Learning for Engagement - lose the ring fencing

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Abstract:
A current education initiative in Scotland (Curriculum for Excellence, CfE) offers opportunities for innovative curriculum frameworks to be explored, to re-think teaching approaches and learning experiences, to re-examine inter-relationships of 'subjects' and encourage greater interconnectivity. Learning is underpinned with values, purposes and principles which include relevance, challenge and enjoyment, coherence, depth, breadth, choice.

The work presented here draws on a project which aimed to investigate 'synchronised learning'. This paper illustrates the eagerness of the learners to explore, develop knowledge and be creative. It examines the benefits of a learner driven discovery model of learning and discusses parallels and connections with the desired learning experience of a design capability centred Technology Education.

The model of learning discussed requires educators to identify commonalities between subject disciplines and develop a negotiated pedagogy that links learning. It demonstrates the potential learning achievable when artificial boundaries and conceptions of 'subjects' are removed and learners are empowered to take greater responsibility for what, when and how they learn, under the supportive watch of teachers.

KEYWORDS: INTERCONNECTIVITY; DISCOVERY LEARNING; LEARNER RESPONSIBILITY; TECHNOLOGY EDUCATION; SUBJECT BOUNDARIES

INTRODUCTION

'Education should be directed to the development of the personality, talents and mental and physical abilities of the child or young person to their fullest potential…….Due regard, so far as is reasonably practicable, should be paid to the views of the child or young person in decisions that significantly affect them, taking into account the child or young person's age and maturity.' Education(Scotland) Act 2000.

A current education initiative in Scotland (Curriculum for Excellence, CfE,) offers opportunities for innovative curriculum frameworks to be explored, to re-think teaching approaches and learning experiences. In 2002, the Scottish Executive undertook a 'National Debate on Education ', which engaged general public, educationalists, parents, industry and commerce, learners, and various sectors of education. The government accepted the consensus to have 'a less crowded' and 'better connected' curriculum which offered more choice and enjoyment for learners of 3-18 years old (Curriculum Review Group, 2004).

The resultant outcomes of the programme of curriculum reform are ambitious and far reaching. In summary, Curriculum for Excellence, CfE, 2004 states-

- Learning is underpinned with **values** that have helped define the democracy of Scotland –wisdom, justice, compassion and integrity;
- The **purposes** of the curriculum are described developing young people's disposition and capacities to enable them to be successful learners, effective contributors, confident individuals and responsible citizens.
- The curriculum is to be designed around the **principles** of relevance, challenge and enjoyment, coherence, depth, breadth, choice.

Young people are to achieve 'both through subject teaching and more cross-subject activity'. This requires schools and teachers to examine inter-relationships of 'subjects' and the unique contribution such a 'subject'; offers the learners. Indeed the process of reform demanded that each learning area had to justify the continued existence prior to the reform programme clarifying the commissioning statement for the curriculum development. 'Curriculum for Excellence' review programme aimed to significantly de-clutter and restructure the curriculum, with the intention to create greater opportunity and time for young people to achieve and to allow teachers to exercise judgment on appropriate learning. The reform also seeks to provide more space for music, sport, dance, drama, art, learning about health, sustainable development and enterprise to broaden life experiences and life chances of young people.

In 2008, consultative guidelines for all eight areas (Health and Well Being; Languages; Mathematics; Expressive Arts; Science; Social Studies; Religious and Moral Education; Technologies) of learning have been made available and a period of consultation, trailing and review is now underway.

CfE attempts to create a framework where learners learn how to learn, prepare for the knowledge economy, develop trans-disciplinary ways of working, engage in creativity and risk taking. Thus learning, through raising questions, thinking, finding out, doing, reviewing and developing, is given greater value than acquisition of knowledge in itself. The inter-relationship and the mutually supportive nature of areas of learning are being recognised.

ILLUSTRATION FROM PRACTICE

The work presented here draws on first hand observations of two Scottish schools involved in a project was titled 'The Leonardo Effect project'. It aimed to investigate and develop a pedagogical approach of *synchronised learning* that exploited the potential offered by the acknowledged commonalities between 'subject' areas, initially selecting Art through Science and Science through Art as the focus. It also challenged existing curriculum structures. Robson et al (2006) hoped to identify alternative frameworks for learning and teaching.
In summary, the Leonardo Effect project aimed to

- explore the validity of synchronised integration of art and science
- examine whether creativity was enhanced through the model adopted
- increase learner's knowledge and understanding of the world to inform their art making
- optimise learning potential by appealing to a range of learning styles and preferences
- enrich learning through a wide variety of first hand experiences and stimulus

Currently, schools seem to have an artificial disjunction between art and science as 'subjects' or 'disciplines'; there is a separation of Art and Science learning, with each treated as unique and distinct aspects of the curriculum. Yet, there is a high degree of consensus on what art and science have in common (e.g. Wenham, 1998; Bohm & Peat, 2000; Robson et al, 2005, Kemp, 2001). Both are about investigation, ideas and translating or transforming something into something else. Science and art are about curiosity, enquiry, hypothesising, testing ideas and experimenting in response to the *what if*…. Common to art and science is the need for observation, recording, visual literacy and expression, questioning, clarification, intellectual risk taking, dealing with uncertainty, relating to and drawing from everyday contexts or personal frame of reference, multi-modal communication. Scientific enquiry is involves trying to understand the world around through understanding science concepts and exploring cause and effect. Art encourages contemplation, clarification, communication to, through, for and with others. Science involves theoretical explanation of phenomena. Art is about making personal sense of phenomena and what is seen, touched, heard, tasted and experienced.

Indeed, Flannery argues persuasively that "more attention to the aesthetic dimension of science could both give students a truer picture of scientific inquiry, and improve their attitudes toward science," and that a "greater awareness of aesthetics by science teachers might have the additional benefit of improving their teaching methods" (Flannery, 1991, p. 578)

Brady& Kumar (1999) discuss the 'zone of artful science' where art and science are reciprocally aware of each other as essential to the common project of advancing knowledge and are conscientiously articulated as such in our scholarly activities and curricula.
They argue for removal of the artificial and restrictive divide of science and art.
''Interdisciplinary cooperation will not displace any discipline's historical integrity or control over its conventional subject matter. Rather, it will have the effect of *expanding the context* in which such disciplines are to be understood. That can be promoted directly by insisting on an open and genuine cross-pollination of the disciplines….' page 518

This serves to illustrate the need to re-examine subject boundaries and inter-connectivity.

As a design technologist, who recognises the artificial construct of school curriculum and appreciates the need to usefully employ all domains and areas of learning when engaging in designerly activity, I was intrigued. I operated as a meta-evaluator for the Leonardo Project, Scotland component. What I saw under the teachers' headings of Science and Art could have been labelled Design and Technology. Technology Education has been slow to develop in Scotland. However, school development plans tend to prioritise Science in efforts to encourage teachers to include science experiences and knowledge for their learners. Even so, confidence of the primary teachers has remained low (Murphy et al.2007). In an effort to engage teachers and learners in science, it appears that educators may be recognising the value in active, meaningful, experiential and creative approaches which incorporate art, design, engineering and technologies.

The following vignettes based on observations (pre-coded schedule), interviews (semi structured, similar codes as observation schedule) and feedback from learner survey attempt to provide a flavour of the experiences and responses I witnessed.

Observer vignette from Leonardo Effect Project
Synchronicity and exploring what has been learned beyond art and science.
The comments from children and teachers alike indicate recognition that learner achieved far beyond subject knowledge, concepts, skills and processes of art and science e.g. greater creativity, team-working, cooperation, questioning, trying out and making judgments, language development, accurate use of terms and labels, working things out, problem solving. Teachers thought learners were not really aware of art and /or science being a focus necessarily. The mix of language, expressive multimedia fine art work (2d and 3d), factual note taking, observation, experimentation and recording of science, historical knowledge and indicators of what more to research, interviewing, listening, data collection and so on created a very natural flow of learning.

'… Child orientated and child led. They were the owners asking the big questions , coming up with their own problems and their own solutions and liked it. ……sharing of learning, sharing of planning, responsibility of learning and planning cooperation …. But teachers let go but need to stay in charge….The children felt they were in charge, they knew where they wanted to go and how to get there and this gave them confidence –they themselves will be able to say why 'Curriculum for Excellence' capacities have been met– they are certainly reflective and successful learners.' Headteacher school x

Specific Example of synchronicity and exploring what has been learned beyond art and science. (School Y)
The learners embarked on a research activity in the ICT room through a prepared web quest-a ppt. that the teacher had created with specific links that the pairs could follow at their own choice. The learners took notes and printed what they wished. This webquest was devised to compare mechanical concepts, principles, knowledge with the natural flight studies undertaken in the first two weeks. In the plenary review slot, they were very willing to offer what they had found out about jet turbines engines, wind speeds and directions, technical terms and components involved. One learner made connections between cargo planes with the cargo/container ship which grounded in Cornwall (early2007) and people stealing motor bikes from the washed up cargo. Another learner made connections in a rather profound way; *'birds were the fastest things on the planet, then airplane were invented and the pollution meant that birds were less and the forest was getting cut down and monkeys were getting killed and less birds in the forests and if we recycle our stuff and use less then this won't be a bad as it is…'*

'Joined up connections made by learner and teacher…no learning outcomes are stated but LOs are in everything! Learning is driving the project… it flows.' Headteacher school Y

Example of learner driven learning in practice: School Y
Discovering Structures on a need to know basis.
This class worked in small groups to design and develop a fantasy flying creature between them. Some made small model planes with body slots for wings. One learner was observed attempting to stiffen the wings which he made from thin funky foam. He did not appear to wish to change the material but instead had cut another copy of the shape to add . He explained his thinking; two of same would be stiffer than one sheet. He was disappointed that it seemed to be unsuccessful an idea. When prompted to consider the way that our human bodies of 'softish' muscle and blood and skin was made to be stiffer and stronger, and how birds were made to have some stiffness and strength yet weren't too heavy, he led himself to the notion of some sort of skeleton to stiffen seems useful an idea.
He decided the skeleton would have to be light. With more prompting to help him revisit his research about birds and bones he decided the skeleton would be hollow and made from light materials. He collected cut some short members of artstraws. Various configurations were explored to make a sandwich of funky foam stiffened by the art straw triangulated section, reflecting his thinking about nature and manmade lightweight but strong structures. Rather oddly he opted to stick up right members in a colonnade to the wing and then asked how he could make the triangles again. This after laying them flat to make a 'truss'? He then said he wanted a bi-plane like the Wright brothers one.

Example of learner driven learning in practice, **School Y** *'They want to write things down!'*(teacher)
Using the videos, DVD, books and websites, and working in groups of 3, the children were exploring anything that attracted their attention. The big sheet of flip chart paper encouraged large scale note taking, and allowed the children to note in any way they wished, notes, full sentences, bullet points with simple diagrams, paragraphs etc. One group devised a note taking chart in tabulated forming which they took notes to compare bat, insect and bird. On their chart they made concise statements against a range of criteria for each species.

These sheets were used as a frame of reference for each group to provide a verbal presentation of what they had found of interest to their class mates gathered on the carpet. *'What would you like to tell us about what you have learned?'*

At these presentations a member of a volunteer of a small learner group would select what s/he wanted to share with the whole class. Other learners added what they thought or wondered in connection to this contribution. Sometimes the teacher would pose a query to develop the concept, information or point of interest by asking the learners to think about, pair up and share their thoughts with one other before using a 'no hands' up approach to seeking additional contribution from the class.

The vocabulary used was of very high level and technically interesting,
e.g. 'force of gravity', 'tail wing', 'raising wings to allow the air to get under and provide lift', 'batteries provide the power', 'air pressure change to glide over the surface', 'to propel through the air', 'helped by the air direction', 'birds tighten muscles to move the wings', 'equate to rubber band' , 'tighten to propel', 'thrust', 'powerful'.

Reference was made to the visit into the classroom from the falconer and what they had learned from that experience and their field trip to Lochwinnoch nature reserve. They were relating their paper airplanes and mechanical toys they tested in the playground with the birds in terms of the hollow bones and the light feathers. The learners were making connections: e.g. humming bird wings moving in a figure of 8 shape, 25 beats per second were related to propellers. The announced that hot air helps birds like raptors get up and stay up so they asserted that the papiermache shell hot air balloons should be tested with hairdryers to see if can fly upwards. Learners made connections made between their descriptions of how planes get up in to the air with how birds do it e.g. some birds running a while to get up and off. Some airplanes able to take off with out a runway – this was met with disbelief by some so it was posed to the group to think, pair and share their ideas. *"fans' pushing down?'* was offered tentatively.

This review session was wrapped up although many more had things to say with how planes fly, how they take off and forces of flight. It was at this juncture the teacher linked to the rest of the session by saying, *'How about we find out more about that right now?'* The teachers were devising the framework for the tasks. There was a balance of exploration, thinking, drawing/ note taking in whatever for was chosen by the learners input and their discussion. The children had selected to explore manmade flight, rather than natural flight as their main line of enquiry. This is what became the focus of the next task.

Example of differences in learning environment and classroom practice.
When the learners began to design the fantasy flying creature they worked solo initially to explore their own ideas. They used the drawing skills developed from observational and annotated diagram recording tasks used previously. They liked that they could make so many decisions. They explained how decisions were arrived at choices were made. Everyone's design ideas were shown. All class members looked at each others and each learner voted for the ideas they would like in their final class creature. The learners 'signed up', on large sheets of paper, to be part of the group they wanted to be in i.e. head, body, tail, wings, feet, and an 'I don't mind' group. The previous grouping tended to alter in make up at this stage. They changed to friendship groupings. Detailed drawings were produced of each 'component part' of the creature by the group members and modelling began.
Modelling required a lot of discussion, decision making, and division of labour for sub tasking to ensure all group members were actively engaged. There was a variety of processes ongoing simultaneously and the learners developed their skills with a range of media. Inevitably this created a purposeful buzz of activity and a high level of noise.

A flying creature that requires take off and landing gear in the form of 'roller skate-feet' also requires some way of braking on touchdown. A parachute is required and so to is a runway. The learners were unstoppable in their creative thinking and connections were continually indicating an understanding of what had preceded. The negotiation between group members and inter groups was fairly complex. The teachers were surprised at the way the learners were able to handle the situations. They also felt they had to accept the mess, the clutter and the noise levels. The quality of work and depth of learning, the sustained motivation and interest demonstrated by the learners was such that all things could be tolerated.

The model of learning described requires educators to identify commonalities between subject disciplines and develop a negotiated pedagogy that links learning, authentically. It demonstrates the potential learning achievable when artificial boundaries and conceptions of 'subjects' are removed and learners are empowered to take greater responsibility for what, when and how they learn, under the supportive watch of teachers.

This paper illustrates the eagerness of the learners to explore, develop knowledge and be creative. It examines the benefits of a synchronised discovery model of learning and discusses parallels and connections with the desired learning experience of a design capability centred Technology Education.

DISCUSSION

Matthews argues (2000) sensory inputs do not in themselves building up meaning. Words have to be learned and what they mean has to be learned in the context of the sensory phenomena experienced…these definitions then serve to develop meaning which is held in the public domain through learned encultured input ---- which in turn serves to scaffold the experiences and convert private inner domain ideas into meaningful concept.. Thus learn by doing requires instruction and input at well judged points within the discovery. illustration of hot air rising… … use of vocabulary such a s forces and thrust and drag …
This is where designerly approaches can prove to be useful in working towards constructing meaning.
The spark-finding and meaning making of the complex ill-defined problem or scenario or then the exploration and sensory playfulness that leads to a sense of direction or several routes to delve further…. the questions of what if… and I don't know ..need to find out…. drive the learners activity in self directed and self constructed tasks… the need to know

enquiry based approaches… further learning by doing will enable discounting of some ideas and development of others… …

Design and Technology activity is the experience of creative enquiry to arrive at a resolution to a stated need, want or problem (Roth, Tobin and Ritchie, 2001). They described designing as having a focus on doing something and learning on a need to know basis, driven by the designer (learners setting goals , questions and targets, drawing on a wide range of subject disciplines without necessarily recognising them as subjects..) rather than 'knowing something' in order to explain or hypothesize.
analysis is a key part to inquiry and synthesis is a key part of designing.

My argument has long been as Haury (2002) – hands-on-brains on learning , using all senses and engaging learners in an authentic enquiry, respecting curiosity and wonder…. regardless what 'subject' label is attached.
Inquiry method is a central focus of many science education reforms and
as a design technologist, I equate inquiry method with designerly thinking and designerly activity.
Haury states the case for teaching science through design and suggests that in doing so, some of the issues of science education can be addressed

- integration of science with other subject areas..
- forging connections with daily life,
- facilitating active learning,
- accommodating a variety of student learning styles,
- attending to science in the context of technology and society,
- nurturing imagination and creative thinking,
- developing skills in critical thinking , problem solving and decision making, increasing awareness of science related dimensions in occupations.

Although there are central commonalities between design technology and art and science the most obvious difference lies in the purpose of the activity.

INTERDISCIPLINARY STUDIES, ACTIVITIES, LEARNING AND ACTIVITIES.

Perhaps one has to be confident and comfortable with ones own domain and expertise prior to embarking with colleagues on an interdisciplinary piece of planning- the Leonardo Effect Project approach took this away from the teacher and it was the children who directed the learning. Thus the natural curiosity and willingness to explore and find out regardless of artificial boundaries of school systems and constructs such as timetables and subjects – these things no longer existed …. learning was central to all activity and learners were driving the learning.

For this to be effective, the project illustrated the need for a rich range of resources, inputs and stimulus (e.g. field trips, visitors, DVD, handling collections). The teachers needed to have confidence in their ability as a teacher -as -facilitator, be equipped with a wide range of strategies to
develop understanding of observations, content and language
encourage cooperative learning
provide feedback and prompts
question
model hypothesising
make problem solving explicit
encourage cooperative learning
enable negotiation and team work

The success in the two case study schools I observed helps create an argument for 'subject' specialisms and expertise to be used in more contextualised meaningful way. It also emphasised the skilfulness of the pedagogical approaches adopted by the class teachers. Within the unseen framework they created space for personalisation choice, individualised and flexible learning.

Building Curriculum 3 (LTS,2008) suggests changes are needed such as 'providing space for imaginative teaching that can capitalise on approaches which make learning relevant, lively and motivating.' page 9

Building Curriculum 3 urges schools to ensure the curriculum includes' space for learning beyond subject boundaries' so that young people can make connections between different areas of learning…. LTS, 2008, page 21.
Curriculum managers and teachers are being encouraged to seek out opportunities to plan coherent programme which minimise fragmentation… e.g. using small teams of teachers and other staff working together to cover curriculum areas, each contributing from their subject specialism and by collaborative approach to planning which enable young people to make connections between different ares of learning.

'Curriculum Areas are not structures for timetabling: establishments and partnerships have the freedom to think imaginatively about how the experiences and outcomes might be organised and planned for in creative ways which encourage deep, sustained learning and which meet the needs of their children and young people.' page 20 Building Curriculum 2008

'Subjects are an essential feature of the curriculum, particularly in the secondary school. They provide an important and familiar structure for knowledge, offering a context for specialists to inspire, stretch and motivate. Throughout a young person's learning there will be increasing specialisation and greater depth, which will lead to subjects increasingly being the principal means of structuring learning and delivering outcomes….' page 20 Building Curriculum 3 2008

Building Curriculum 3 promotes interdisciplinary learning --- and suggests that effective interdisciplinary learning is based upon experiences and outcomes drawn from different curriculum areas or subjects within them… can provide opportunities for mixed stage learning which is interest based…

The OECD noted- ' if a curriculum is operated as a rigid structure, the time available for learning will be for subjects and not students.'

'' Discovery led to invention and invention to new discoveries…. Royal Society in its early decades fostered both discovery and invention, both being at the fruit of imagination and ingenuity. But in due course, what was then called natural philosophy came to be described generally as 'science'. The growth in knowledge led to the designation of limited fields of inquiry and limited bodies of knowledge and subjects. 'Subjects' would be studied or investigated increasingly in isolation from other subjects, without regard for the wholeness or systematic nature of things. Distinctions would come to be drawn between science and art, or science and technology or pure science and applied science.." (Chambers,2000, p 329)

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