. Simplifies the task if necessary
3. Highlights critical features of the task
4. Models key processes or procedures
5. Sensitively monitors the child's success with the task
6. Withdraws support when the child can proceed independently.

Valuable scaffolding emerges not just from directly 'educational' activities, but also from leadership and teamwork. The central idea in Vygotsky's model of children's learning is that all learning begins in the social context, which supports children in the processes whereby they construct their own understandings. Thus he argued that all learning exists first at the 'inter-mental' level (within the experience of joint attention and inter-subjectivity) in the form of spoken language, and then at the 'intra-mental' level (within the child's mind, in the form of internal language, or thought). This has been termed the 'social constructivist' approach to learning.

Within this model a further key insight is that of the 'zone of proximal development' (or ZPD), as illustrated in Figure 3.1. Faced with any particular task or problem, Vygotsky argued, children (or any other learners for that matter) can operate at one level on their own, described as their 'level of actual development', but at a higher level when supported or 'scaffolded' by an adult or more experienced peer, described as their 'level of potential development'. The ZPD is that area of learning between these two levels of performance or understanding, within which the child is really challenged, but which they can achieve with appropriate support.

Vygotsky and his followers have further argued that children learn most effectively through social interaction, when they are involved in jointly constructing new understandings, within their ZPD. Vygotsky's view was that 'private speech' was a self-directed language with the purpose of self-regulating one own cognitive, emotional and motivational processes. This represents a crucial bridging mechanism between external 'social speech', produced in the context of social interaction with an adult or peer, and fully formed 'inner speech', which we all use as adults to help us to structure and keep track of our thoughts. It appears predominantly in young children up to the age of 7 or 8 years, and then gradually fades, as the capability for 'inner speech' is established.

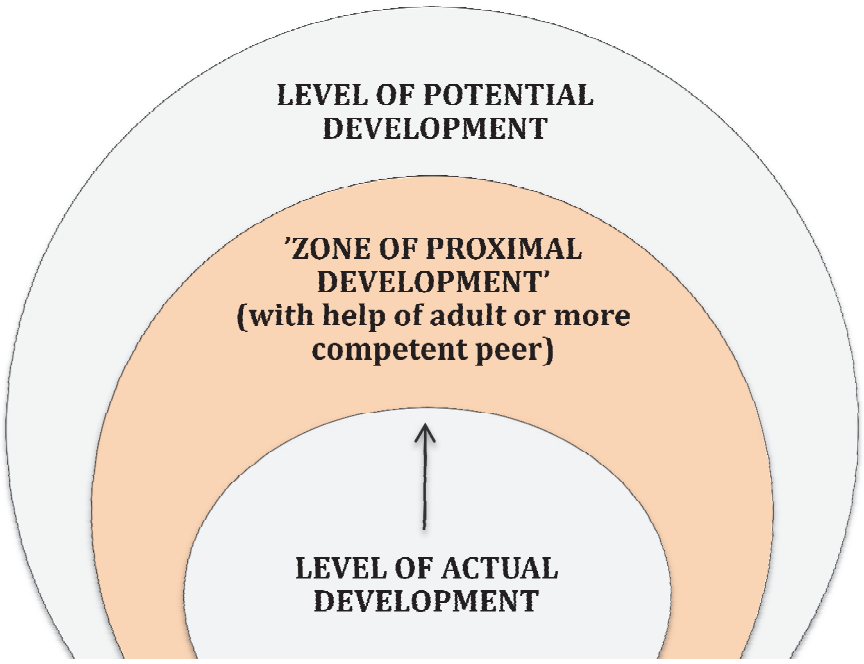


Figure 3.1: Vygotsky's 'zone of proximal development'

If Vygotsky's model is correct, it would be predicted that private speech would support young children's thinking and would be produced by young children at the highest rate, when they are required to deal with a problem that is in their ZPD. It would also be predicted that the production of private speech would enhance children's problem-solving abilities.

Extensive research into the phenomenon of private speech has fully supported both of these predictions (Winsler & Naglieri, 2003, Fernyhough & Fradley, 2005). The production of private speech by any individual

child graphed against the level of difficulty of a task produces an inverted U shaped curve, or what might be termed a 'Goldilocks' pattern. That is, tasks which are too easy or too difficult lead to relatively low levels of private speech, but tasks which are at just the right level of challenge lead to significantly higher levels. At the same time, between children, those who produce the higher levels of private speech when faced with a challenging problem are those who are most successful in solving it. Taken together, all this evidence would suggest that the incidence of 'private speech' is an excellent indicator of children being involved in tasks which they find appropriately challenging.

1.2 Learning through focusing on things together

The examples of learning through imitation and modelling in Chapter 2 described how social interaction has an enormous impact on learning. The early predispositions and ability to interact and read meaning already as babies clearly describes a level of 'inter-subjectivity' or deriving meaning through interaction between, for instance, mother and child. This 'mutual' attention is a key element in early communicative episodes (Trevarthen & Aiken, 2001).

Research has shown that the language development of children is supported by 'joint attention' episodes, where the child and their parent or carer are focused on the same thing and are doing it together (such as play, reading, or a conversation). Within these cases, it has been noted that some adults are much more aware of the child's pointing gestures or gaze as indicators of their focus of attention, and, having established the child's focus, some adults tend to use this as a basis for further interaction, including talk. Others, however, tend to attempt to switch the child's attention to their own focus of interest. Not surprisingly, the former 'attention-following' strategy, building on the child's current interest and attention, has been found to support language development much more effectively than the 'attention-shifting' approach (Schaffer, 2004). Thus, more generally we can see that following the attention of a learner, and building upon whatever is capturing their interest, is a good strategy to foster learning – whereas trying to impose a different agenda is likely to be much less successful.

Sugata Mitra carried these concepts a bit further by introducing how children through access to computers and the internet, were able to learn many things by themselves (Mitra, 2000). However, in later experiments through established 'self organized learning environments', Mitra exemplified how children sitting together could dramatically increase learning a new subject through computers (Mitra and Kulkarni, 2010). It was also found that younger learners could be supported by the presence of an older child who would take the the 'attention following' role, deliberately supporting learning by asking questions about what was happening on screen. This research on the role of computers within a learning environment, with a collective of people around it, holds promising results for how technology and social interactions can stimulate learning.

1.3 Learning conversations

It is now widely recognised that providing children with a relevant vocabulary and requiring them to formulate their ideas in discussion is a vital element in helping children to develop flexibility in thinking and construct their own understandings about the world. In the 1980s, Tizard and Hughes (1984), in a classic study of 4 year old girls attending pre-school in the mornings, and spending time with their mothers at home in the afternoons, presented evidence of these young children engaging in intellectual search through conversations with their mothers. The kinds of meaningful dialogues they shared with their mothers, unfortunately, were lacking in their pre-school experience. Sylva and colleagues (Sylva et al, 2004), more recently, in a large longitudinal study of factors leading to effective early years educational provision, have shown that high quality pre-school experience can significantly impact upon a range of intellectual and personal gains, even over-riding the effects of social disadvantage, for example, and that a key element in high quality provision appeared to be the occurrence of episodes of 'sustained shared thinking' between adults and children.

This kind of evidence has led to the recognition that a certain style of interaction between adults and children, along the lines emerging from the research we have reviewed here, and between pairs or small groups of children, can be enormously beneficial to learning. Neil Mercer and colleagues (Littleton, Mercer et al, 2005), for example, have identified three qualitatively different kinds of talk in young children's discussions, characterised as

- Disputational (unproductive disagreement),
- Cumulative (uncritical additions to what has already been said) and
- Exploratory talk (involving active joint engagement with ideas, where assertions and counter assertions are supported by explanations, justifications and alternative hypotheses).

They have further developed the 'Thinking Together' approach, which incorporates tasks to support children's developing ability to engage in exploratory talk in group discussions, including activities to help children construct their own agreed 'rules for talk' and to use these to help them structure productive joint activities. Interestingly, one key element in this, and the work of Howe and colleagues (Howe et al, 2007) is that the children must attempt to agree on the solution to the problem under discussion. Actual agreement does not appear to be as important as the attempt to achieve this. Littleton, Mercer et al (2005) showed that young children could make significant strides in their ability to argue their case and provide explanations for their views, and that there were measurable gains in both the quality of their language and their non-verbal reasoning skills.

1.4 Learning with different types of relationships

John Bowlby (1973) argued that “Human beings of all ages are happiest and able to deploy their talents to best advantage” when they experience trusted others as “standing behind them”. He theorised that the knowledge that there are others on whom one can rely supports self-reliance (Ryan, Stiller, & Lynch, 1994). Across the numerous frameworks that have been developed around the role of social relationships in learning, “there is a common assumption that the quality of a person’s functioning in terms of autonomy, confidence, and self-reliance can be related directly to an experiential set one has regarding significant others” (ibid., 1994).

Ryan, Stiller, & Lynch (1994) studied how young people’s relationships with parents, teachers, and friends, affected their learning. Unsurprisingly perhaps, those who had good relationships with their teachers, and with their parents – feeling secure with, and supported by these adults – achieved more in school. Those who said that they emulated teachers were more engaged with the school, unsurprisingly, but also had more positive feelings about themselves, and they performed better in school than than those who said that they emulated their friends, a trait associated with lower self-esteem. The researchers state:

> It appears that for adolescents a sense of emotional security with teachers and utilization of teachers as emotional and school supports is associated with greater sense of control, autonomy, and engagement in school. In this sense, the study emphasises how much schooling is an interpersonal as well as a cognitive enterprise... and, more specifically, the real-world importance of students' underlying beliefs that teachers represent sources of interpersonal support. (1994: 244)

In some ways the correlations in this study are entirely predictable (the kinds of students who indicate that they are well attached to their school teachers are more likely, rather than less likely, to be those who are doing well in school). If we assume, however, that the role of ‘teacher’ can be taken by other people in a learner’s life, then the study underlines the importance of social relationships in learning and a meaningful bond between ‘teacher’ and learner. This accord with the study’s broader finding that "feelings of connection and security with others can play a crucial role in academic socialization and adjustment" (1994: 246).

Although Ryan and colleagues found that an attachment to peers, rather than teachers, tended to pull students away from school success, this is perhaps an inevitable result of the correlation method (the students who are especially attached to teachers are *bound* to correlate more highly with school-based notions of achievement).

Fuller & Skinner (2003) note various studies which have shown the importance of peers, and parents, as well as teachers. They report that several studies have shown a connection between “children’s perceptions of peer social and emotional support and their academic goals, engagement, and self-concept” (p.150). A sense of relatedness can help to motivate children when they are faced with difficulties – the sense that

trusted others will “back them up” enables them to respond with more “vigor, flexibility, and constructive actions” (p.148). In this sense, the availability of actual immediate support is less important than the learner’s own sense that such support would be available if necessary. Summarising the evidence, Fuller & Skinner note that "Over and above the effects of actual support, it seems that the *perceived availability* of trusted others acts as a buffer, allowing people to show more self-reliance, vigor, and tenacity in the face of obstacles" (p.149, emphasis added).

This suggests that an effective learning environment at school, online, or elsewhere – would be one which fostered the sense that helpful and positive peer support was always *available*, regardless of whether or not this support was regularly accessed. Learning relationships have an important temporal dimension too. Learning from a trusted mentor who has accompanied an individual on their learning journey for several years is bound to have a different character to the experience of dispersed ‘blips’ of friendly support, from several people whom one does not know very well, experienced in a supportive online learning environment. The latter experience is not necessarily inferior – praise from ‘random’ others can be very rewarding – but is of a different type.

2. Social Learning with Objects

As seen above, self-efficacy and scaffolding are at the centre of meaningful learning through the understanding of social learning and collaborations. However, objects also have qualities which stimulate social interactions, and provide meaning to learning (Robinson, 1992).

Objects provide opportunities for emotional attachments and meaningful experiences, and can act as ‘things to think with’, because they unlock memories, associations and insights into thought processes (Turkle, 2007). As Mitch Resnick observed, “the ways in which we see the world are deeply influenced by the tools and media at our disposal. If we are given new tools and media, not only can we accomplish new tasks, but we begin to view the world in new ways” (Resnick, 1996).

Similarly, the dependency of objects in engaging in relationships is clearly described through Merleau-Ponty’s example of the ‘blind man’s cane’, which acts as an extended instrument for perception to an extent where it even becomes unnoticed (Merleau-Ponty, 1962). The tool becomes incorporated, blurring the boundaries between the person and the tool. Dourish (2004) described the extended notion of embodiment possible through tangible interfaces and social computing. Dourish calls this an embodied interaction, with ‘the creation, manipulation, and sharing of meaning through engaged interaction with artifacts’. Thus, objects do not only mediate our relationships, but transform and create learning relationships.

Embodiment is a property of our engagement with the world, that allows us to make it meaningful. Embodied interactions, made possible by social objects and communities, create new social learning spaces. The more abstract possibilities of virtual communities feed into concrete and physical environments as a way to

engage with ideas, creating a social relationship between the digital objects and physical space. The Microsoft Kinect system is an example of how body gestures can mediate digital interactions, changing how we perceive and act through media, as well as how we collaborate and learn through networks.

> Another way to think about a social situation is as an "information-system", that is, as a given pattern of access to social information, a given pattern of access to the behaviour of other people. (Meyrowitz, 1985: 37)

Objects and online spaces thus provide scaffolding opportunities and a social life to information, augmenting and enhancing existing tools and practices. As children increasingly fluently navigate in networked environments, this suggests the need for education to embrace new digital or hybrid relationships as part of its learning agenda. The 'social' dimension of learning is therefore not necessarily a homogeneous relationship between humans, but a much more complex heterogeneous association of elements, which are bound together by social connections (Latour, 2005).

> People are who they are because they are a patterned network of heterogeneous materials. If you took away my computer, my colleagues, my office, my books, my desk, my telephone I wouldn't be a sociologist writing papers, delivering lectures, and producing "knowledge" (Law, 1992: 4).

Bruno Latour and John Law describe how the social dimension emerges from the interactions between both human and non-human actors, and is maintained through associations between things. According to this view, human connections and interactions with – and through – objects are equally important for learning. Therefore new ways of creating learning relationships are required.

Csíkszentmihályi and Rochberg-Halton (1981) also found a relationship between meaning and objects when investigating why certain objects evoked special memories or associations. As social relationships are based on personal associations and memories of comforting moments, similarly strong attachments to things are formed through everyday interactions. Their research showed a relationship between the attachment to the object and the meanings and feelings it represented for the owner. As with the captivating and almost addictive state of the 'flow' experience, things capture the same experience in two ways: by providing a familiar symbolic context that reaffirms the identity of the owner, or directly by engaging the attention of other people (Norman, 2004: 48).

These elements of meaning that appear through embodied interaction also influence how meaning is invested in digital relationships. The connection between objects and things seems to provide the 'difference that makes a difference', in that only when the mind responds to the environment through interaction, are objects represented and perceived as relevant information to our knowledge and learning (Bateson, 1972).

3. Online platforms and domains of learning

Online 'Web 2.0' platforms such as YouTube, Scribd, Wordpress, Flickr, Wikipedia and Ravelry can be 'things to think with' in themselves, requiring users to focus and organise their creative efforts within particular structures and systems. These platforms offer access to a diverse range of objects and materials made by others, which can themselves potentially be developed and remixed. Such platforms have contributed to a significant expansion of learning organised spontaneously out of personal desires and interests – known as 'informal learning', in contrast to learning in formal settings such as schools and colleges.

Informal learning is described by Kylie Peppler (2011) as a term which highlights 'learning that happens nearly anywhere at anytime – at home, with peers, online, at museums, at street festivals, in after-school settings, in libraries, and across other settings'. She notes, following Julian Sefton-Green (2004), that we could map learning on two dimensions, from formal to informal settings on one axis, and from structured to unstructured curriculum or activities on the other axis. To incorporate the potential of new technologies, we could add another axis to this diagram, running from the physical world to the digital world. Informal learning, however, is not 'one type' of learning. The learning activity can be structured or completely unstructured; it could be entirely offline, entirely online, or somewhere in between; could be initiated spontaneously out of personal interest, or for a more planned or practical reason. With the new platforms it is getting more 'difficult to make a distinction between formal and informal learning, as there is often a crossover between the two' (McGivney, 1999: 1)

A third category has also been proposed: 'non-formal learning', which refers to learning that is not in a educational institution, and does not lead to certification, but which is structured and intentional from the learner's perspective (EC, 2001: 32). Then, 'informal learning' reflects learning which is non-structured and more incidental.

In general, new forms of non-formal or informal learning are influencing the traditional formal educational institutions of learning. New experience-based and collaborative forms of learning introduced through new technologies and platforms present a more informal, organic, contextualized approach, in sharp contrast to the traditional model of a formal, de-contextualized, passive, teacher planned, individualistic form of learning (Beckett & Harder 2002).

3.1 How can platforms support learning?

The educationalist John Holt (1964, 1967) argued that learning is something that humans do *naturally* from the earliest age. He suggested that machinery designed to make 'learning' happen as a specific kind of activity, separate from the normal experience of everyday life, often just gets in the way. Therefore those who wish to support learning should follow the interests of the learner, or just provide tools which enable exploration, learning and discussion around their interests without seeking to directly 'teach' at all. This view therefore favours, in particular, a 'DIY learning' approach where individuals are simply supported to explore whatever engages their curiosity.

Ivan Illich (1971, 1973) similarly argued that learners should be free, and supported, to pursue their own interests, rather than given set blocks of information at prescribed times. This, he suggested, leads individuals to experience 'a loss of personal potency' and a dependence on 'experts'. Illich indicates that an overplaned system of teaching and learning destroys the natural joy in learning. Instead we should prefer informal learning that is lightweight, flexible, and spontaneous, and which involves processes where learners can make their own meanings and express themselves through action.

These ideas about learning and education, now several decades old, were not developed with today's modes of informal learning in mind. Another insight, not directed towards online learning spaces, but may inform our understanding of them, is the 'Studio Thinking Framework' developed by Lois Hetland and colleagues (2007, cited in Peppler, 2011). The researchers conducted an extensive longitudinal, ethnographic study to identify the unique habits of mind cultivated in successful Visual Arts classrooms, and presented these as eight 'habits of mind':

The Studio Thinking Framework: Eight Habits of Mind
(Hetland et al., 2007, somewhat rewritten to extend beyond art practices)

- *Develop craft:* Learning to use and care for tools and materials; learning conventions of the field.
- *Engage and persist:* Learning to embrace problems of relevance within the field and/or of personal importance, to develop focus and other mental states conducive to working and persevering at tasks.
- *Envision:* Learning to picture mentally what cannot be directly observed and imagine possible next steps.
- *Express:* Learning to create things that convey an idea, a feeling, or a personal meaning.
- *Observe:* Learning to attend to things and issues more closely than ordinary 'looking' requires, and thereby to see things that otherwise might not be seen.
- *Reflect:* Includes both *Question and explain:* Learning to think and talk with others about an aspect of one's work or working process, and *Evaluate:* Learning to judge one's own work and working process and the work of others in relation to standards of the field.

- *Stretch and explore:* Learning to reach beyond one's capacities, to explore playfully without a preconceived plan, and to embrace the opportunity to learn from mistakes and accidents.
- *Understand the Field:* Includes both the *Domain:* Learning about historical and current practice, and *Communities:* Learning to interact with others in the field and within the broader society.

This approach to learning is similar to that adopted by successful informal learners, whether online or offline, and should apply well beyond the Visual Arts class. In this framework, the informal learning find their own route of learning by:

1. planning their own route to understand the established practices of the field
2. being necessarily persistent
3. planning their own progress through reflection and questioning
4. learning to reach beyond a narrow view of their own capabilities
5. stretching themselves to achieve the buzz of self-motivated learning and accomplishment.

3.2 Informal learning with online platforms

The World Wide Web has made it typically quite easy for individuals to find *information* about things that they are interested in or curious about, and to make contact with *other people* who are also interested in those things. Both of these, but especially the second, were often rather difficult before the advent of the Web: whilst a library might have a book on your topic of interest, the conversation, exchange and inspiration with others who shared your passions would be lacking – and these things are vital for helping learning to grow.

John Seeley Brown and Richard Adler (2008) have argued that we now see a move from the 'push' model of schools and colleges, where a set body of information is supposedly delivered to students, towards a 'pull' model of social learning, where the internet and new technologies enable learners to pull down information, and access relevant networks, as and when they feel the need to.

In particular, certain platforms on the Web have led to a flourishing of informal learning, and a positive cycle of knowledge-sharing, inspiring and learning, leading to more and more knowledge-sharing, inspiring and learning, even when the platforms were not created for that particular purpose. Such uses of these tools are subsequently adopted in more formal learning situations, and so the line between 'informal' and 'formal' tools rapidly becomes blurred in practice.

Wikipedia, for example, was initiated in 2001 with the optimistic hope that a certain number of enthusiasts about different subjects might build articles around their interests. It could not have been predicted that it would have exploded so quickly, or so internationally: just 10 year later, there are 19 million articles across the 282 different language editions of Wikipedia. What also could not have been predicted would be the dedicated communities which have emerged around particular articles, and groups of articles, who debate and learn from each other in their ongoing project to make a great set of articles (Lih, 2009; Dalby, 2009).

YouTube is perhaps an even more surprising case, as it was established in 2005 with no apparent educational remit, but as a video hosting site and community which in its early days was seen largely as a place for videos of funny pets, skateboarding stunts and pop songs. However, over the years it has grown to include communities of people enthusiastically sharing their knowledge and experience on all kinds of topics, from car maintenance and IT skills to cookery and knitting (Gauntlett, 2011; Burgess & Green, 2009; Snickars & Vonderau, 2009).

It should be noted that sites such as these are not always simply the home to supportive participants who wish to support fellow users to achieve their personal best. Sometimes comments and feedback can be very harsh. Wikipedia is a curious case, since the quality of the overall project is largely improved through a process which can at times be highly fractious between individuals engaged in little battles over the correct formulation of facts, or the line between facts and opinion, within the discussion communities for particular articles. For instance, the article on Cornwall (a county on the far south-west of England) has for several years been battled over by those who wish to see Cornwall as a separate nation and those who do not. This kind of conflict is usually seen as productive by Wikipedia's management and administrators; indeed the Cornwall article is held up as a model of partisan disagreement leading to general consensus over forms of words acceptable to all parties – a kind of shared learning process.

The participants in debates of this kind have been pushed to refine and sharpen their arguments, and to do further research to support their views. It is therefore a learning process, although not always a comfortable one. Nevertheless, the question of how to foster more encouraging, less abrasive learning discussions online remains, and will be considered later below.

3.3 Examples of informal learning on platforms

Peppler (2011) describes many areas of the arts – broadly interpreted – where new digital forms, tools and practices have encouraged young people to engage in informal learning for themselves. These include:

- *Visual Arts*: including, for example, the very popular deviantArt social network (14.5 million members and over 100 million submissions), new iPhone and Android 'painting' apps, and the Nintendo DS Art Academy.

- *Comics and Manga*: the Web has enabled comics fans to share their work and build collaborative narratives, and helped those in the West to develop a much greater interest in Japanese *Manga*; events such as the ever-expanding Comic-Con have cultivated physical interactions alongside the online environment.

- *Digital photography*: With digital cameras being included in most phones, many laptops, and other devices, as well as in objects called 'cameras' themselves, photography is more prevalent, and taken for granted, than ever before. Facebook users have shared literally billions of photographs (for example, Facebook stated that on New Year's Eve, 2010 – just the one day – 750 million photographs were uploaded). Different online communities use photography for different purposes; Peppler highlights the street art (graffiti) artists who self-organise across physical and online spaces, and use photography to display their work as well as engaging in sidebar discussions about photographic tips and techniques. She cites five areas where Guy Merchant (2010) has identified that photosharing is important to learning: learning through seeing, learning through reflection, learning about image, learning about multimodality (how the different elements create meaning), and learning about Web 2.0.

- *Music*: A study of the impact of the video game *Rock Band* indicated that it fostered both skills and interest in other music study and performance, including an interest in classical music performance (Miller, 2009; Peppler et al., 2010).

- *Fan fiction:* Online platforms have enabled fans of popular media narratives, such as the *Star Trek* and *Twilight* series, to create and share their own stories involving these characters and universes. The case of *Harry Potter* fan fiction shows the scale of this phenomenon: the site harrypotterfanfiction.com, for instance, reports that it "is currently the home of 33,134 contributing authors, who have written over 583,929,800 words in 264,250 chapters of 74,184 stories"; and this is just one among several *Harry Potter* fan fiction sites. A study by Rebecca W. Black (2008) found that the communities of online fan fiction authors promoted literacy in teenagers, as well as social and personal growth.

- *Creative coding*: The online programming language, Scratch, has fostered creativity amongst the target group of 6 to 16 year olds, and many others, with an easy to use click-together system which controls images, music and sound. The Scratch online community is extensive and characterised by sharing of elements and techniques, with geographically dispersed young people learning together through the programming tool and its network.

New ways of connecting with online environments, such as the embodied interaction with Microsoft's Kinect system mentioned above, will open up further possibilities that have not yet been fully exploited.

The success of these informal learning environments reflects the significance of personal motivation, as outlined in Chapter 1. The senses of autonomy, relatedness and competence are key drivers for people to contribute in this sphere, leading people to invest significant amounts of time engaging with online platforms, and releasing a wealth of positive surprises when other people comment or contribute.

3.4 Online spaces as learning *communities*

The term 'virtual community' is now well-established, and almost old-fashioned, in research on online networks. The notion of 'community' describes people occupying a kind of social structure, and a sense of belonging or collective spirit, and traditionally of course has included a geographical area of activity, which here is replaced by an *online* area of activity. Howard Rheingold, who coined the term 'virtual community', suggested that individuals were turning to online networks to find community spirit and support which was often missing in everyday life (Rheingold, 1993).

Miller (2011:197) has argued that 'community' is often not the right term for online shared spaces, as it implies a kind of warmth and shared experience, and empathy, which is not always present. He suggests that discussion of 'networks' would be more appropriate. Nancy Baym similarly notes that "the mere existence of an interactive online forum is not a community" (2010: 74), but nevertheless points to research studies which show that in the realm of everyday practice, rather than academic theory, *users themselves* would refer to 'community' and community values within their preferred online spaces, even where researchers avoided the term.

In a study of massively multiplayer online games (MMOs) and their users, Constance Steinkuehler and Dmitri Williams (2006) found that 'by providing spaces for social interaction and relationships beyond the workplace and home, MMOs have the capacity to function as one form of a new "third place" for informal sociability'. They argue that participation in such virtual 'third places' can lead to relationships which connect diverse people in a shared endeavour. Although if and when players transition into more 'complex, long-term collaborative activities' then the spaces become stronger in tying members of particular online groups more closely together.

Brown & Thomas (2011) describe how the New Culture of Learning will essentially involve online games and play:

> Gamers learn through experimentation. They play with the tools they have in the virtual world they inhabit, repeatedly making minor adjustments and recording the results. They might approach the game methodically, going through a series of incremental steps, or intuitively, letting their experience guide the choices they make, but in either case, they rely on the connections among the things they know at a tacit level to achieve their goals. (Brown & Thomas 2001: 82).

Central to such learning environments is motivation and play, as the students follow their passion and operate within the constraints of a bounded environment. Additionally, they get very clear feedback on how they cope with challenges and solve problems, by comparing with others.

Subhasish Dasgupta (2006) asserts that there are three elements which are needed for virtual communities to function properly: '*structure'* (a shared understanding of community rules and norms, similar to Baym's 'shared practice and space'), '*trust*' (which must be established for effective collaboration to take place; aligns with Baym's 'shared identities' and 'shared resources and support', especially a willingness to support others with no expectation of immediate reciprocal reward), and '*common goals*' (a shared understanding, present across all of Baym's typology).

For a learning community, rather than online community in general, there should also be a commitment to supporting the development of others, a kind of pedagogical civility which cannot be taken for granted in all virtual spaces.

4. Self-efficacy and informal online learning

As we saw in Chapter 1, self-efficacy beliefs – a person's degree of faith in their own effectiveness – can be crucially important in learning. These beliefs can affect the projects contemplated, whether individuals feel they can actually start them, and whether they can carry on in the face of difficulties and obstacles. We saw that certain experiences could help to build self-efficacy – in particular, 'mastery experiences' where an accomplished triumph can really boost personal morale. Observing role models, and support from others, could also have an impact. This connects with the notion of scaffolding, outlined earlier in this chapter, where influential others can help a learner move from one level to the next, ultimately growing beyond the need for such supports.

Self-determination theory suggests that when people engage in autonomous projects, initiated and shaped by their own interests and desires, they are more able to satisfy their needs, leading to greater satisfaction and wellness. Furthermore, as mentioned in Chapter 2, environments which stimulate more than one of the senses (such as those offering both visual and auditory stimuli) can strengthen neural responses and so contribute to more 'sticky' learning. We also saw evidence that just watching audio/visual material, such as television, is much less powerful than when engaging with interactive systems, which require active thought, reflection and evaluation.

4.1 How do online platforms foster self-efficacy in learners?

Well-designed online learning platforms enable people to engage in projects where they can tinker and make things, and share material and engage in discussions, and it is through these activities that a lot of informal online learning occurs. (There are also more formal spaces of learning online, such as video repository The Khan Academy (www.khanacademy.org) and MIT's OpenCourseWare (http://ocw.mit.edu), but at present

these tend to be more one-way and about receiving information from 'experts' rather than the communication, participation and scaffolding needed by learners).

Such platforms for informal learning, such as the the mainstream Web 2.0 platforms mentioned earlier, offer a space for sharing ideas and creative material with an interested external community of enthusiasts, and for receiving feedback (something previously difficult to achieve except, perhaps, for those fortunate to be close to fellow enthusiasts, and able to find them). This enables learners to develop their ideas and practice in a model which is supportive but not overly instructional, designed for exploring and experimenting (Claxton, 2008).

If we look again at the Studio Thinking Framework outlined by Hetland et al (2007) above, we can see that such platforms could potentially encourage the development of craft (learning effective use of tools, materials, and conventions of the field); envisioning the work as a series of steps; self-expression; reflection (both 'learning to think and talk with others about an aspect of one's work or working process' and 'learning to judge one's own work and working process and the work of others in relation to standards of the field'); and especially the dimension that Hetland et al call 'Stretch and explore': 'Learning to reach beyond one's capacities, to explore playfully without a preconceived plan, and to embrace the opportunity to learn from mistakes and accidents'.

Some of the eight habits of mind would take more personal commitment to master, such as learning to persist. This is not something one can develop by using an external technology, but persistence would have to arise from own determination, and be appropriately encouraged by the qualities of the platform and by the responses of others.

4.2 Platforms and scaffolding

The metaphor-based terms 'platform' and 'scaffolding' have emerged from different fields, but they share a connection in that both involve performative stages or levels where one contribution can support the next, combining constructively together. Earlier in the chapter, we explored the crucial social role played by those who support the learning of others, as highlighted by Vygotsky. This model speaks to the social interactions which support, encourage and extend learning.

Scaffolding, in the model developed by Jerome Bruner, is about supporting learners in achieving beyond their existing capability – giving them a 'step up' so that they can advance, often through questions, pointers and encouragement, rather than direct instruction. This means that they can enter Vygotsky's 'Zone of Proximal Development'. Ultimately, the learner should reach a point where they do not need the scaffolding supports (Verenikina, 2008).

Well-designed online platforms do offer a scaffold which helps new users through tutorials, or just easy to follow steps, to find out for themselves how to achieve basic tasks (such as uploading a video in YouTube, or setting up a Stash of materials in the knitting network Ravelry). Having achieved a basic but significant step of that kind, users may then use FAQs or support forums to troubleshoot problems, receiving feedback or encouragement from others. Resolving any issues enables users to move on to, say, engaging with the community around a particular topic of interest (even if that community has not engaged with them yet). This might, in turn, lead them to move to the level where they offer comments, answers and support to others, as well as starting to post more complex content of their own. These participants may, in time, reach a stage where they no longer need practical advice on using tools, but are happy to continue learning and contributing around the ideas and themes that concern them. In this way, online platforms offer a kind of scaffolding process, and foster a spirit where users feel that they can work things out for themselves, without requiring an instructor or an instruction manual.

4.3 Reasons for making and sharing

David Gauntlett (2011) has drawn together research that has examined *why* people use online platforms to share and develop materials related to their interests. Reasons why people share material online were found to cluster around particular themes:

- To help others to learn, or be entertained
- A desire to share work, ideas, and to be recognised
- To add to the information available on the Web
- To be an active participant in discussions
- To be a maker and not just a consumer
- To collaborate and to get feedback
- Contributing to and being part of a community

Several of these connect with learning – to learn oneself, and to help and support other learners. Gauntlett reports that the theme of *recognition* was strong: people want to lay down signs of their cognitive existence and their ideas, and they want this to be *noticed*. This reminds us that those who are active in online learning communities are, quite reasonably, not to be thought of as 100 per cent altruistic: they are willing to support other learners, but in return they want to learn themselves. They are keen to share their own work, but hope that this will be recognised and appreciated by others; and they like to make helpful contributions within the community but want those contributions to be properly noted by others as well. (The flipside of this can be seen in Wikipedia discussion pages where individual contributors become furious when their careful contributions are reverted, deleted or contradicted by others – it is not always a smooth and friendly process).

4.4 The value of making and sharing

Drawing on this research, Gauntlett contends that making and sharing things online can have a significant impact upon an individual's sense of their own agency and ability in the world; their online contributions make visible an active, productive self which is appreciated by others (Gauntlett, 2011: 107), thereby contributing to a sense of self-efficacy. A negative reception online can knock these beliefs the other way, but it appears that such experiences are most often counteracted by the greater number of positive, identity-rewarding responses.

A study commissioned by the New York Times Customer Insight Group (2011) also sought to explore the reasons why people share online, and for the first time presented findings from a substantial survey of those who like to share material online – in this case, 2,500 American individuals who were categorised as 'medium/heavy' online sharers. The findings suggest that online sharing, and the discussion which may follow it, can contribute significantly to informal learning and understanding. For instance, 73 per cent of the respondents said that they process information more deeply, thoroughly and thoughtfully when they share it, with an even greater number, 85 per cent, saying that other people's responses helped them to understand and process information and events. Although based on self-reports, these high percentages give strong support to the principle that sharing and discussing information and ideas leads to greater processing and understanding of that material. The data also showed that sharing is strongly associated with making personal connections: more than two thirds (69 per cent) said that they share information because it allows them to feel more involved in the world, and almost three quarters (73 per cent) of these online sharers said that they share information because it helps them to connect with others who share their interests.

A separate study, conducted by researchers from the University of Pennsylvania, looked at what kinds of articles from the *New York Times* are most commonly shared online -- based on a mass of data gathered over a six month period (Tierney, 2010). The expectation that this would tend to be short, amusing stories about sex or pop culture turned out to be false. On the contrary, the most-shared articles were more likely to be 'long articles on intellectually challenging topics', with science articles being especially popular. Although users of the *New York Times* website may not be representative of the general population, this finding suggests that sharing material online is characterised by an aspirational, learning effort, and that (as the previous study showed) this learning about more complex topics will be strengthened and embedded through the very process of sharing.

4.5 Informal enthusiasts

Informal learning tends to be most focused within particular enthusiast communities. A study by Stacey Kuznetsov and Eric Paulos (2010) surveyed 2,600 people who participated in a range of online DIY communities (Instructables, Dorkbot, Craftster, Ravelry, Etsy, and Adafruit) to explore their motivations and practices. The values of the participants in these communities were found to strongly reflect an ethos of 'open sharing, learning, and creativity' rather than profit or self-promotion.

The researchers found that over 90 per cent of their respondents participated in DIY communities by posting questions, comments and answers. They did this frequently and diligently: almost half of the participants responded to others' questions, and posted comments or questions, on a daily or weekly basis. There was also quite a significant follow-through to face-to-face meetings. One third of the respondents attended in-person meetings, and over a quarter presented their work in person at least several times a year.

In terms of their motivations for contributing to DIY communities, the responses were strongly about inspiration and learning. Almost all respondents (97 per cent) said that they contribute in order to get 'inspiration and new ideas for future projects' (81 per cent strongly agree, plus 16 per cent agree), and almost all (97 per cent again) wanted to 'learn new concepts' (68 per cent strongly agree, 29 per cent agree). Motivations to do with information exchange were also strong: more than three quarters of participants said that they contributed in order to receive feedback about their own personal projects, and in order to educate others. By contrast, a majority of participants disagreed with more instrumental motivations, such as 'finding employment' or 'improving online reputation', which were rejected by 68 per cent and 60 per cent of participants respectively.

Kuznetsov and Paulos drill down into the notion of 'question answering [in online communities] as an instrument of learning' and find, in the qualitative comments, that all of their respondents suggested that the act of answering questions helps learning. One participant explained: 'It's like that saying that you learn more by teaching and sharing with others. Every time I pass on a little bit of information to someone else, it helps to ingrain that knowledge in my head, even spur on a desire to learn more' (2010: 5).

4.6 High quality learning conversations

The communities in Kuznetsov and Paulos's study clearly generated a high quality of supportive conversation around their topics of interest. The role of *critique* is important in learning to be creative (Peppler, 2011) – and was an important part of the Studio Thinking Framework discussed above. But not all online communities play host to thoughtful and constructive critique. Earlier, for instance, we discussed YouTube, a platform which hosts an incredible array of creative work. However, over time it has become apparent that YouTube does not necessarily host the highest-quality conversations about particular topics. Clay Shirky, generally an optimist about online networks, has admitted that online conversation at the negative end can be 'astonishingly bad' and 'enough to make you wish for the enforced public silence of 20th century media' (Shirky, 2011).

However, Shirky argues that online spaces can be *designed* to foster high quality, supportive conversations – and as evidence, he points to the kinds of carefully designed craft and art communities such as Ravelry, Etsy and deviantArt that were also highlighted by Kuznetsov and Paulos. These online social networks tend to foster positive conversations because they are more focused around a particular interest; participants have greater commitment to each other and to the 'shared enterprise' of the network; and are more willing and able to take steps against those who violate the ethos of the site.

Shirky (2011) identifies these as three forces that affect online conversation:

1. Forces that set conversational context (scale, homophily, identity)
2. Forces that guide conversations (visual and verbal cues, social rules)
3. Forces that restrict conversations (membership, karma, moderation)

The most important point here is that positive or negative online behaviour does not happen at random; rather, communities can be *designed* from the outset to encourage supportive behaviours and to discourage abuse.

5. Summary

Cultivating one's own learning identity is today increasingly individual, informal, and self-managed. But learning itself is often a social and networked process. This shift is supported by the rise of free online learning resources and communities.

Learning can be 'scaffolded' by supportive others, such as teachers and peers, helping learners get to the point where the scaffolding is no longer needed. There is a 'zone of proximal development', a range of greater abilities which learners can reach if they are supported by scaffolding – interactions with others which support their learning, follow their interests and help to simplify particular difficulties. Learning is enhanced when others take an active interest in the subject of the learner's attention. Relationships are important to learning; peers, parents and teachers help to support learning, and even the knowledge that their support is *available* is encouraging to learners.
Beyond individuals, we also form relationships with objects used on an everyday basis, and it is the combination of the relationships with objects and people that form the full social learning space. The physical environments are also becoming increasingly connected to online spaces, enabling new ways to engage with ideas, creating a social relationship between the digital objects and physical space.

Web 2.0 platforms in particular, have given a huge boost to self-organised learning. Learners can now have immediate access to communities of others who share their interests and are often willing to give advice, help and support. This corresponds with a rise in informal learning, where people are embracing learning, and the sharing of knowledge and experience, within their everyday lives and in diverse settings.
Informal learners, like all learners, are supported in their learning process by the ability to engage and persist; being able to visualise future steps; observation and reflection; and to play, experiment and tinker with possible outcomes. Online platforms and potentially also online games can develop communities which foster this kind of learning, and support learners who can be inspirational role models for their peers.

Self-efficacy beliefs can be supported by online platforms, if they provide opportunities for mastery experiences – a recognition of one's own agency and ability in the world – and/or when there is support from other participants, and inspiration from role models. Online platforms can support and provide scaffolding for learners who wish to engage in autonomous projects, in areas where they have great interest but no local support. Online platforms tend to offer multimodal ways of learning, through video, audio, and text-based interaction and enable learners to experiment, tinker, and explore, following their own curiosity, which has been shown to be a powerful mode of learning.

Research showed that people support others online partly to be a helpful member of a community, but also partly as a process of embedding their own knowledge and understandings.
Not all online spaces foster the most supportive conversations; it is a design challenge to create supportive spaces characterised by trust and shared goals.

Chapter 4:
Learning Contexts

Chapter 4

Learning Contexts

Introduction

In earlier chapters we have seen how learning relates to individual competence and motivation; how cognition and multiple senses shape learning experiences; and how relationships and communities are central to learning. In this chapter, we focus on the settings in which learning occurs. Such settings are not just physical places (built or natural environment) or mere technical platforms (infrastructure or software). Instead, *settings* are culturally mediated in both space and time. They form the milieu in which we operate, contain the starting point for our activities, and combine into an ecology of learning, serving as levers for human exploration and experimentation.

> Learning should be viewed in terms of an environment – combined with the rich resources provided by the digital information network – where the context in which learning happens, the boundaries that define it, and the students, teachers, and information within it all coexists and shape each other in a mutually reinforcing way. (Thomas & Brown, 2011)

This discussion of place and settings for learning goes hand in hand with the discussion of learning institutions and the role of networked technologies in learning. Davidson & Goldberg (2009) challenge the role of traditional universities and institutions in the face of the inventive, participatory learning offered by the internet, which requires leaders to adopt a more inductive, collective pedagogy.

> Learning institutions must be open to flexibility of scale at both ends of the spectrum, devising ways of acknowledging and rewarding appropriate participation in and contributions to such collaborative efforts rather than too quickly dismissing them as easy or secondary or insufficiently individualistic to warrant merit. (Davidson & Goldberg, 2009: 25)

Traditional institutions and places become extended by new contexts for learning, where learning institutions are part of mobilized networks, stressing flexibility and interactivity. The emergence of digital and mobile technologies provide new ways for learning, and the content can be distributed and connected in unexpected ways, as seen in Chapter 3. When people and artifacts are configured in a setting, people are no-longer 'out of place', but actions become meaningful for the physical organization of the environment (Dourish, 2004).

The environmental factors pinpointed by Bandura, outlined in Chapter 1, do not affect human behavior directly, but influence people's aspirations, self-efficacy beliefs, personal standards, and emotional states. In what follows, we discuss the importance of settings, and how contexts can serve as a medium for learning. We describe the environmental qualities conducive to learning, and how physical contexts and events support the emergence of networked and participatory learning.

1. How learning contexts are changing

1.1 Settings matter

Physical places play a major role in people's lives, and researchers in the fields of human ecology, psychology, and anthropology generally agree that people feel and behave differently depending on their settings. And yet the power of place is generally under-explored when it comes to education. John Holt wryly observed, "Why do we think humane learning can go on in buildings that look as if they were designed to hold atomic secrets?".

Ideal places for learning are ones that encourage being at rest with yourself (Tuan, 1977), and which provide identification – a sense of belonging (Norberg-Schultz, 1980). The Montessori classrooms took these physical factors of place into consideration when organizing 'prepared environments', customised according to young children's optimal development. A tailored environment was created for children to have a place of their own, where the materials were properly organized for maximum independence, and structured as an attractive and welcoming area large enough to accommodate a variety of activities (Standing, 1957).

In the Reggio Emilia approach to education the environment is also a crucial link to development, in that it is even considered to be the 'third teacher'. The clear physical organization of the spaces is also important, because the environment 'speaks to us' or enables certain activities. Greater emphasis is placed on the

connection between the exterior and the rest of the community. Multiple points of view to learning and personal interests are encouraged around open-ended activities, most of which are initiated by the children themselves. The environment in the Reggio Emilia approach shares similarities with the philosophy of learning from Dewey, Piaget, and Vygotsky, where an optimal physical space is seen as one that nurtures concentration, creativity, and the motivation to independently learn and explore (McKellar, 1957; Gandini, 1998).

This organization of the physical environment to enable creativity and exploration provides the framework for a traditional learning context, particularly relevant for very young children. However, the model quickly becomes insufficient to support the changes in network technologies and social relationships, especially for older children and adults.

Pairman & Terreni (2001) have introduced the concepts of the *interactional environment*, which includes social interactions in the context, and the *temporal environment,* involving the routines and changes to the learning context over time. Therefore individual perception of the learning context is paramount, but is understood to exist over an extended period of time, and beyond the classroom settings.

1.2 Settings change

Temporal and interactional environments introduce a performative aspect to learning, where learning contexts are significantly influenced by both social, physical and technological elements. Learning arises from a process involving personal, situated, active learning within a community of learners and practitioners, often described as learning ecosystems (Educause 2003). Nardi & O'Day (1999) define the difference between an ecosystem or 'ecology' and a traditional community of practice (where a group of people share an interest or a profession), as a difference in dynamism, where the nature of the ecology supports greater dynamism:

> Ecology suggests diversity in a way that community does not. Communities can be quite homogeneous, or defined along a single dimension... ...Ecologies imply continual evolution. The idea of community does not put the same emphasis on change (Nardi & O'Day, 1999: 56).

They argue that it is important to define one's own local information ecology, where one has knowledge and authority to act in a committed and reflective way. Engagement and participation is seen as important when constructing collective participatory and socially shared activities. The modern library is a good example of the transformation of institutional roles under way – with its role changing from assisting in finding information to evaluating, assessing and applying information (Nardi & O'Day, 1999: 102).

A recent study on the future of libraries suggests that they are seen no longer seen as containers of literature, but now can support fulfilling goals like experience, involvement, empowerment and innovation in

order to support each individual's perception of knowledge. Skot-Hansen et. al. (2010) suggests a new context and model for the 21st century library, which includes:

- Inspiration space
  Excite – a space for meaningful experiences and mediation.
- Learning space
  Explore – a space for discovery and exploration
- Meeting space
  Participate – a public space or 'third place' for empowerment and involvement.
- Performative space
  Create – a space for interactivity, production and publishing.

Some might argue that a more traditional role of libraries as 'spaces of reflection' is still valid – or maybe even required, as libraries are in general adapting to the role of organizing a culture of participation and critically reflecting on digital learning. The reform of libraries echoes after-school activities like the Computer Clubhouse, which supports a traditional learning environment through more project-based activities where children build, rebuild and share projects, mostly of social significance, with others (Kafai et. al. 2009)

In some places, learning contexts expand directly into urban areas through tech-shops, bike kitchens and gardens as temporary 'fourth places', as Jill Hurst-Wall (2011) has called them, using shipping containers outfitted to offer an array of services for creative learners. This outlines the importance of experimenting with new possibilities and reaching out to places where learning might be more practically relevant.

The changing contexts of learning influence how learning institutions are accommodating digital networks of learning. Here, physical spaces are increasingly supporting multidisciplinary, team-taught, interactive learning in a more organic fashion, where hallways are used as meeting places, cafés as working stations, and flexible areas as studios. As seen in previous chapters, cognitive theory advocates more stimulating contexts for learning with an emphasis on the active construction of knowledge, and allowing for a greater degree of peer-to-peer exchange and less 'information transfer' (Oblinger, 2006):

> Environments that provide experience, stimulate the senses, encourage the exchange of information, and offer opportunities for rehearsal, feedback, application, and transfer are most likely to support learning. (Oblinger, 2006: 2.4)

1.3. Emerging learning networks

In any of these different types of environments, there is a 'learner' in the centre of attention, and thus an interest in 'personal learning environments' has been developing. Originally seen as a counterpoint to more institutionally managed learning environments, "it describes the tools, communities, and services that constitute the individual educational platforms learners use to direct their own learning and pursue educational goals" (Educause, 2009).

Wheeler & Malik (2010) describe the personal learning environment as consisting of three components:

- *Personal Web Tools* are any web or mobile tool used to support personal (and lifelong) learning. This include tools to generate, organize and share content.

- *Personal Learning Network* indicates the connections to where we can find information, being more important than knowing content.

- *Personal Learning Environment* contains the umbrella of the network and tools, but include all kinds of media and experiences, which are connected through social networks.

A more general way of describing this apparently more 'learner-centric' approach is to contrast Google and Twitter. Would it be more important to know a central place, where you can find all the most relevant information in the world, or to be connected to a personal network, who might be able to provide a focused answer? While there are advantages in both approaches, it appears that preferences vary depending on the situation. In both cases, however, there still seems to be a lack of 'where' and a situated element, which may be why a new domain of 'microlearning' has emerged.

Microlearning describes a learning context where each individual is using the capabilities of new (mobile) media to learn through (a) a low time commitment, (b) combining small chunks of information, (c) with a relatively small amount of effort and (d) within a narrow topic. This kind of learning is emergent in the sense that it relies on peer-to-peer interaction, where groups or communities quickly exchange information based on a situation and context, to create a meaningful learning experience. It is especially relevant due to the ever-increasing fragmentation of information sources and units used for learning, especially in a time where we see a considerable degree of change (Research Studios Austria, 2011).

> We advocate speaking of microlearning in terms of special moments or episodes of learning while dealing with specific tasks or content, and engaging in small but conscious steps. These moments, episodes and processes may vary depending on the pedagogies and media involved, but the measures of scale of the amount of time and content involved can be made fairly constant (Hug & Friesen, 2009: 4).

In microlearning there is also a focus on the individual aspect of learning. The use of blogging, social networking, and photo-sharing from mobile devices naturally brings learning closer to the individual. However, a particular challenge remains how to coordinate specific content to fit to a particular moment, to make it relevant both as part of formal and informal learning environments.

Learning contexts are changing from being primarily represented by the organization of elements in the physical environment around fixed places or temporary occasions, to the social interaction enforced by more situated, flexible and participatory environments. Expansion in the use and integration of digital technologies for individual learning purposes is further driving the evolution of learning contexts.

2. Elements of Learning Environments

As we have seen, places for learning are lively and constantly evolving, and thus depend on the environment, the interactions between the people and objects, and the distributed intelligence of the place.

2.1 Situating Learning

Situated approaches to human learning posit that what we know – and how we come to know – is "situated," or contextual, and thus should not be separated from the situations in which it is constructed and actualized (Brown & Collins, 1989; Lave and Wenger, 1991). In Schoen's words, learners are "reflective practitioners" who think and act *in situ* (Schoen, 1983). This growing interest in the notion that knowledge lives and grows in context, has led researchers in the field to pay much closer attention to:

1. the ways people engage and navigate specific situations (how they work their way through things, and how they feel and think)
2. the ways that the situations themselves may trigger or hinder learning.

Situated learning has antecedents in the work of Gibson, with the theory of how objects determine possibilities for action (1977/1979), or more specifically indicating how an object should be used (Norman, 1990). However, it extends far beyond the basic functional requirements of an object or an environment, as qualities refer to the embodied actions which are inscribed, grafted or hard-wired into an artifact or environment (Monteiro, 2006). If learning environments should be more situated, they might require settings with less conventional forms of expression and a higher degree of interpretation, which are personalized through interaction, in the same way as the LEGO System can be considered as an open system.

Beyond laying plans for the future and thinking about what happened in the past, most cognitive activities rely on an interaction with distributed activities like using tools and moving around in the environment. Learning through the environment and context begins with embodiment and develops through actions and events, which depend on memories, objects that are permanently present, configurations and spaces that are able to constantly challenge our constructs.

To summarize, situated learning takes its starting point from practice and the understanding of how everyday situations create possibilities for a learning environment. It also implies that the specific situations determine our modes of engagement, because they rely on our embodied interactions with our context.

2.2 Relational Settings

John Dewey's notion of pragmatism was inspired by the Darwinian notion of environments constantly undergoing change, influencing people to adapt to changing circumstances. Similarly, we need to be constantly redefining learning goals, empowering people as active beings able to affect change in the environment. Dewey suggested that the goal of education is to be able to participate in creating an unfinished world. However, to achieve this, one needs to know the world and how to affect it.

The people participating in an environment are therefore also creating the environment, not only in the sense of their personal experience, but by influencing the environment, other people and the general norms. The interaction with space is also evolving with the advent of mobile and embedded technologies. While interactions are often thought to occur face-to-face or through computer interfaces, the development of technology is removing some past constraints on interactions in that they no longer require:

a) being in the same place
b) objects in the same time and at the same age
c) all participants being visible
d) the interactions evolving at the same pace without shifts
e) the same expectations or status of each of the participants
(Latour, 2005: 200ff)

Looking at the 21st Century classroom it is no wonder that controlling students' attention is difficult, if a teacher is to maintain one fixed agenda without each of the participants making a contribution. If joint attention in physical place should make a difference for learning, Latour argues for a set of new tools and principles (Latour 2005: 207), using digital technologies to settle interactions and position learning according to the needs of the individual. Given that activities and technologies create a more dispersed learning engagement, there is a requirement for common 'subjects' which either synchronize discussions in new places of learning, or empower the use of open works where each individual contributes and accounts for their own learning.

2.3 Distributed Cognition

Distributed cognition is a branch of cognitive science that studies how human cognition is distributed across objects, individuals, artifacts, and tools in the environment. For Hutchins (1995) it was characterised by the memorable statement that the mind is in the world (as opposed to the world being in the mind). In other words, one must consider the roles of the social and material world, and understand their impact on the thinking of individual human actors.

Distributed cognition shares similar references with the psychology of Vygotsky (1978), in that cognition also relies on a system of representations, distributed across members of a social group, involving a great deal of coordination. This social organization is also relevant when considering distance learning and the online community aspects of learning, as previously noted.

The current development of mobile technologies and pervasive computing adds to the concept of distributed cognition by adding a dimension of embodied interaction, where the environment can now respond to individual and collective associations. With pervasive computing, settings themselves can be said to learn.

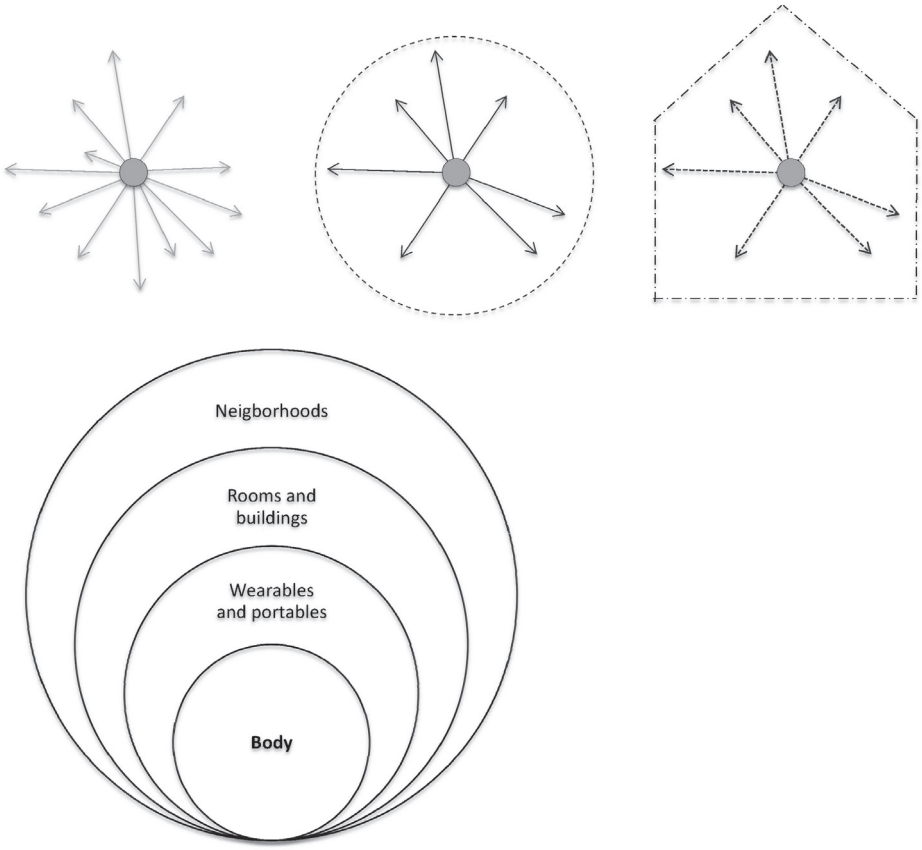


Figure 4.1 / 4.2: Learning flows in a two-way relationship between subject and context. Software that recognizes the abilities of respective users adapts itself to them, and guides their learning. (McCullough, 2004: 127)

Mobile and pervasive computing can adapt to the intuition of being in a place and provide a sense of place, but McCullough argues that these distributed forms of intelligence should be enriched by local protocols to recognize forms of tacit knowledge.

> The requirement for protocols to situate information and create tacit knowledge, as well as the 'scales of place' from the body into a neighborhood. (McCullough, 2004: 142)

These technologies branch out from the body, and become increasingly intelligent. This more radical notion of distributed cognition has led to the notion of 'connectionism', meaning that in an increasingly 'techno-social' world learning not only rests at the level of the individual, but is stored both in computers and other people. Thus 'learning' can be said to take place outside of people, and systems augment this by combining and connecting separate nodes of knowledge (Siemens 2004, 2006; Bockarie 2008).

To summarize, with distributed cognition, learning is also distributed and develops through an interaction between the individual and the environment through the organization of artifacts. Any object or context can be said to becomes part of individual cognition, and networked technologies entail increased dependence on distributed systems, which affects the development of knowledge.

3. Ecological systems

Urie Bronfenbrenner, the Russian American psychologist, saw opportunities for personal and societal growth in the system of relationships that form a person's environment. He examined the socio-environmental conditions that shape, and are shaped by the growing child, offering valuable guidelines for the design of educational settings. Bronfenbrenner named it "*bio-ecological* systems theory" to emphasize the non-obvious notion that a child's body itself is a primary environment that fuels her development (Bronfenbrenner, 2004).

The bio-ecological model includes four systems of influences, and a temporal dimension:

1. *The micro-system* involves close connections, such as relationships with the immediate environment of family members and peers, favourite places and special moments
2. *The meso-system* describes relationships outside of the closest bonds, such as typical interactions in a school or restaurant, or if the family is together with other people.
3. *The exo-system* concerns relationships that are outside of the individuals's control, such as the influence of a parents' workplace, or community institutions such as a church.
4. *The macro-system* includes the cultural values in the particular society and position within the socio-economic structure.
5. *The chrono-system* which includes transitions over time, for instance the impact of family or peers becoming ill, or greater institutional changes.

Our bodies are our life support system, mobility system, and *that with which – and through which* – we perceive and interact with our surroundings. Bronfenbrenner argued that we therefore need environments that foster the physical, emotional, and mental well-being of children and their caregivers.

3.1 Ecological systems as basis for school programs

The 'Comer process' or the 'School Development Program' (SDP) provides a structure and a process for how to mobilize adults to support childrens' learning and development, especially in relation to schools (Comer, 2009).

> The SDP emphasizes the central role of schools in enhancing children's development; it recognizes that childrens' lives are shaped not only by their families and communities, but also their relationship with teachers and administrators. The relationship between schools and children reflects their mutual perceptions and expectations (Comer, 1996: xiii).

It shares similarities with the ancient African notion, 'it takes a whole village to raise a child' (adopted by Hillary Clinton in 1996), pointing to the larger eco-system of parents and the society as an extended family responsible for a child's development. This emphasizes the collaboration between the home activities with parents, the school initiatives, after-school programs, leisure activities and online communities,.

The Comer Process has been used as a guiding principle for schools which coordinate both with student, staff and parent teams within three guiding principles :

- *No Fault* - Maintains the focus on problem-solving rather than placing blame.
- *Consensus Decision-Making* - Through dialogue and understanding, builds consensus about what is good for children and adolescents.
- *Collaboration* - Encourages the principal and teams to work together.

In recent years, ecological approaches to human development have started to gain momentum, effectively addressing the intertwining of contexts and resources, the uses of digital media and technologies, and the urgent need to provide new venues and opportunities for students' academic success, youth development, and lifelong learning (Herr-Stephenson, Rhoten, Perkel, and Sims, 2011)

3.2 The digital influence of ecological systems

People are ever more "in touch with" remote events or people, or at least the think that they are. They also seem more resilient than in the past to *living together apart* (commuter couples, Facebook friends, Skype exchanges) which, in turn, can fuel a culture of non-commitment – being together occasionally and when convenient. Such changes in turn impact how people live, engage with others, treat and trade things, and

cultivate the grounds on which they stand. In the light of this, Brigid Barron offers a re-definition of *learning ecologies*, that seems more suited to our times, as:

> The accessed set of contexts, comprised of configurations of activities, material resources, and relationships, found in co-located physical – or virtual – spaces and that provide opportunities for learning (Barron, 2004: 6)

The strength of this definition rests on the call for 'a fertilization of resources that together multiply and improve the educational opportunities and learning trajectories available to today's youth – and everyone else who needs to learn everywhere and all the time, in order to stay afloat and upgrade themselves.' (Barron, 2004: 7)

4. Learning in and beyond schools

Not only do learners seek supportive environments, they are investing increasing amounts of time building their networks, cultivating their circles of acquaintances, and choosing the places they might call their own. Scale is not what seems to matter; instead, for children, what matters is the joy and pride they can take in setting the stages and building the props to advance their play. Value comes from springing back and forth, in one's imagination, between 'reality' and make-believe (between actualities and possibilities), and in-and-out between miniaturized and magnified versions of the places and events under construction.

4.1 Schools and college environments

For younger children, school is still a place to make new friends (one step removed from family) and to learn new things. For older students, further and higher education is often experienced as an important moment away from parents, and before career and new life commitments. Freeing students from their past and shielding them from adulthood is what collegiate life is all about. The huge success of Harry Potter comes as no surprise, especially at a time when many teens are left with no 'real' spaces, or neighborhood, to talk of. As in Harry Potter, each college has its own quirks, local vocabularies, odd customs, and mascots. But the crux of campus life lies in the ways students, faculty, and administrators interact and how each member values, contributes, or challenges the school's mission and heritage (O'Connor & Bennett 2005).

The importance of place in learning becomes most obvious when we think of distance education, and its attempts in developing and delivering on-line course materials. While useful under particular circumstances, distance learning face difficulties because it underestimates how much learning happens "in situ".

In university campuses, Peter Radloff (1998) stresses the importance of open spaces in campus life: hybrid environments that increase flexibility over when, where, what, how and with whom students learn. To help inform the design and implementation of built environments, Jamieson, Fisher, Gilding, Taylor, & Trevitt

(2000) presented the following principles. Although intended for universities, these principles are relevant because of the focus on project-oriented, flexible learning, which can foster a sense of ownership by individual communities.

1. Design space for multiple uses concurrently and consecutively.
2. Design to maximize the inherent flexibility within each space.
3. Design to make use of the vertical dimension in facilities.
4. Design to integrate previously discrete campus functions.
5. Design features and functions to maximize teacher & student control.
6. Design to maximize alignment of different curricula activities.
7. Design to maximize student access to, and use and ownership of, the learning environment.

4.2 Learning beyond school and independent of context

The research into meta-cognition and self-regulation, described in chapters 1 and 2, has been particularly relevant within educational contexts, and in relation to educational concerns. This is perhaps not surprising since, as we have seen, extensive research has shown that meta-cognitive and self-regulatory abilities are important determinants of children's development as learners, and that they are highly teachable. As noted above, it is often in the hybrid environments, the more open spaces, on their way home or at home, that children are allowed the time to engage in meta-cognitive activities – but then they might need further guidance.

Typically, as Whitebread & Pino Pasternak (2010) have noted in a review of the field, these interventions involve making metacognitive and learning strategies explicit, and encouraging children to reflect upon and talk about their learning. Examples of such approaches include:

- '*co-operative groupwork'* (Forman and Cazden 1985): a range of techniques involving children in collaborative activities which oblige them to articulate their own understandings, evaluate their own performance and be reflective about their own learning.
- '*self-explanations'* (Siegler 2002): an instructional practice which requires children to give 'how' and 'why' explanations about, for example, scientific phenomena or the events in a story, and then asks children to give explanations of their own and an adult's reasoning.
- '*self-assessment'* (Black and Wiliam 1998) a range of pedagogical ideas involving children's self-assessment of their own learning, including, for example, children making their own choices about the level of difficulty of tasks to be undertaken, and selecting their best work for reflective portfolios.
- '*debriefing'* (Leat and Lin 2003): a range of techniques for reflecting upon an activity or piece of learning including 'encouraging pupils to ask questions', 'making pupils explain themselves' and 'communicating the purpose of lessons'.
  (from Whitebread & Pino Pasternak, 2010)

These studies, together with many others, suggest that students who are adept at learning independently, and engage in effective self-regulation (Whitebread et al, 2005), participated in classrooms characterised by:

a) positive and supportive classroom climates;
b) a strong focus on understanding;
c) encouragement of autonomy by shifting responsibility from the teacher to the students, and
d) shared responsibility for learning.

Encouraging successful learning beyond the school and across contexts appears to hinge on particular teacher-students interactions that seem to be beneficial for students' learning and understanding (Rojas-Drummond and Mercer 2004; Alexander 2004). According to these researchers, teachers who are using the following approaches are likely to enhance students' opportunities for learning (also independently beyond school):

a) encourage active participation on the part of the students; and provide opportunities for students to explain their reasoning;
b) support the acquisition of procedures and strategies;
c) use questions that encourage the students to engage in reflective processes.

These characteristics map very well onto elements of self-determination theory (Deci & Ryan, 1985) – relatedness, autonomy and competence – and the research concerning making the processes of learning explicit. This suggests the importance of building metacognitive skills in students to fully embrace the promise of informal learning, where it would be easier to accommodate a sense of personal control, autonomy, social space and activities with cognitive challenges.

5. After-school and extra-curricular learning in today's new media ecology

Educational offerings, in the future, will have to be diverse, flexible, articulated and systemic. The role of digital media and technologies will be significant but in no way sufficient. The physical and mental health of learners will be a priority. In the latest MacArthur funded report on *Digital media and technology in after-school programs, libraries, and museums*, Herr-Stepenson, Rhoten Perkel, and Sims (2011) write, regarding youth development programs:

> Indeed digital media can offer opportunities for both self-directed and collaborative learning, can open access to information that might not otherwise be accessible, and can allow for creative expression in new formats. However, [...] we have seen that the non technical aspects of youth programs – the location and context, the staff and peers – are essential to the function and success of youth organizations, even in the land of digital natives and the age of cyber-learning. (2011: 66)

This growing fluidity of 'learning' between old institutions and new practices seems appropriate for the edgeless school. More than ever, learning is happening everywhere and all the time, hence the need to break down the barriers that separate the knowledge and experiences that are taught and sanctioned by schools from the knowledge and experiences that students (of all ages) gain through other means and will need in their everyday lives. Almost a century ago, in his lecture 'Waste in Education', John Dewey pointed out the difficulty of separating school from people's everyday lives and experiences:

> From the standpoint of the child, the great waste in the school comes from its inability to utilize the child's experiences outside the school in any complete and free way within the school itself; while, on the other hand, he is unable to apply in daily life what he is learning at school […] When the child gets into the schoolroom he has to put out of his mind a large part of the ideas, interests, and activities that predominate in his home and neighborhood. So, the school, being unable to utilize this everyday experience, sets painfully to work, on another tack and by a variety of means, to arouse in the child an interest in school studies. (Dewey, 1915 / 2001: 46)

As early as 2003, after-school education has been described as an "emerging field." After-school programs refer to adult-supervised, activity-based programs run during the after-school hours (usually between 3-6 pm), either at school or by community organizations. From YMCAs to boys and girls clubs, these programs are provided at low or no cost, and offer childcare for working parents and opportunities for youngsters to receive the extra academic support they need, and participate in recreational activities and sports. After-school programs are often described as "intermediary spaces", a term that reflects their hybrid yet important role between school, family, and community. In Noam, Biancarosa, and Dechausay's words:

> After-school connects to academic work without serving as a school, takes on aspects of family life (such as comfort, security, recreation) without becoming a family, and instills community-consciousness in children without becoming a civic group (Noam, Biancarosa, and Dechausay, 2003: 5)

The term *Extra-curricular activities*, in contrast, usually refers to more exclusive, and often costly, adult supervised activities, such as piano or dance lessons, and private or public tutoring services. In recent years, extra-curricular activities have grown to include increasing numbers of *youth-self-generated* (non adult supervised) initiatives, from friendship or interest-driven online and participatory cultures, to community-based networks of *bricoleurs*, gardeners, skaters, and knitters.

Noam, Biancarosa, and Dechausay have grouped after-school programs and extra curricular activities into three kinds, based on their approaches to learning, and views on how to best integrate digital media:

1. Extended learning activities include after-school programs whose primary goal is to increase students' academic achievements by providing the time, place, resources, incentives, and human

support for students to succeed in school – while, in some cases, rethinking how 21st century schools can improve their curriculum and standards.

2. Enriched learning activities, or "interest-driven" activities (Ito et al. 2009), include project-based programs and networks that stress the role of self-directed, exploratory, and hands-on learning. Examples include computer clubhouses, competitions, and youth media production programs.

3. Intentional learning activities include adult-driven participatory youth programs designed to foster non-academic skills, such as civic engagement, social competence, and self-efficacy. Examples include sports teams, youth radio stations, and groups dedicated to recreation and gaming.

6. Summary

Knowledge is a social construct embedded in bodily practices, and learning is a collaborative enterprise that engages every sense. We are social beings, and we learn – or learn to learn – so that we can join the teeming society that surrounds us. Virtual environments can usefully mimic some of the social dimensions of learning, but it can still be argued that the actual physicality of face to face engagement still has no satisfactory substitutes (O'Connor & Bennett: 2005: 3).

We should give the best to our children by building learning spaces in which it is worth living, contributing and learning – from libraries, to laboratories for cooking and gardening, classrooms, stages and auditoriums. Caring about the milieu is less a matter of material resources as of mindsets: a reflection of our culture's views on what it means and takes to 'get an education'. While a multitude of contexts can provide different learning opportunities, the individual's own skills in enquiry, metacognition and self-regulation become critical to mediate their own learning experiences, and to engage with contexts to co-create learning.

Chapter 5:
The Future of Learning

Chapter 5

The Future of Learning

Introduction

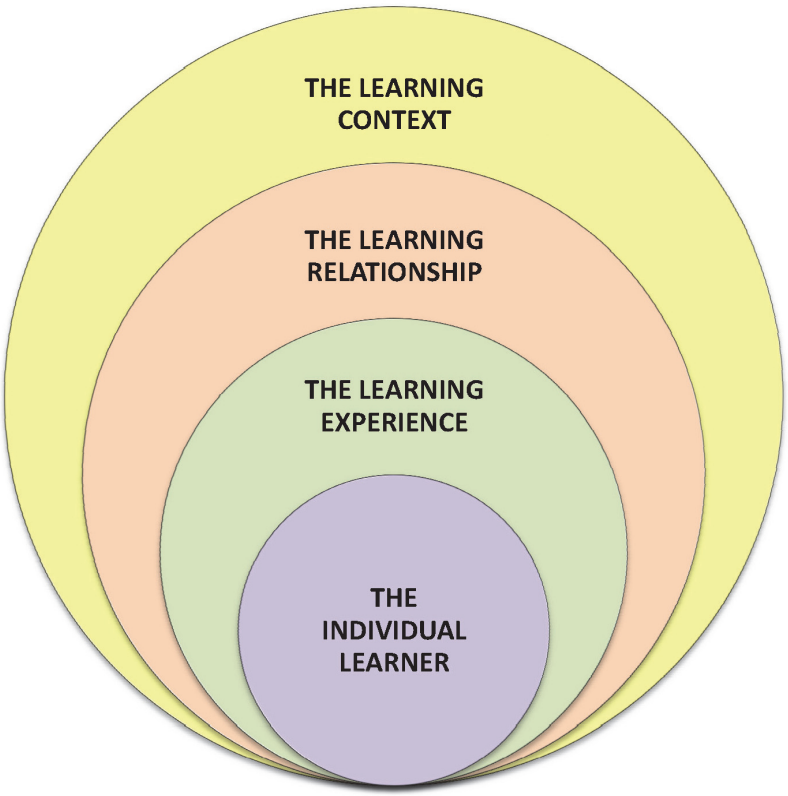
In the previous chapters, we have outlined four main areas, most important to understanding the changes taking place with the future of learning. This chapter combines these different perspectives into one model, showing the relationships between the individual learner, the experience, social relationships and different learning contexts, based on three creative stages of learning.

People learn by doing: testing out new things, and reflecting upon the result. This learning is enhanced through communication and exchange, and participation with others. Knowledge is built when people connect their own sense of discovery and fascination with a meaningful learning process, and a sense of purpose in a larger community.

In this chapter we further consider the important role of peers in learning, and the function of creative leadership in learning. This can involve empowering others, but also the need to determine one's own interests and individual learning, in a world of endless opportunities with pervasive media and new technologies.

1. The model for the future of learning

In our report on Systematic Creativity (2008), we showed how systems are crucial to creativity and learning. Systems not only channel creativity into solving specific problems, or give form to unique expressions, systems are also used by the mind to create meaning. They enable us to build knowledge by structuring how we engage and what we perceive in relation to goals we have set.



As we have seen in the four previous chapters of this report, learning can be seen as a kind of system, which grows from the individual learner, via their experience and relationships, to the broader context.

This diagram shows:

- *The Individual Learner* - the learner's style and approach to engagement in the system.
- *The Learning Experience* - the qualities and approaches to learning in the system
- *The Learning Relationships* - the relationships among individuals, supported by platforms and resources, in the system
- *The Learning Context* - any part of the environment which facilitates learning

These four elements illustrate how learning in the future becomes an inter-related system, founded on self-determination and motivation, with an objective to grow the competence of the individual. Michael Wesch has described this change as a process of moving from knowledgeable to becoming knowledge-*able*, ensuring that there is personal relevance in learning, to maintain attention and focus on real and relevant problems while pursuing a growing interest in other people's point of view (Wesch 2009).

1.1 Stages of Learning

Dewey (1939) argued that education should both have a) a societal purpose, and b) a purpose for the individual student to understand human experience as a starting point for learning. Whitehead similarly emphasized that learning needs to be realistic, cannot be separated from practice, and needs to rest on a 'correct' notion of reality. He proposed the following three stages of learning in his 'Aims of Education' (1929):

1) The stage of *Romance*: where the learner's immediate emotional involvement leads to enjoyable anticipation of a journey of intensified curiosity and wonder.

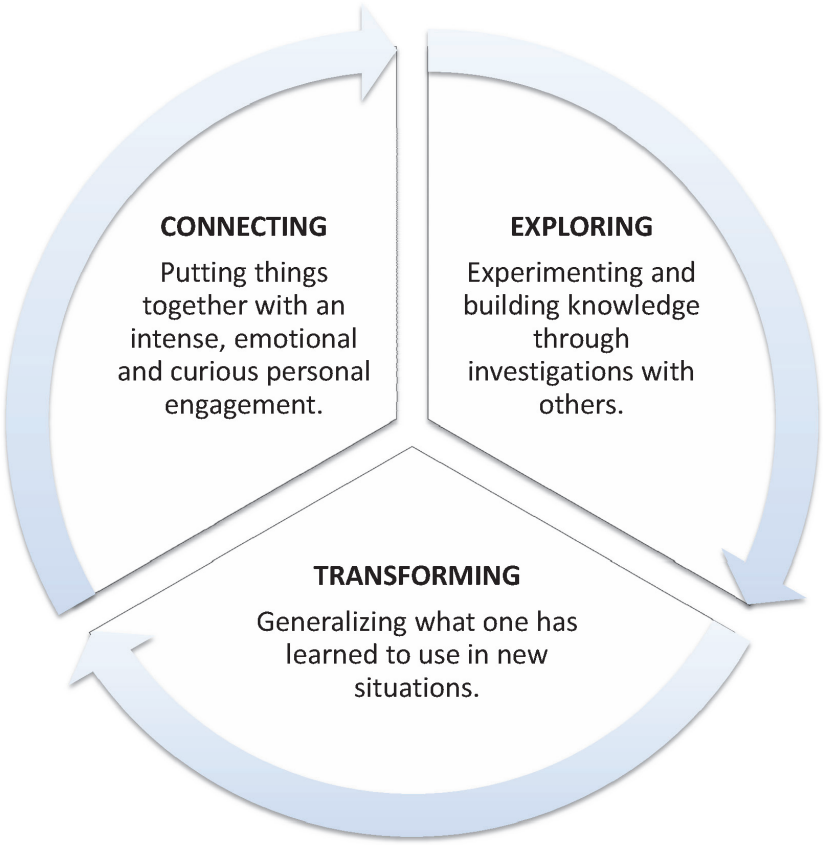
2) The stage of *Precision*: where the journey becomes more serious and scholarly; experiments and investigations lead to focus on detail and accuracy.

3) The stage of *Generalization*: where the romance of knowledge is integrated with the understandings of precision, acting as a springboard for new ideas, inventions or philosophies.

Each stage requires the others; the excitement of the *romance* phase leads to the deeper engagement with the material which characterises the *precision* stage; and the two of these – the passion and the knowledge – combine to form the broader insight of the *generalization* stage, which then sets a path to new learning journeys.

In chapter 1 we described similar influences of the personal, behavioural and environmental factors in learning. Moreover, creativity has a profound relationship with learning. In the report Systematic Creativity (2008) we defined creativity as the act of coming up with ideas and things that are new, surprising and valuable. In the context of learning, creativity is particularly powerful in that the most profound kind of learning happens when we discover it ourselves through a creative process. Boden's three types of creativity: combination, exploration and transformation are thus critical components in learning. Harnessed appropriately, they will have a transformational impact on how learning will develop in the future.

This leads to the following three stages of learning based on the three types of creativity and Whitehead's 'Aims of Education':



A. Connecting

This is the journey of intensified, heightened curiosity and wonder, where personal interests and emotional engagement serve as the starting point for learning. It is fulfilled by combining personal skills and motivation, making connections between things and ideas, and posing questions to existing conditions.

B. Exploring

This involves the investigation of data and exploring the questions and phenomena found in the connecting stage. It includes experimentation, problem-solving, trying out new things and testing out ideas with a focus on detailed observations of cause and effect.

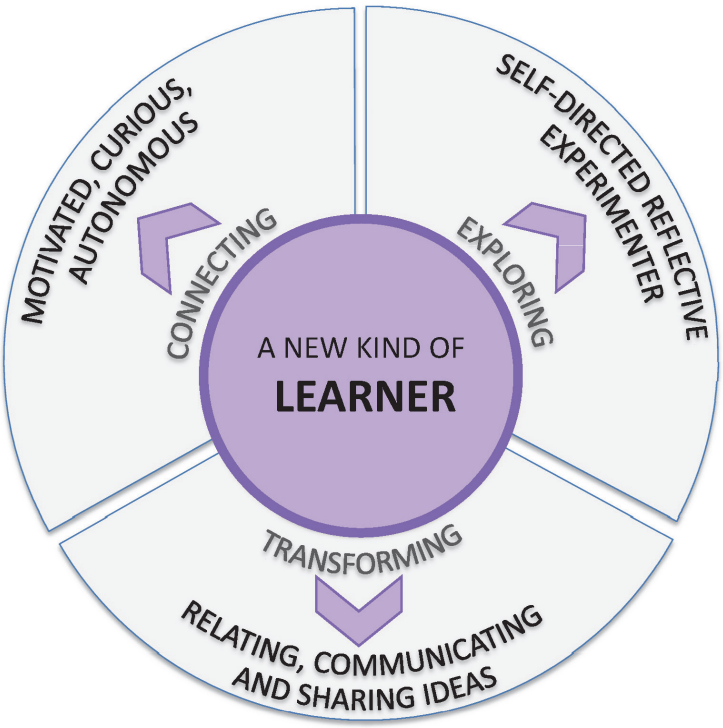
C. Transforming

This involves recognising opportunities where existing knowledge is relevant, and the creative process of applying it in a new situation. This happens by generalising what one has learned, adding perspectives from others and making use of a diverse network.

These three stages are used to frame the four elements of learning in the overall model.

1.2 The future of learning: Four areas of transformation

The transformation of the learner will be driven by three principal developments in individual engagement, each defined by a particular kind of creativity:



Creative influence: Connecting

Engagement style: Motivated, curious, autonomous learner

Becoming motivated and curious, real learning is about connecting to personal goals.

It is crucial to have the autonomy to engage with the world, take risks and maintain confidence even when unpredictable things happen.

Creative influence: Exploring

Engagement style: Self-directed, reflective, experimenter

The learner is engaged in a self-directed process of continuously experimenting, reflecting, reinterpreting and reorienting learning towards mastery. It involves exploring different sources and ideas, where the learner creatively drives their own development.

Creative influence: Transforming

Engagement style: Relating, communicating and sharing ideas

The learner should be able to relate their knowledge to others – learning, and helping others to learn, through communicating and sharing. Through supporting other learners and helping to cultivate understanding, knowledge can become more thoroughly worked-through, leading to new insights.

The transformation of learning will be driven by three principal developments in approaches to learning, each defined by a particular kind of creativity:

Creative influence: Connecting

Learning approach: Personal passionate learning

Learning experiences need to be personal and passionate through a self-managed process connecting experiences with personal interests. This involves observation of the impact of one's own actions, followed by self-reflection, thinking about experiences, and evaluation.

Creative influence: Exploring

Learning approach: Relevant, anywhere, networked learning

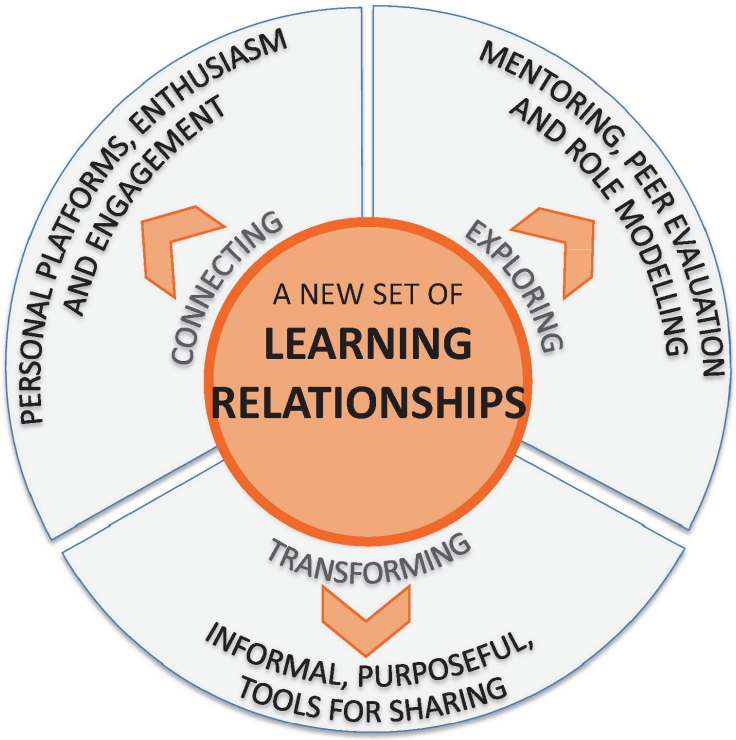
The new kind of learning involves making creative use of relevant learning resources to suit the situation at hand. Informal learning should be easy to access from any location, yet its success relies on continuous experimentation and effective, well-organised online networks and platforms appropriate for the relevant learning experience.

Creative influence: Transforming

Learning approach: Interacting with peers, mutual support and collaboration

The new kind of learning is increasingly a mutual exchange, and is most effective when it involves transformations through conversation and feedback with others. Interacting with peers, mutual support and collaboration are all natural parts of effective learning.

The transformation of learning relationships will be driven by three principal developments in the types of relationships, each defined by a particular kind of creativity:



Creative influence: Connecting

Nature of learning relationship: Personal platforms, enthusiasm and engagement

New relationships for learning are based on an enthusiasm for subjects of personal interest, and finding a community of learning that fits the learner's own levels of engagement. This involves self-expression, reaching beyond one's capacities, and a personal commitment to grow through inspiration from others.

Creative influence: Exploring

Nature of learning relationship: Mentoring, peer evaluation and role modelling

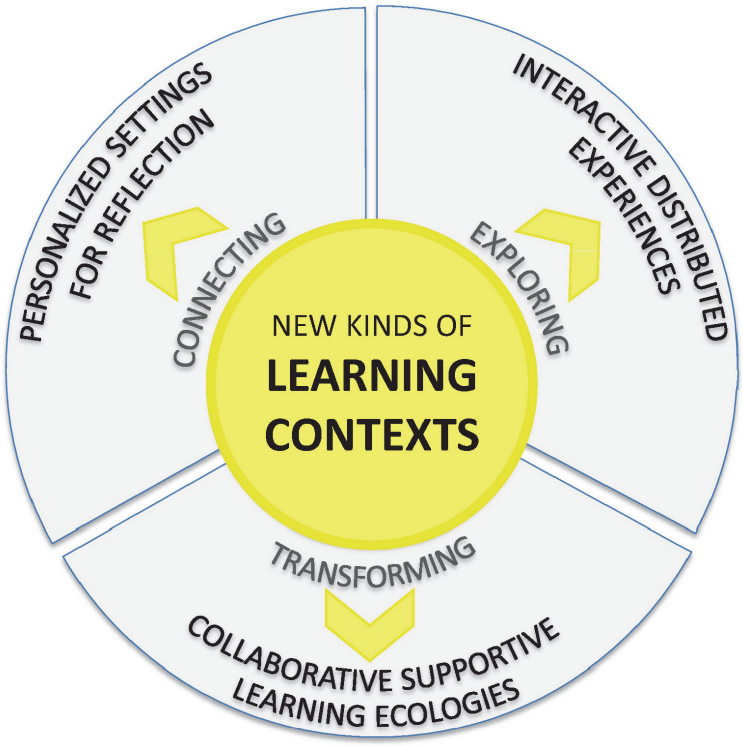
New learning relationships rely on interaction and support, mentoring, sharing with peers and knowing how to gain competence from others. Individuals explore most effectively when supported by other people, being inspired by role models, and having mentors to take learning further.

Creative influence: Transforming

Nature of learning relationship: Informal, purposeful, pop-up resources

New learning relationships involve open platforms and informal, portable learning resources, rather than predictable and fixed 'places of learning'. This is about finding the big questions to imbue learning relationships with a shared purpose, and making use of available resources and multiple senses in order to cultivate the most profound learning.

The transformation of learning contexts will be driven by three principal developments in the types of contexts, each defined by a particular kind of creativity:



Creative influence: Connecting

Quality of learning context: Personalized settings for reflection

Situating learning, whether physical, online, or both, is at its essence a matter of connecting to a personal setting for learning. New kinds of learning contexts offer an extension of the individual and are fit for the purpose at hand. Personal learning networks and tools need to remain supportive of the learner's own learning goals.

Creative influence: Exploring

Quality of learning context: Interactive, distributed experiences

New kinds of learning contexts are interactive and customized, and responsive to changes in locality and occasion. They offer relevant features and functions to support the task at hand. New technologies allow contexts to be distributed in time and space, to become part of current learning processes and individual requirements.

Creative influence: Transforming

Quality of learning context: Collaborative supportive learning ecologies

A learning context is part of a broader ecology of learning, and requires collaboration between domains, including physical and digital learning environments. Although the immediate environment of the learner is the most important, learning is transformed by layers of influence, which consistently build physical, mental and emotional well-being.

This brings us to the full model describing the relationships between the learner, the learning experience, relationships and contexts, within the context of the three creative stages.

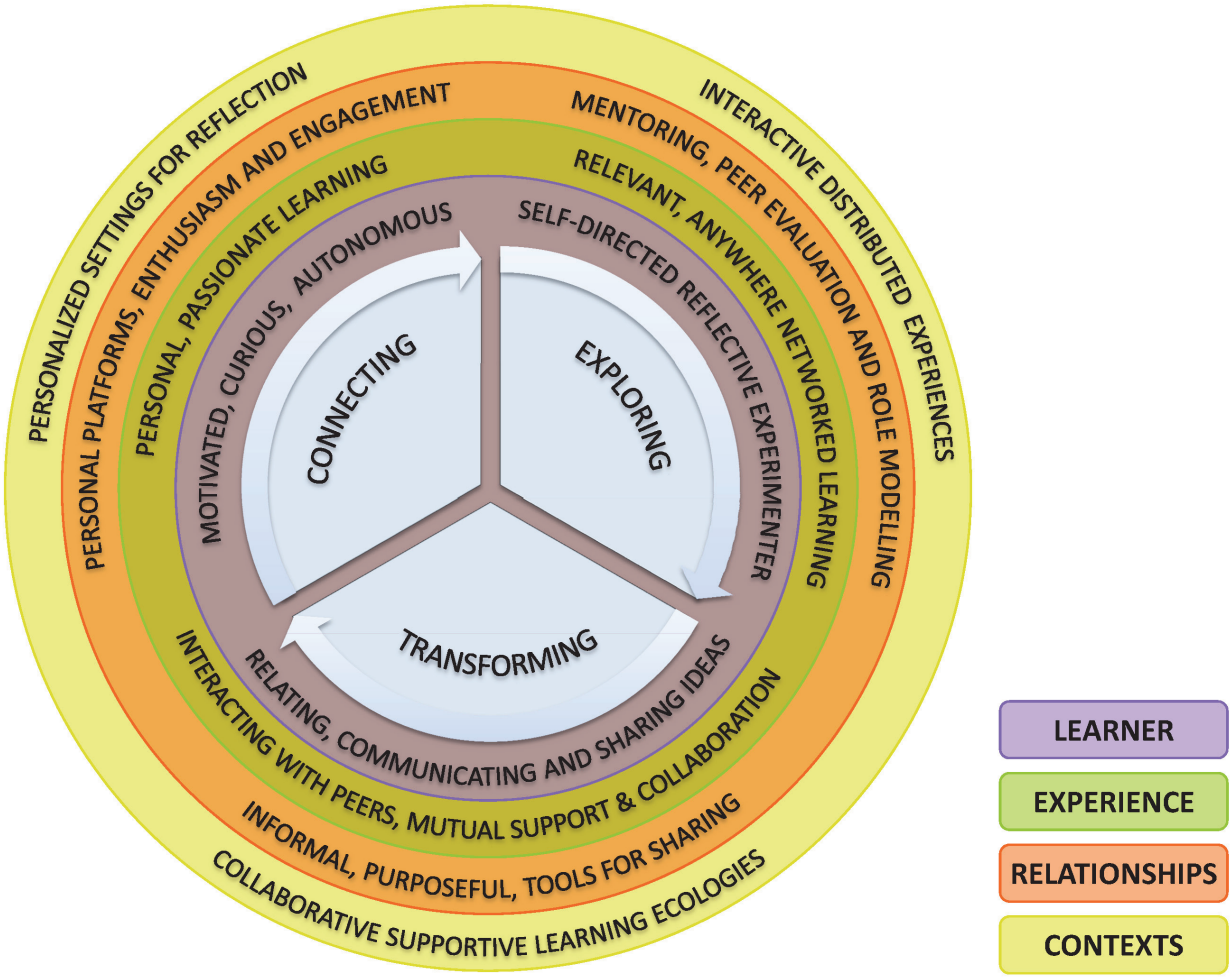


Figure 5.1: The full model for the Future of Learning

Each of the elements (learner, learning experience, relationships, contexts) drives a common set of principles grounded in a very personal, exploratory and practice-oriented interest in learning. The elements collectively form a model for the future of learning, including priorities or goals within each stage (connecting, exploring, transforming). The goals can be either open or closed, rather like the systems of science that channel creativity into problem-solving through very particular closed goals, or systems of art that channel creativity into playfulness and imagination through more open goals (Systematic Creativity, 2008).

The social systems and meta-cognitive abilities are some of the most important aspects of the model. The three stages of connecting to a learning journey that arouses emotional attachment, the exploration with experimental behavior, and the transformation and generalization of knowledge towards application can further develop the process of how to learn (meta-cognition). Furthermore, these stages enable individual learning goals to be achieved, reflected and supported by peers for improved integration in long-term memory and an easier adaptability to different tasks.

2. Expanding Experiential Learning

Experiential learning is clearly central to our model for the future of learning, as learning very much "involves the integrated functioning of the total organism – thinking, feeling, perceiving and behaving" (Kolb, 1984). Kolb's experiential learning process of *performance*, *adaptability* and *development* has a particular focus on the transformation of experience. In the Future of Learning model, the experiential learning process is integrated into the phase of 'exploring', but needs to be further incorporated into 'connecting', and 'transforming' types of learning, in order to connect learning to personal motivation, integrate learning into practice and enable a more effective use of collaborations.

Another central tenet of the Future of Learning model, Self-determination Theory, emphasises the needs fo*r competence, relatedness and autonomy*. While *competence* is an integral part of Kolb's experiential learning model, a*utonomy* is less obvious and captures the emotional and highly personal engagement at the starting point for any exploration phase. Similarly, although *relatedness* in the Kolb model is identified as a way to relate knowledge to external criteria through abstract conceptualization and active experimentation, it is less reliant on other institutions, environments or collaborations. Relatedness and autonomy are two needs central to the Future of Learning, in that these needs drive the development of connecting learning more to the individual and to transform the learning into a collective environment.

What this all means in practice will be explored further below.

2.1 The creative reflective learner

Autonomy and even emotional engagement in problem-solving, learning and creativity, springs from the central urge to be in charge of one's own life. Being *creative*, by undertaking activities one judges oneself to be capable of managing, is supportive of this need. Believing in what one is capable of doing and critically *reflecting* on this, has been proven to have a beneficial effect on individual thought-patterns and emotional reactions.

We have described how the needs for competence and autonomy are essential for intrinsic motivation through the support of systems, and furthermore how self-efficacy can be strengthened through the involvement of others, and through a mastery experience. However, it is of no surprise that many of the factors within adult life and education are driven by factors related to extrinsic motivation. Success is therefore a fine balance between the alignment of personal competence with intrinsic factors, and the internalization of extrinsic factors. This is captured in the stages of 'connecting' and 'transforming' learning in the above model. For this reason, extrinsic motivation can be described as a continuum from a purely external locus of control, to gradually becoming more internalised. The Organismic Integration Theory specifies the variations of motivation (Ryan & Deci, 2000: 61), on a six-point scale from 'amotivation' at one end – a lack of motivation or interest – through external pressures to conform, to 'identification', described as

'the acceptance of a behaviour as personally important and a valued learning activity', to full 'intrinsic motivation', which brings enjoyment and satisfaction.

While intrinsic motivation is the most conducive for learning to occur, the greater the internalisation of extrinsic motivations for learning, the less they hinder the learning process. Internalization happens most naturally and effectively through a sense of belonging or connectedness to a group, or a culture – through a sense of relatedness. This relates directly to the model for the future of learning: the personal interest in goals (connecting), a common engagement in subjects which support personal competence through shared experiences (exploration), and the relatedness of these goals and experiences towards a broader system of belonging in a culture (transformative), are both meaningful and mutually supportive.
The result of this development from intrinsic personally driven motivation, towards a reflective approach with exploration and experiments, and then becoming anchored in learning ecologies, is illustrated in the following diagram.

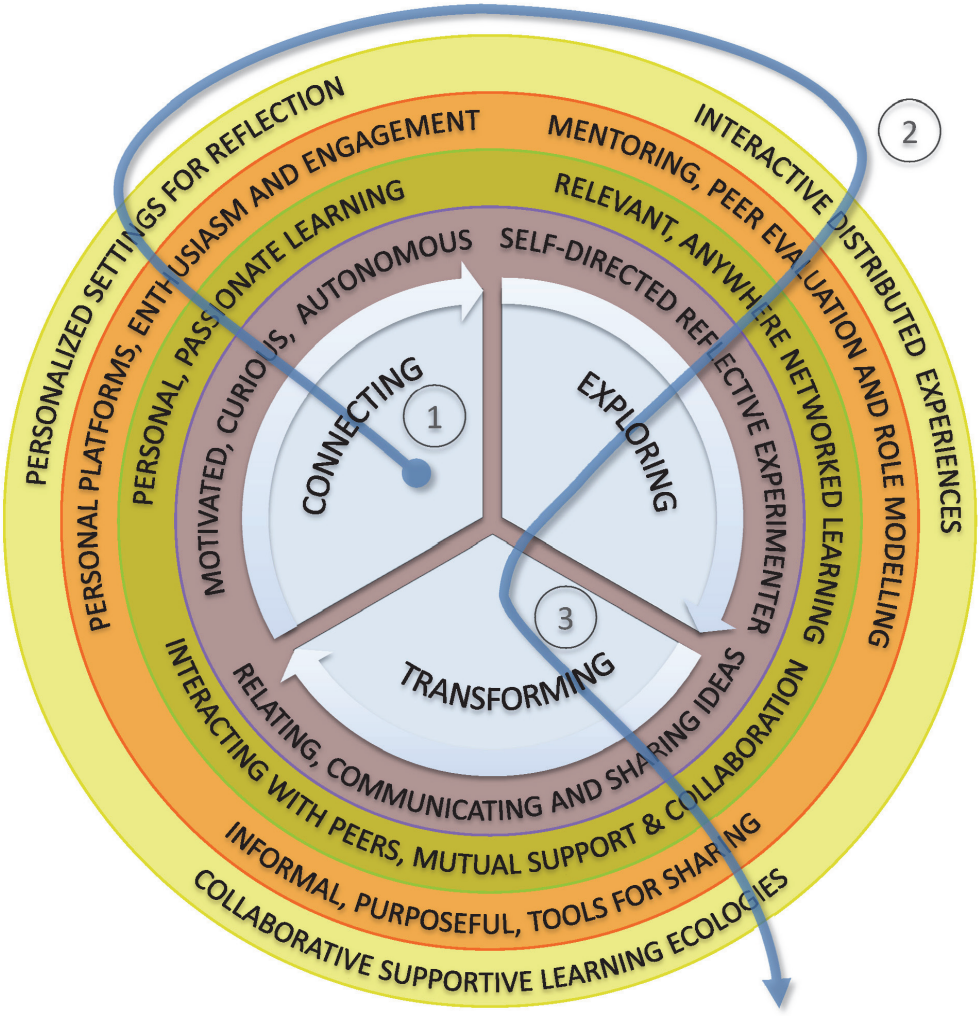


Figure 5.2: The reflective learner's journey, connecting individual interests, experimenting with strategies, and monitoring this in an external context.

1. Connecting the individual to the context

Effective learning is initiated by establishing a connection to the curiosity and interests of the motivated and curious learner. The goals of the individual are connected to a passionate learning experience, and an engagement through platforms, situated in a personal learning context.

2. Exploring the context to be situated in self-directed experiments

Personalized settings for learning provide an opportunity to dive into interactive distributed experiences, which are shaped through peer-to-peer relationships around subjects of common relevance, driving focused self-directed experiments.

3. Transforming the experiment to an external context

In the last phase of transformation, this knowledge is communicated and shared with others through collaborative tools. The relevance of this knowledge in new situations can lead to a change in behaviour in larger communities, which in turn can trigger an interest in new questions or new subjects.

This path describes the reflective learner, which weaves together the learner, the learning experience, the relationships and the context, by connecting, exploring and transforming knowledge.

Expanding learning based on intrinsic motivation is essential to the flow experience of aligning personal challenges with the activity at hand. It also triggers a 'thrill' – the reward mechanism – with the feeling of overcoming challenges and the ability to see this information relevant for other situations.

The point from meta-cognition is that the above process is not a linear process where each step is planned beforehand. We are deeply embedded in a social context of learning, and the extrinsic factors of motivation are personalized as part of an engagement with everyday situations. For instance, the understanding of the scope and detail of the required outcome of a task, requires a good understanding of expectations; and sometimes tasks radically change, because the relationships between tasks have become more dynamic. For this reason, it is essential to use meta-cognitive activities and learning to reflect on our capabilities. We plan activities, evaluate and change strategies as part of monitoring our progress, as well as repeat this to check accuracy of the strategy. The reflective learner applies individual knowledge, evaluates their experiences, and uses mental strategies to control the feedback as a basis for the next activity.

The availability of digital media enhances the ability to align personal goals and interests with a broader context and other people. However, it also increases the frequency of feedback, and requires additional focus to maintain attention to the specific purpose of the experiment, to monitor and control strategies.

Digital literacy takes into account the growing ability to understand, evaluate and integrate digital information (Gilster 1997). Here the traditional written and spoken language of education is now combined with multimodal forms of representation – imagery, sound, video, and speech, as well as writing – which through Web 2.0 are combined and reproduced. This is a challenge for pedagogy because the culture around multi-

literacies is often more familiar to school students than their teachers. For this reason, a model of pedagogy dealing with environments rich of different media needs to focus on (Jewitt 2008):

1. Situated practices, based on learners' experiences in their life world.
2. Overt instruction, to understand a vocabulary for the structure of meaning and systematic decisions involved in the design process.
3. Critical framing, connecting meaning to social context and interpretation of the cultural context.
4. Transformed practice, with ways to recreate and reconceptualize meaning across contexts.

This emphasizes the importance for a reflective learner to (a) connect to the personal factors of motivation as a starting point for learning, (b) explore these personal factors within situated contexts through creative explorations and collaborations, (c) to evaluate and control their own capabilities within an external context, and (d) critically reflect and make use of multi-literacies in this process.

The important role of creativity in learning and meta-cognitive regulation and reflection, describes an active reflective learner. Freire (1974) described this as apprehending data upon reality, and believed that reflection was the most critical component of education, resulting in 'critical consciousness', in which learners become actors, not observers, and authors of their own decisions. The background of this clearly comes from constructionism, where action is fundamental because it changes reality, but at the same time it addresses the importance of critically validating information, which Freire described as a 'praxis':

> It is not enough for people to come together in dialogue in order to gain knowledge of their social reality. They must act together upon their environment in order to critically reflect upon their reality and so transform it through further action and critical reflection. (Freire Institute, 2011)

2.2 Transforming learning with practice

In this section we describe an expansion of experiential learning, within the stage of transformation. Learning is something we do all the time, and increasingly we are forced to understand the broader relevance of what we learn, and how we learn. Modes of learning have changed dramatically over the past decades, but schools and teaching have mostly changed around the edges (Davidson & Goldberg 2009, p. 8). Significantly, Jenkins points out that:

> Young people have a richer intellectual creative life outside of school than inside. Things they learned from, things they cared about, were the things they did after the school day was over (Jenkins, 2011).

The importance of integrating practice and informal learning is that it is happening both through physical activities and digital platforms. The Quest to Learn initiative in New York leverages the digital life of kids outside of school, and makes them able to dive into complex problem-solving through a game-based

methodology, which clearly illustrates how new practices and technologies can integrate with traditional institutions (Salen, 2011). This is an example of how motivated learners begin to share new contexts for learning, engage in experiments, sharing experiences and over time develop a community of practice, which can drive change in the larger more formalized cultures of learning.

With the emergence of informal learning environments, there is a greater recognition of the values of learning occurring in these communities, and the competences of self-efficacy and enthusiasm which can be achieved through participatory learning. These new relationships can be illustrated through the following diagram. The changes that are happening through informal learning and participatory culture by sharing ideas, interacting with peers, developing new tools (like games and digital platforms) are shaping a learning ecology, where everyone acts in a committed and reflective way. Learning is becoming the experience of developing things together with others, sharing meaning, and being fascinated with the process of inquiry. When people stop sharing things, a learning ecology dies, as no new subjects are raised and the knowledge becomes an archive. When this paradigm is accepted, it guides a learning more focused on process and the development of individual competences.

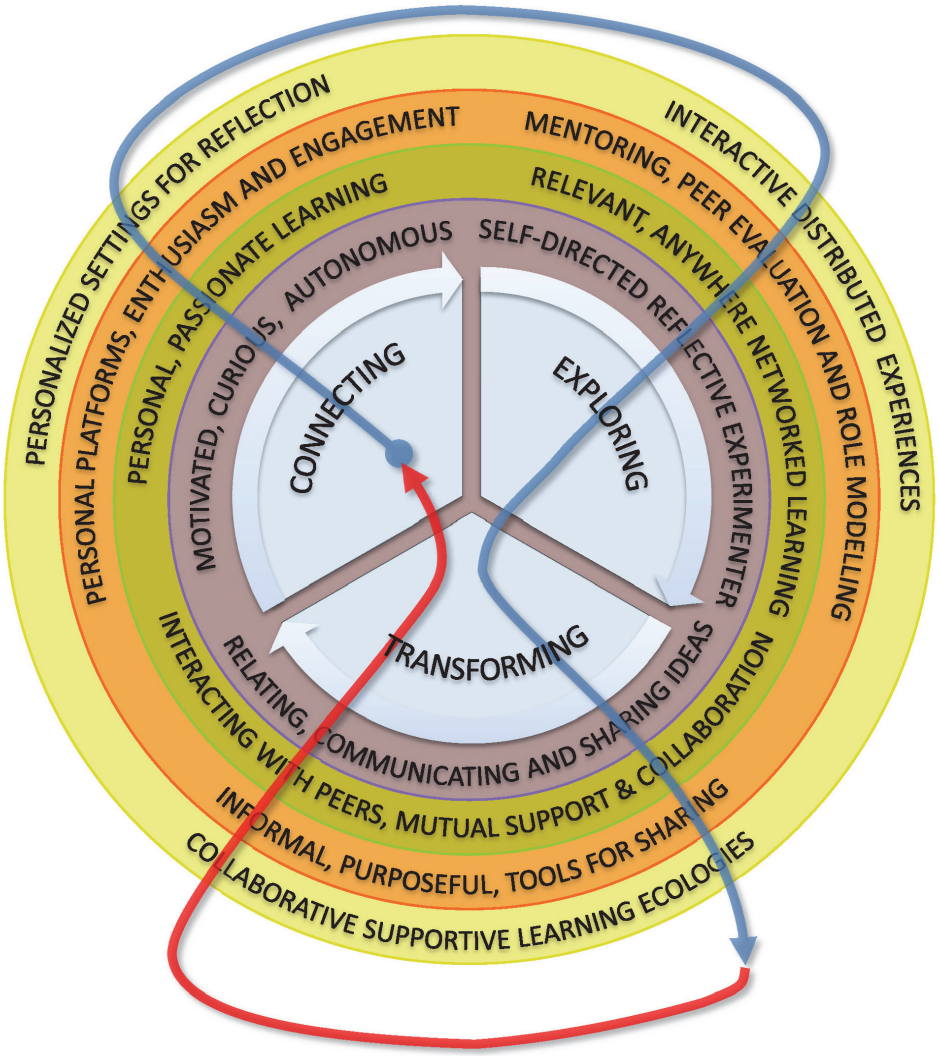


Figure 5.3: Relating the knowledge applied in new situations back to the individual.

Treadwell (2008) calls this the second paradigm shift in learning. The first being the shift from oral language to written language, and the second being the shift from written language to multimedia and collaborative tools through the internet. The focus is on the requirement of students to build conceptual understandings and to apply these in different contexts, rather than knowing about any particular field (Treadwell 2010).

The focus on practice and the shift towards collaboration and new technologies doesn't necessarily result in an unschooling movement where 'living is learning' (Holt 1977), but it changes the role of educational institutions and introduces more integrated relationships between learning at home, in school, and at events.

New technology platforms with online educational videos, like the Khan Academy, potentially invert the model of traditional education in the sense that curriculum is presented through videos to be watched at home. Then the purpose of school is to do your 'homework' by discussing and applying knowledge together with teachers and peers. Although, the idea of watching videos at home may seem to be a rather passive part of this model of learning, we can expect that high quality materials will become available for individual home study, aimed at triggering interest and the understanding of basic concepts. The learning happening in school is instead focused on applying knowledge, active experimentation and reflection through support by feedback and scaffolding. Technologies are not used to limit personal engagement but instead to focus the resources on an active and reflective practice through collaboration.

This emphasizes the role of 'communities of practice' as learning environments using digital technologies (Systematic Creativity in the Digital Realm 2009). As the arrow in the above diagram shows, there exists an opportunity to connect the creations of the self-directed experimenter with the collaborative learning ecology, through digital tools for sharing. This arises because human adaptation appears to be happening faster, and only learning which is performed and used is relevant.

In *The New Culture of Learning*, Brown & Thomas (2011), have demonstrated how a culture of play, expressed explicitly through gaming, can define a new learning space. The game environment in multiplayer games such as *World of Warcraft* provides a shared space, where each individual member needs to collaborate in teams and learn new skills to be successful in the next mission. It is a highly playful and social experience with friendship and community based on interest and affinity, and individual competence is constantly measured based on achievement in the game. Learning could benefit from the systems thinking embedded in games, and even provide motivation for the bigger questions to change the world (McGonigal 2011), but they often lack attachment to a reflective practice, and alignment with the personal learning networks and tools within education.

3. Creativity and learning

The above model for the Future of Learning emphasizes the three elements of creativity – connecting, exploring, and transforming – driving the processes of individual interest, active experimentation, and the transformation of knowledge into new situations. As described in Systematic Creativity in the Digital Realm (2009), creativity is essential to learning, especially because the interconnections, creative abilities and the interactivity of the Internet offer learners an initiation into a web-based 'participatory culture' (Jenkins 2010). In a participatory culture, students are no longer recipients of generalized knowledge, but rather producers of knowledge meaningful for the individual. This encourages connections to other learners, to share and build capacity for content creation and remixing (Greenhow et. al 2009).

This relationship essentially depends on two important factors to support creativity and learning. The first factor is the need for feedback from peers and collaborators to move from one stage of learning to the next. The second factor is that interacting with other people is also is an exercise in leadership.

3.1 Learning through feedback

We have seen that learning is not an isolated act of the individual, but is highly social and interactive, involving peers, digital media, objects, and contexts. In a participatory culture, learners are required to share their learnings, and to reflect upon this in a creative way. In this section we show that the individual processes of creativity and learning benefit from the feedback in a collaborative and supportive environment.

In the early Bauhaus movement, Moholy-Nagy emphasized creativity as the single most important competence of the students, in order to:

a) find new aspects of a problem
b) develop new solutions to this problem
c) gain support for these solutions

The first two elements are related to competence and autonomy, as well as the factors of self-directed learning, experimentation and evaluation. However, less attention has been given to the importance of gaining support for creative solutions. This is relevant not only for the creative artist, who is going to communicate a piece of personal art, but is part of the reflective process, which is essential for learning.

Sternberg & Lubart (1995) have described creativity as 'the ability to buy low and sell high'. Usually there is a challenge in making creative ideas more publicly available, but from an investment point of view, the creative person buys low by presenting a unique idea, and then convinces others about the value of the idea, to increase the perceived value of the 'investment'. Novelty is usually met with suspicion and insecurity, because creative ideas challenge the current reality (Mueller et.al., 2011). As Boden (1990) has noted, creativity relies heavily on the influence of the crowd to realize new ideas.

To close the loop of learning, the 'transforming' stage should involve not just the application of knowledge in a new situation, but also the connection of that knowledge back to other learners. Then the loop can flow between the phases of connecting, exploring and transforming, and involve others in the process, as shown below.

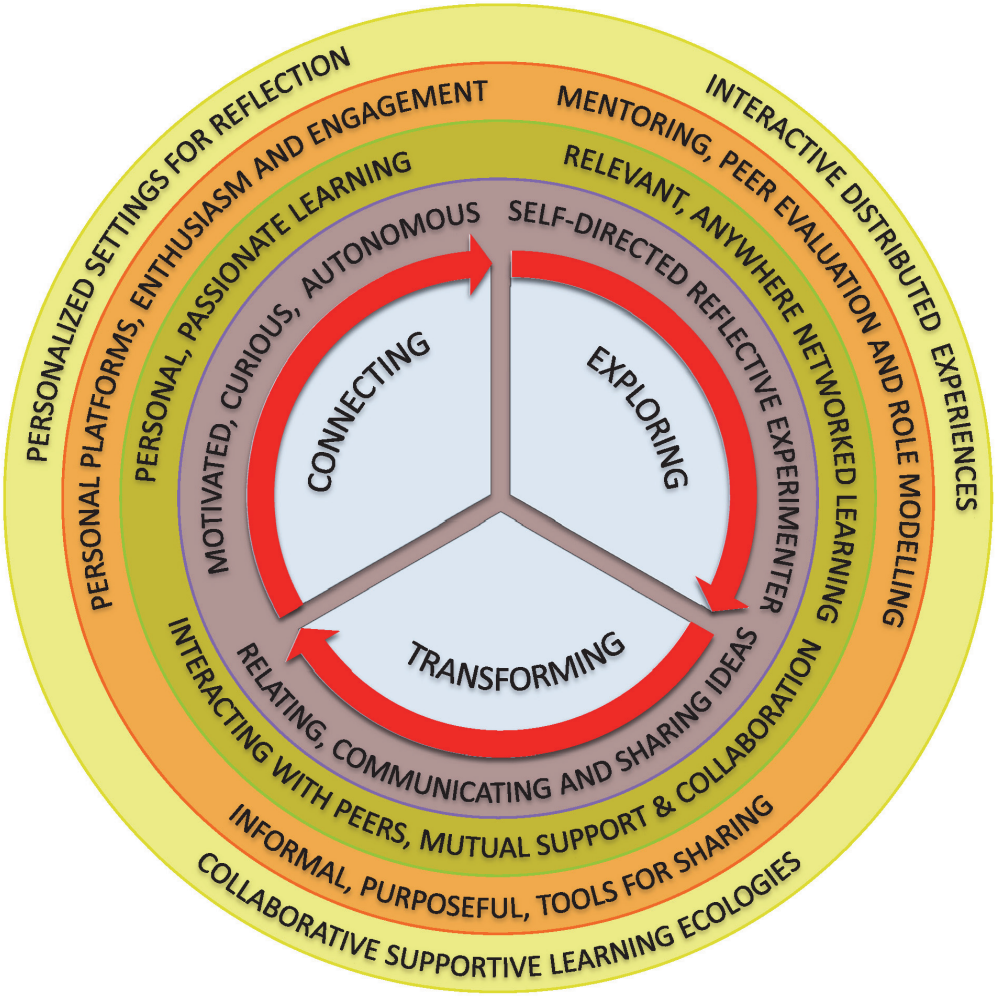


Figure 5.4: The learning loop supported by feedback from peers.

If this 'learning loop' is not maintained, it is difficult to transform a really well developed idea from one specialized community to someone outside of the community. Therefore, other people need to be brought along throughout the creative process. As we have seen, creative learning is concerned with the process of working together on common subjects with the same tools. Similarly, co-creation involves a process where people learn from each other and are involved in the joint creation of value.

The ability to achieve creative mastery depends on the ability to master tools, which other people can understand and therefore value. However, this is not simply an exercise in communication, as one has to respect and take care of one's peers to enable mutual support. These relationships are essential for meta-cognitive discussions and reflections, which drive development and the individual capacity to learn. As we

have discussed in relation to social relationships, feedback is the most important element of learning, because it is information provided by an agent (such as a teacher, peer, or parent) regarding one's performance (Hattie & Timperly, 2007). Feedback needs to be related to the specific task, is influenced by objects, tools and media, and can be supported by online communities.

Feedback reduces the discrepancy between current and desired understanding, and according to Hattie & Timperly (2007) this consists of four levels:

- First, feedback may include directions to the learner to acquire more, different or correct information for a given task or a product.
- Second, feedback can be aimed at the *process* used to create a task or the product, such as a suggestion of a different strategy to complete a task.
- Third, feedback can be focused on the level of self-regulation, to enhance self-evaluation or confidence in a required task.
- Fourth, feedback can be related to the self, which may not be directly related to the task, such as praise for a particular talent.

The understanding of feedback as part of social learning in pedagogy has been referred to as 'dialogic teaching', in which the emphasis is on generating genuine discussion and argumentation, rather than the transmission of knowledge (Mercer & Littlejohn, 2007).

The value of requiring children to work in collaborative groups for learning has been extensively investigated and demonstrated, for instance through the pedagogical strategies, which encourage children to reflect upon and talk about their learning.

Fundamental to this appears to be (a) the requirement that it places on children to articulate their ideas, and justify their reasoning; and (b) the ability of learners engaged in an enterprise together to understand one another's difficulties, and help in appropriate and effective ways (Howe, 2010). Indeed, Tomasello (2009) has argued that any successful educational approach will be enormously enhanced if it harnesses humans natural ability to learn by cooperating in groups.

3.2 Creative Leadership

The other aspect of creativity and learning is focused on the role of creative leadership. In the introduction to this report, we mentioned Kolb's three processes of learning – performance, adaptation and development. Adaptation is the most important form of learning because it focuses on the longer-term mastery of situations. This requires the ability to determine the most appropriate strategy. Here, the social process of learning is central, and needs to involve meta-cognitive skills, input from the environment, and discussions with others or more experienced peers.

At the same time, current trends point towards a change in what were traditionally conceived as the most important competences for the future. A report by The Partnership for 21st Century Skills (2011) emphasized critical thinking, communication, collaboration and creativity as some of the most important focus points for 21st Century learning. This was supported by the IBM Global CEO Study (2010), carried out among 1,541 business executives worldwide, which indicated that coping with complexity was the number one challenge. The study emphasised the importance of:

1. Embodying creative leadership
2. Reinventing customer relationships
3. Building operating dexterity.

As Ken Robinson (2006) has powerfully suggested, schools should be equipping children and adults with the competences that will be essential for a future career. Pushing creativity to the centre of the curriculum would emphasize the individual competence to surprise oneself, experiment with the world, and share this to bring out collective value.

In Project Oxygen, Google investigated what would make a perfect manager. They had previously believed that deeper technical expertise would be the most important skill to lead a successful team – but it turned out to be the least important factor. Instead these were the rules which they identified to create better managers (Bryant, 2011):

1. Be a good coach
2. Empower your team and don't micromanage
3. Express interest in your team members' success and personal well-being
4. Be productive and results-oriented
5. Be a good communicator and listen to your team
6. Help your employees with career development
7. Have a clear vision and a strategy for the team
8. Have key technical skills so you can help advise the team

At the A. B. Combs elementary school, principal Muriel Summers asked parents and business leaders what expectations they had for their school, and she received answers similar to the above list, with an emphasis on leadership, self-direction, responsibility, communication, creativity and teamwork (Summers 2010). The school applied the principles from Stephen Covey's *The Leader in Me* (2008), based on his famous *7 Habits of Highly Effective People* (1989), to make students learn how to develop their full potential, and take responsibility for their own learning, resulting in significantly improved academic results.

Essentially, this puts 'leadership' at the centre of the three stages of learning, so that the learner's mindset is focused on adjusting behavior, selecting and executing the most optimal strategy for a certain goal. Ellen

Langer has described this role of 'paying attention' to life itself as being mindful: thinking about what we are doing, and how we are reacting, in the moment you are doing something (Langer 1989). The concept has led to mindful learning, or sideways learning, which describes the psychological state of mind to guide behavior when being in engaged in learning:

1. Openness to novelty
2. Alertness to distinction
3. Sensitivity to different contexts
4. Implicit, if not explicit, awareness of multiple perspectives
5. Orientation in the present
   (Langer, 1997: 23)

The qualities of a playful mindset was also explored in greater detail in the Future of Play (2010: 33). Creative leadership involves a focus on circumstances at the moment we are doing it, and being sure not to undervalue our own responses.

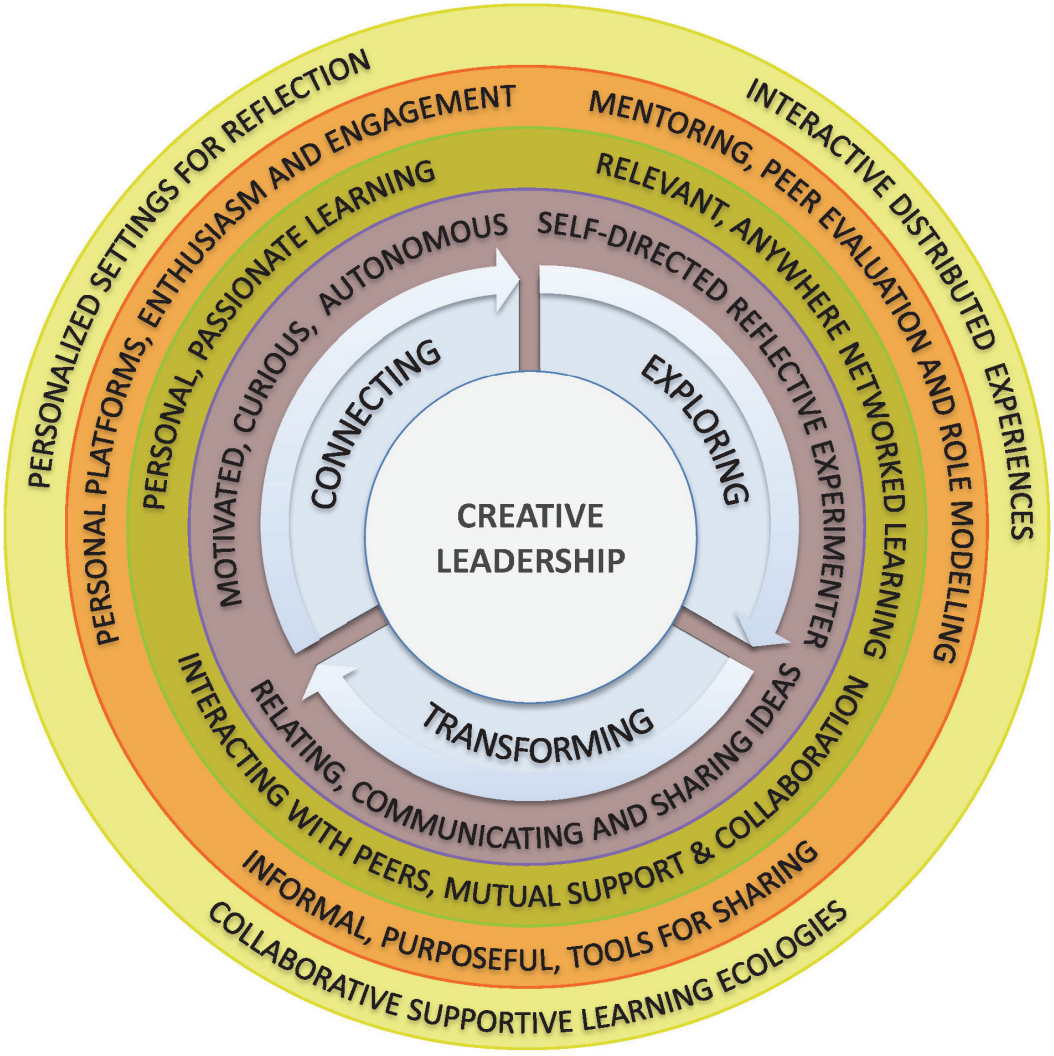


Figure 5.5: Leadership at the centre of the model for the Future of Learning.

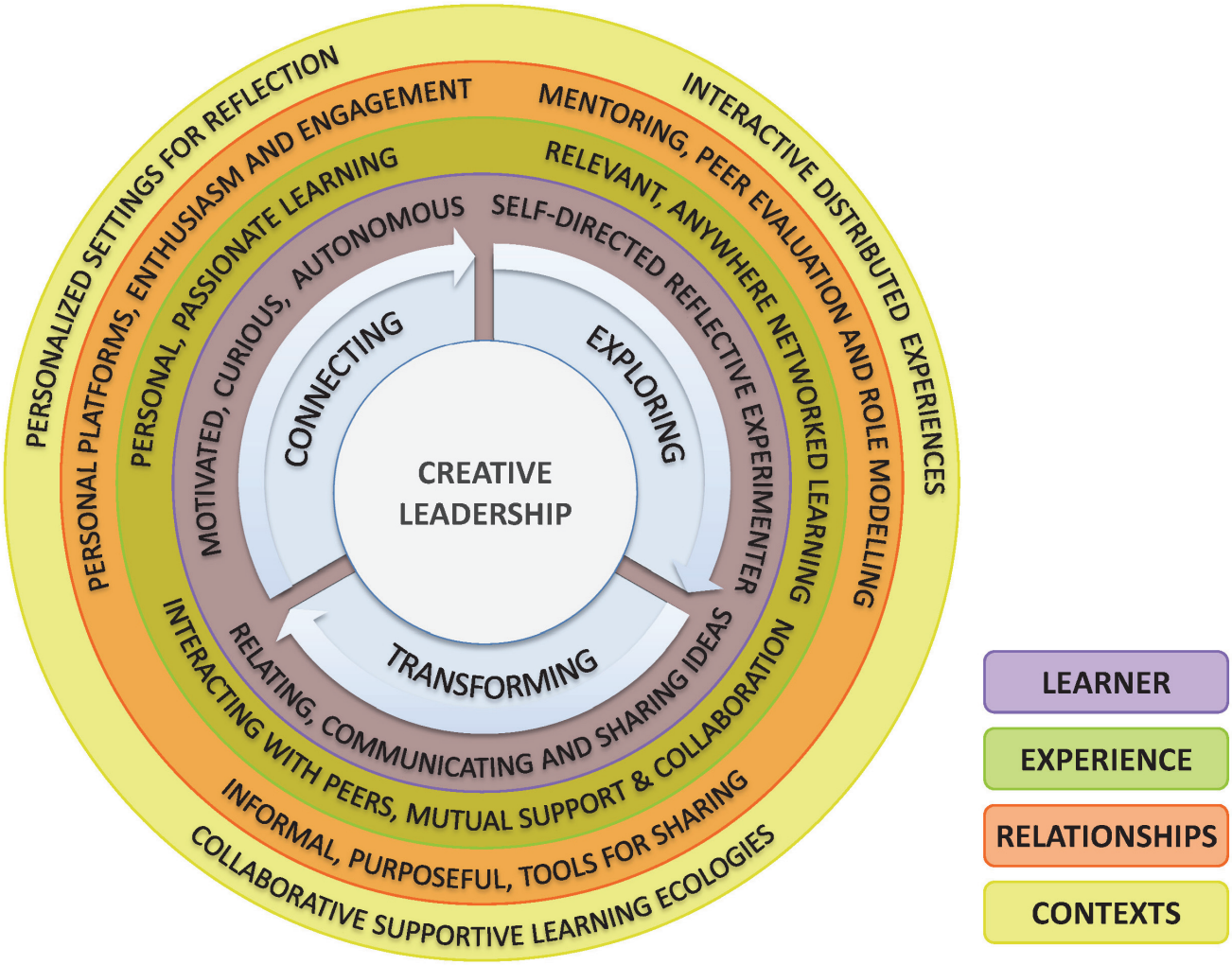
These leadership competences enable us to plan and monitor ourselves during tasks. Meta-cognition is used to develop this ability to devise a strategy, and evaluate options among different scenarios. This means that self-regulation will not only improve study skills, but also helps to make more accurate judgements about learning, and decisions on personal learning goals.

Playful experiences provide the ideal environment for developing these self-regulatory abilities, including the ability to perform different roles and adapt performance to the task in hand (Sokol et. al. 2010). In *Pedagogy of Freedom*, Freire (1998) describes a particular kind of curiosity that he calls 'epistemological curiosity'. In opposition to 'spontaneous curiosity', this epistemological curiosity is driven by the desire to understand the world, enlightening oneself and critically reflecting on a personal view of the world, in order to avoid knowledge being the same for everyone.

> There could be no creativity without the curiosity that moves us and sets us patiently impatient before a world that we did not make, to add to it something of our own making (Freire, 1998: 83).

4. Becoming a creative reflective learner

This chapter described a process in which the creative reflective learner works proactively to set personal goals, experiment with solutions, and implement these into new situations.



As we have seen, these three stages are the core of working creatively with learning:

- *Connecting* – being able to connect a question or problem with your personal interests, existing knowledge, and the situation you are in.
- *Exploring* – being able to use personal competences to experiment with alternative solutions.
- *Transforming* – being able to apply your knowledge in new situations, and share this for original purposes.

Each of these three stages – connecting, exploring and transforming – have a system of four layers, relating to:

- *the learner* – your individual competences and abilities
- *the learning experience* – how to use your competences
- *the relationships* – how to relate knowledge to other people, objects and networks
- *the context* – how to organize places and situations to support your learning process

The process of learning happens through each stage of creativity, engaging the four elements in the system.

It then follows that there are four dimensions of connecting:

- Connecting the learner – how you are motivated and achieve autonomy
- Connecting the learning experience – how you learn most effectively
- Connecting the relationships – how you share and express your knowledge
- Connecting the context – the places and situations where you learn best

And four dimensions of exploring:

- Exploring the context – how you can organize your learning environment to support your process
- Exploring the relationships – how / who / when you seek the support of other people and resources to ensure that you perform at your best
- Exploring the learning experience – how you evaluate your results
- Exploring the learner – how you challenge yourself to grow skills and optimize performance

This leads to four kinds of transformation:

- Transforming the learner – consolidating your knowledge and your personal ability to share and communicate it
- Transforming the learning experience – deciding on the knowledge you want to understand and communicate
- Transforming the relationships – selecting the tools you want to use to share your knowledge
- Transforming the context – determining how the knowledge could be used for other situations, and in which communities it would it be relevant

Feedback from peers leads to an understanding of your own knowledge and skills, and how these can be optimized throughout the process. With creative leadership you are able to align your personal strategy with your current performance, and adapt appropriately to keep thriving.

Chapter 6:
From Play Well to Learn Well

Chapter 6

From Play Well to Learn Well: The LEGO® System in the Future of Learning

LEGO products have their foundation in the ideal that children and adults should 'play well' – the Danish phrase 'leg godt' giving LEGO its name – and are already popular tools for learning. If we extend this to the ideal of 'learn well', what does this mean in the 21st century?

1. The LEGO System and Learning

In Defining Systematic Creativity (2008), we offered a 10-point account of the value of the LEGO System, which begins with the system of interconnecting physical parts, and goes on to describe the less tangible LEGO values and ethos. Here it is presented with added notes which show how 'play well' becomes 'learn well':

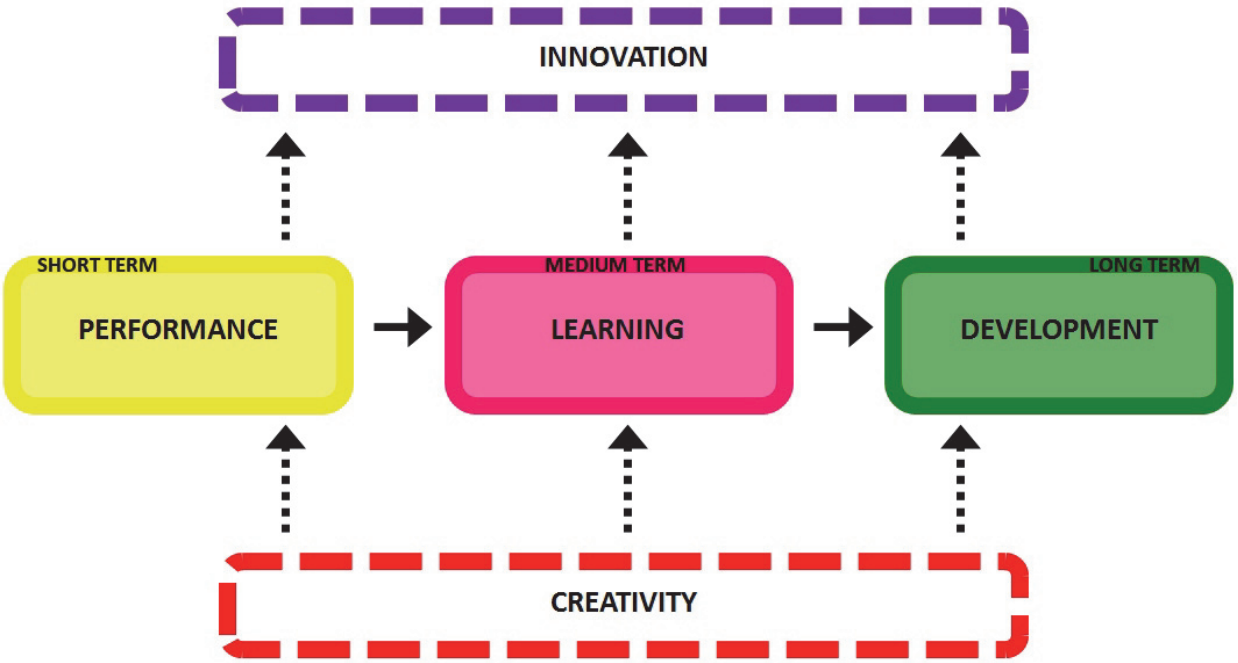
	The LEGO System	The LEGO System and learning
1.	The LEGO System is an interconnecting set of parts. Connections come easily and sometimes in unexpected ways.	We learn by putting materials, knowledge, and ideas together. Serendipitous connections can be surprising and illuminating.
2.	The LEGO System has a low entry level for skills, so that anyone can pick up LEGO bricks and make something satisfactory and meaningful.	We engage in learning when we can straightforwardly pick up tools, join a conversation, and then become engaged in the process and develop our thinking and abilities to a new level.

3.	The LEGO® System is a medium for mastery – a developed level of expertise is also rewarded as the system can be used to create both very simple and very complex constructions.	Our self-efficacy beliefs are substantially boosted by mastery experiences, where we can see what we have achieved and attribute that success to our own abilities.
4.	The LEGO System offers the ability to create something where previously there was nothing – coupled with the lack of need for preparation and planning: as they say in LEGO Serious Play, 'If you start building, it will come'.	Creating and making new things is a powerful form of learning.
5.	The LEGO System is an open system with infinite possibilities. It can grow in all directions and the parts can be combined in limitless ways.	Learners should be supported to develop in any direction that interests them.
6.	The LEGO System embodies a belief in the potential of children and adults and their natural imagination – that anyone can make and express whatever they want to, through the system.	Supportive peers, and supportive tools, enable learners to flourish.
7.	The LEGO System is founded on a belief in the value of creative play, and a respect for play as a powerful vehicle for learning and exploration.	We learn best through creativity and play, which are active and powerful modes of learning.
8.	The LEGO System offers a supportive environment in which different ideas can be tried out and experimented with, with no negative consequences. On the contrary, it is common that one good idea leads to another.	We learn best when active experimentation is encouraged. The learner should know that they can make mistakes, and that these are opportunities for learning, rather than negative events.
9.	The LEGO System grows with the person, from the youngest child to the grown-up adult user.	Learning happens throughout life, from the earliest days of a baby's existence and through all of our life stages. Having tools which we can take with us supports continued development.
10.	The LEGO System also grows beyond the person: at all levels of engagement with LEGO, from Duplo to the world of the AFOL, the LEGO System is a social tool, fostering connection and collaboration.	Learning is a social process. Learning flourishes when a network of peers and supporters offer shared resources, scaffolding and inspiration to their fellow learners, and collaborative projects enable learners to work and learn together.

Most importantly, the LEGO® System is an easy-to-pick-up tool, which can be used for many and diverse purposes. People already use the word 'LEGO' as a metaphor when thinking about a modular form of learning, which can be put together in different ways. This can be advantageous – but the LEGO system is not just about having blocks, which can be put together in different configurations. The LEGO system can be much more – about building meanings together, in a social process; about serendipity and surprising innovations when different elements come together; and about sharing creative ideas through play.

2. Creativity feeds learning, leads to innovation

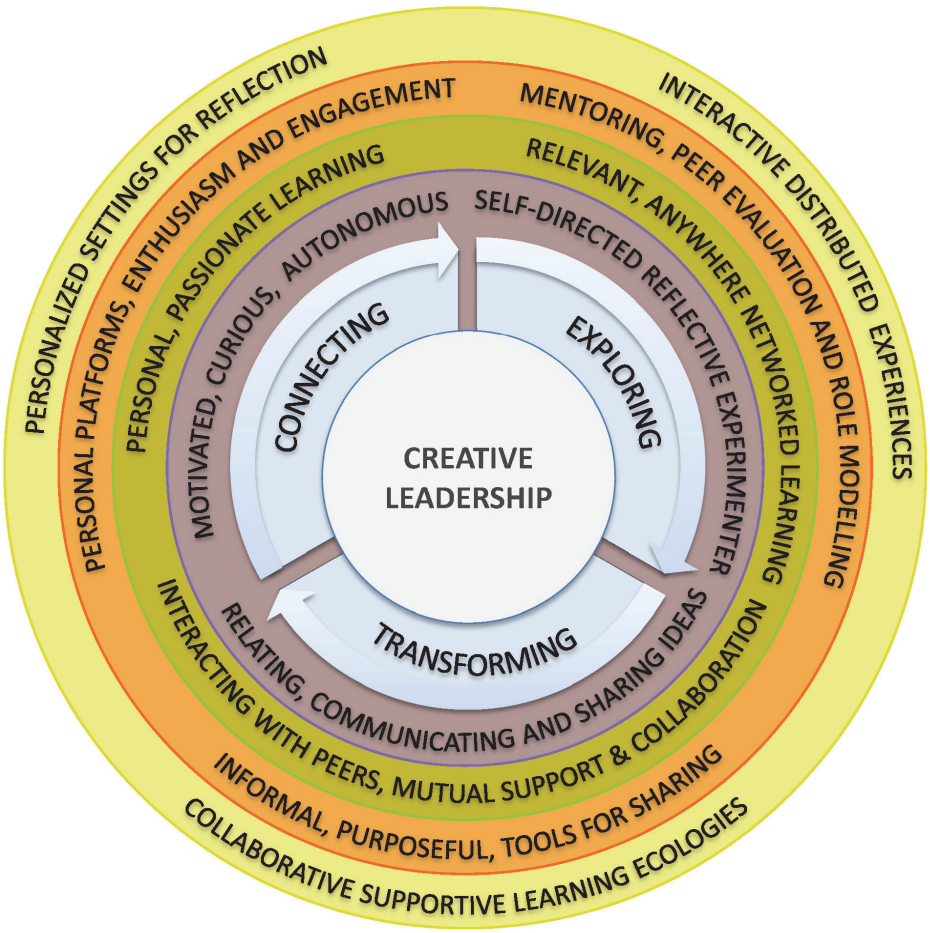
At the start of chapter one, we saw a quotation from David Kolb (2006), which showed how learning develops across time. At first there is a response to a situation, or event, which is not so much learning, but more performance. A more embedded development of our knowledge, or understanding, we call learning. Our growth over a lifetime is thought of as development. For Kolb, however, these are all dimensions of experiential learning. In the diagram below, we show how creativity feeds into all stages of the learning process, enriching how we think about, and make use of new experiences and learnings. We also see that these uses, generated through the application of creativity to our different kinds of learning (from short-term responses through to long-term development), can lead to innovation – that is, applications of creativity which lead to solutions that will be of value to others. In particular, the learning journey from short-term performance to long-term development is a process through which – ideally, at least – creativity becomes embedded and flourishes, which means, that the learner builds the ability to not only come up with new ideas, but to communicate them in meaningful ways. This is what really opens the door to significant innovation – when the learner is able to translate ideas into practice, and apply their imagination to real problems. Then they are able to make a difference not only in their own life, but in that of others.



The LEGO® system supports all areas of this model: it encourages, and gives form to, imaginative play and experimentation, so that creativity can develop. It facilitates expression of ideas, making the early 'performance' stage of learning more fluid. This later becomes more embedded in learning and personal development. Again, each of these can be supported by play and experimentation with LEGO materials, as the LEGO system supports both simple and complex constructions – from little square houses to complicated machines. Furthermore, any of the stages of learning can lead to innovation – that is, new ways of doing things that are valuable and can be adopted by others. The LEGO System supports the generation of creative ideas and enables them to be expressed in a solid, visible and tangible way which can be shared with others, either in person or online.

3. The LEGO® System and the Future of Learning Model

In the previous chapter we proposed this model, which highlights the elements that will be central to the future development of learning. At its centre is creative leadership, which begins within the individual through the use of meta-cognition and self-regulation – learning to learn effectively. Play is a crucial part of this process, enabling reflection and building confidence in imagination and exploration.



Around creative leadership there is a cycle of connecting, exploring and transforming, which mirrors – albeit with some different divisions – the four C's of LEGO® play (Connect > Construct > Contemplate > Continue). The 'connecting' activity on the new model is like Connect and Construct. The 'exploring' activity is Construct and Contemplate – putting things together and reflecting on them creatively. And the 'transforming' activity is Contemplate and Continue – thinking and turning creations or ideas into something new. The four C's are underpinned by a fifth C – Collaboration, which yields value and richness to each step through engaging others.

The four concentric circles refer to changes in the learner, learning experience, relationships, and contexts. The implications for the learner are a greater emphasis on self-organised and self-driven learning, based in following personal passions. Such learners need to be more confident at exploring and experimenting (helping to build their self-efficacy beliefs, discussed earlier in this report). The LEGO System is based around the idea of making and re-making, tinkering, and seeing what works, learning from things that go well, and learning also from 'mistakes'. Like this model of creative reflective learners, it emphasises making connections, and sharing ideas in visible, tangible ways. The LEGO approach to learning was therefore already well placed for future learners. Here we would underline the need for future LEGO products, whether physical or digital – or both – to help learners build confidence in their own abilities; to support tinkering and playfulness (rather than one 'right' way to do something); and to encourage the dimension of sharing and communication.

The implications for learning are connected to the needs of learners, and so emphasise personalised learning paths based on individual interests, with reflection on those paths encouraged by network connections, which support learning at any time and in any place. In such networks, people can learn from, support and inspire others, through communication, conversation and collaboration. The LEGO Group should therefore continue to support networks of collaboration and shared interest in learning, and develop new ways to bring together users in ways where they can build and fuel each others' learning – something which has to be carefully designed to be effective, and to foster positive contributions. 'Communication, conversation and collaboration' does not necessarily mean online networks – these things can also occur locally, of course, in play and in the classroom. In chapter 3 we saw the value of a 'thinking together' approach for fostering learners who are able to reflect on and organise their own problem-solving, and therefore creativity, and learning (Mercer, 2000; Dawes, 2010). The LEGO System offers an excellent platform for the development of 'thinking together' activities, where learners of any age can come together to make things and simultaneously verbalise and reflect upon their approaches.

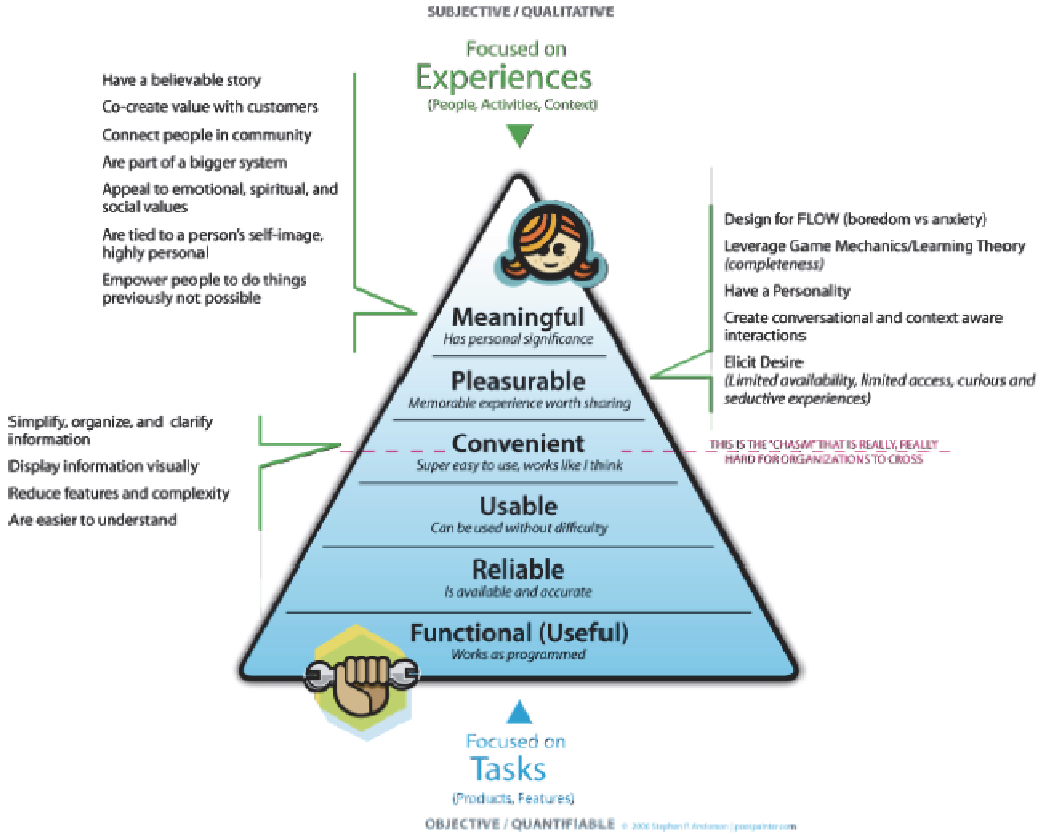
On relationships for learning, we see a corresponding move towards more careful selection and cultivation of those relationships which are most likely to encourage and inspire learning. Peers, mentors and role models can play a powerful role in building confidence and encouraging learners to stretch themselves in new directions. They can be helped by informal, pop-up learning resources, and open platforms for sharing which engage multiple senses, rather than the more traditional fixed 'places of learning'. LEGO bricks, of course,

have always been an informal tool which can be taken anywhere and used for playful experimentation, engaging the senses of sight and touch. Although the imagination of users already makes this limitless, the use of LEGO® materials for spontaneous acts of creative tinkering and reflection could be bolstered by portable 'take along' sets for different groups of purposes – or the online sharing of ideas for collections of pieces for different kinds of projects or types of learning. (These can be quite small and simple – one of the lessons of LEGO Serious Play was that giant boxes of materials offered luxurious choices but were not always necessary).

Regarding contexts for learning, we have seen that learning is not limited to fixed physical places such as schools, but can involve occasions, events, and movable spaces, and involve people of all ages. The notion of an 'ecology of learning' suggests a system where different physical and virtual spaces come into play at different times, and a variety of tools are deployed within the learning process. LEGO products are used in many different kinds of learning contexts, from LEGO Education products in schools to the competitive arena of the FIRST LEGO League robotics challenges, as well as within the informal learning of everyday life. A LEGO approach to learning environments might see an integration of digital technologies and hands-on building in a very customisable form, as well as a stronger connection between the learning happening in the different contexts. Seeing activities such as the FIRST LEGO League within a school curriculum, as well as LEGO products used at home, points towards a layering of learning contexts which supplement each other, sharing the same objects.

4. LEGO as a 'community of learning'

The growing number fans of the values of LEGO play and learning has been divided into affinities to understand the evolution of consumers' behavior and interest in the brand, but also serves as a segmentation tool for innovation purposes.



Stephen Anderson (2006)

At the higher levels of the pyramid there is an increased focus on meaning and pleasure, but also an interest and willingness to engage with a company and a community. At the lower levels of the pyramid, consumers care for a superior product experience, but also tend to be less skilled in the more comprehensive building techniques and innovation aspects of the LEGO® System.

These different segments exist in a LEGO fan community, where people support each other.
They share building instructions, news on product releases, and challenge the LEGO System into new adventures. When the different segments interact through communities, or through live events like FIRST LEGO League, the upper layers of the pyramid provide useful feedback to less skilled builders, and inspire them to seek new terrains and develop their competence. This relationship between learners, who share an interest in a common subject, provides a community of self-directed learning, which creates a 'learning

ecosystem'. With the 'long tail of education' (Anderson, 2006) there is an opportunity for the more skilled learners to educate the less skilled learners, if the subjects are very specialized (Walle, 2011).

For example, digital technologies now mean that a few can teach many. This is also reflected in the way that blogs and forums work, where specialized topics are responded to by experts, which a large number of users can attend to, without attending large-scale traditional classes. Additionally, it opens up an opportunity for new types of collaborative study groups, where a group of enthusiasts can gather around a 'master,' across countries and cultures.

In such ways, the masters or experts in a community, the 'lead users' at the top of the pyramid, are able to interact with other interested people lower down, so that knowledge and expertise is pulled and pushed around the network.

5. From 'play well' to 'learn well'

The LEGO® brick is already a classic tool of informal learning. Before there were digital 'platforms', there was the LEGO System, which enabled people to come together and build their ideas in three dimensions, share with others, and collaborate. This tangible exchange of personal enthusiasms was the spark which ignited countless play scenarios around the world. Learning follows from the play, and cannot be separately identified, as it is embedded. Play leads to learning, which fuels more play.

As Mark Frauenfelder, editor in chief of MAKE magazine, has written:

> Many LEGO enthusiasts say that working with LEGO since childhood has caused them to see the world with different eyes. With LEGO on the brain, the physical world becomes a hackable platform, and LEGO is the ideal prototyping material for designing on the fly. (2011: viii)

Many adults today who are into making things – whether as craft, computing, or engineering – credit LEGO play as the original source of their interest. They have learned design thinking, and creative production techniques, whilst simply playing at home or with friends. Because the LEGO® System is an everyday, accessible tool, widely regarded as a source of fun, learning happens under the radar. The LEGO System offers a common language, recognised around the world, which brings people together and helps to create shared understandings. The product can always be leveraged in new ways – such as when more complex layers are added to its construction uses, as in LEGO Mindstorms, or when more complex meaning-making capacity is added to quite simple constructions, as in LEGO Serious Play.

'Play well' and 'learn well' are, therefore, two sides of the same enterprise. We learn through playing, and if our learning opportunities are well designed, we can play while learning. Both learning and playing are best when they are social, bringing people together in collaborative places or platforms to do something new together.

In The Innovator's DNA, Dyer, Gregersen and Christensen (2011) studied the everyday habits of leading innovators, in order to identify what was distinctive about their approach to their work. The researchers argue that the skills and mindset which are common to such innovators are not innate gifts, but can be learned. They are a set of five 'discovery skills' – orientations and behaviours which, as it happens, also form the basis of LEGO® play and LEGO learning:

- *Associating* – putting things together in original ways, and making connections between things and ideas from unrelated fields.
- *Questioning* – asking unusual questions, questioning why and how things work, or challenging the way that things are typically done.
- *Observing* – watching people and things in order to find new ways of doing things.
- *Networking* – making use of a diverse network in order to be inspired by new ideas.
- *Experimenting* – trying things out, testing new ideas, and playfully doing different things to see what happens.

The connection with LEGO behaviours are striking – we have already seen that associating, questioning, observing, networking, and experimenting are at the heart of LEGO values and what people typically do with LEGO products. In adult life, these skills are not simply useful for employees who work in laboratories. Dyer et al found that innovative companies are "almost always led by innovative leaders" (2011: 7, their emphasis). They emphasise: "The bottom line [is], if you want innovation, you need creativity skills within the top management team of your company" (ibid). They go on:

> In other words, innovative people systematically engage in questioning, observing, networking, and experimenting behaviours to spark new ideas. Similarly, innovative organisations systematically develop processes that encourage questioning, observing, networking, and experimenting by employees. (2011: 7-8).

The language of 'innovation' and 'experimentation' might seem to indicate that, in LEGO terms, this discussion relates most to technical matters, such as the sharing of engineering techniques within the LEGO® Mindstorms communities. But that is not the case. The self-organised online communities which support the creative fans of LEGO Harry Potter, for instance, or wholly fan-imagined themes such as Pre-Classic Space, are just as productive of innovative ideas, in everything from building techniques to imaginative creatures and vehicles, through to inspirational models for storytelling and story-sharing. They

operate both within the ‘official’ boundaries of LEGO play, and also move beyond it to incorporate home-made parts and materials, non-standard techniques, and alternative story universes.
This is, indeed, a mirror of the LEGO Mindstorms communities, which both share ideas and techniques within the realm of ‘official’ operations, and also supports a ‘hacker’ community, which invents tools and repurposes materials to achieve novel effects.

This hacker ethic, as Frauenfelder suggested above, comes from within the endless reinvention offered by the LEGO System. Accepting things as they already are is an easy and ‘safe’ option for people in their lives, their learning and their business. In The Innovator’s DNA, Dyer et al make it clear that valuable innovation requires courage and resilience, as well as the passion to want to ‘put a ding in the universe’, as Apple founder Steve Jobs put it. The skills of associating, questioning, observing, networking, and experimenting that LEGO products foster, coupled with the sense of confidence and self-efficacy that we have discussed above, are therefore central to the development of creative societies.

Chapter 7

Bibliography

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