Teachers' perceptions of creativity and how it relates to primary school science:

A reflection

Karen Stephens
University of East London

The aim of my MA dissertation was to explore teachers' perceptions of creativity and how this relates to primary science lessons through the context of an Academy mantra which stated that teachers will endeavour 'to develop a child's creativity'. My literature review makes the case that creativity is a set of skills or traits a person holds which can be developed through acts such as being taught creatively and being situated within a creative environment. These skills can be used across the curriculum, meaning creativity is not subject-bound. As a scientist one would need to: make unforeseen connections, have originality of ideas, articulacy and curiosity which are all key skills of creativity. This also demonstrates how creativity does not have one definition and how the notion that it has can blur professional judgment and cause confusion. Using a case study, a questionnaire was completed by teachers and senior leaders within

the school and this was followed by three semi-structured interviews. The interviewees were able to discuss their own perception of creativity, how it appears in their classroom and what barriers they face in promoting it. These questionnaires and interviews were evaluated to generate themes. There was one unexpected finding in the first interview, so I took the opportunity to explore this further in the subsequent two interviews and discuss this in the critical review.

INTRODUCTION

A good many scientists and artists have noted the universality of creativity... What the scientist perceives as common problem solving, the artist understands as shared inspiration – but the 'answer' springs from the same creative act. (Root-Bernstein 1999: 11)

Creativity. As a word it is not very long nor cumbersome to read; however, the search to fully explain it has spawned thousands of books, much research and the unanswered question... what is creativity? This is a subject I, naively at the time, took on when completing the dissertation part of my MA Education. At that time, I was a primary school teacher (Year 5) and subject lead for science, and teaching skills beyond those promoted in the English National Curriculum were important to me. Two years after the introduction of the 2013 National Curriculum, the school I was working in was amalgamated into an academy, which at that time was quite small. The Academy's mantra used the word creative and I wanted

to explore what this meant and how the Academy meant us to use it. I wanted to explore other teachers' perceptions of creativity and, making a link between a personal and work interest, I chose to look at creativity within the primary science classroom.

LITERATURE REVIEW

During the literature research it became apparent that I was dealing with a subject for which, even after a century of systematic study, there is not one single universal definition. As a complex and multifaceted phenomenon, creativity defies definition and, being versatile and unpredictable, it forbids any systematic definition (Boden, 1994; Treffinger et al., 2002). For creativity to occur, it is perceptible there are relevant criteria, yet no exact criteria exist (Fryer 1996), which implies creativity's impact could be limited, could cloud thinking and could lead to challenging perspectives (Plucker et al., 2004; Wood, & Solomonides, 2008; Thomas & Chan, 2015).

In their review, Cropley & Cropley (2008) noted a variety of paradoxes and inconsistencies across literature on creativity's definition. Treffinger et al. (2002) in their systematic literature review found over 120 definitions of creativity. However, through this review of the qualities, behaviours and other individual characteristics, Treffinger et al. (2002) were able to define creativity as having four key elements: listening to one's inner voice, being able to generate ideas, being able to dig deeper into an idea and the ingenuousness courage to investigate these ideas. A review by Sharp (2004) noted that most researchers agreed on the following key characteristics of creativity: producing something of worth and value, productivity, problem-solving, originality and imagination. These ideas have been expanded on by researchers such as Burnard & White (2008) and Craft (2011) where the ability to ask questions, risk-taking and self-determination were added.

I reviewed notable theories regarding concepts of creativity including Rhodes's (1961) 4Ps, Glăveanu's (2013) Five As, Craft's (2001) Big-C and little-c creativity and Kaufman's & Beghetto's (2009) Four-C model of creativity. Rhodes's (1961) framework, which is still influential to this day, used the 4Ps to classify approaches to creativity: the person, the product, the process and the press (environmental). Functioning as a 'backbone for creative theory', Rhodes's framework has been used on numerous occasions to classify observed research and research in the subsequent decades (Glăveanu, 2013: 69).

This led me to my first challenge: if I could not provide a definition then how was I going to discuss the concept of creativity with the participants?

ESTABLISHING CREATIVITY AS A SKILL FOR THE PURPOSE OF RESEARCH

For the purpose of my research I decided to establish creativity as a skill. Torrance & Myers (1970) state that creativity is a skill and as a skill it can be taught, although Csikzentmahalyi (1996) and Liker et al., (2015) both argue it cannot be explicitly taught. For new ideas to be created, and innovative natures to be fostered, there needs to be a suitable environment (Liker et al., 2015) and, whether it is in a specific field or as a general capability, creativity can be developed (Zabelina & Robinson, 2010). Underpinning the four core skills of widening personal knowledge, accepting challenging undertakings, being open to the attainment of new ideas and stimulating new thinking, Epstein (2016) claims, can increase an individual's creativity.

To be able to generate new ideas, explain new phenomena or evolve innovative ways to problem-solve, a scientist needs to be creative (Liu & Lin, 2014). Neumann's (2007) study of scientists' views about creativity in their respective fields revealed that a significant attribute

for a successful scientist was the aptitude to make unforeseen connections. As Park (2011) argued, creativity is an essential element of school science. Children who participate in inquiry behaviours such as inventing a hypothesis, Rutherford & Ahlgren (1990) suggest, are just as highly creative as those associated with the arts such as composing music. To cultivate a child's scientific creativity, it is beneficial to have an inquiry-based teaching approach (Haigh, 2007; Longo, 2010). Developing inquiry-based learning activities will deepen and develop children's understanding of scientific ideas (Anderson, 2002). Children should be encouraged to engage themselves in the investigative scientific process to be able to better understand the complexity of science (Anderson, 2002; Kind & Kind, 2007). By using higher-level thinking skills, deepening practical skills, being able to make decisions and having the opportunity to think, children will gain a better understanding (Anderson, 2002; Kind & Kind, 2007). To facilitate scientific creativity the learning environment should have an inquiry approach which includes personal involvement and self-direction of the children (Hammerman, 2005; Longo, 2010).

METHODOLOGY

Using an ontological interpretivist paradigm conducted within a small-scale case study, I identified themes to foster a theory based on teacher perceptions of creativity. A sequential mixed method approach was employed using a questionnaire, with closed questions followed by an open question. This was followed by three voice-recorded semi-structured interviews where a list of topics gathered from the questionnaire was discussed as well as the respondent's own thoughts. A pilot study was conducted for the questionnaire but not the semi-structured interviews. Reliability, validity and generalisations were discussed and given due attention. Ethical considerations were given to all those taking part in the study.

The key question I had at the initial stages of my research was, 'What are teacher perceptions of creativity and how it relates to primary school science?' In order to begin to develop this investigation, I created sub-questions based on my understanding of the literature. To design my research proposal, I considered Crotty's (1998) four questions, and these four answers decided and informed my choice of approach, from the broad assumptions I held to the more practical decisions (Creswell, 2003). I chose an ontological interpretivist paradigm because it lent itself to the fact that I was finding out teacher perceptions and not interfering with teaching practices, and as Tuli (2010: 100) noted, the interpretivist paradigm is 'non-manipulative, unobtrusive and non-controlling'. Despite the choice of a mixed method approach, I chose the interpretive paradigm as the theoretical framework most associated with qualitative research and whose purpose is to understand a singular phenomenon (Tuli, 2010) as my collection is weighted toward the analysis and collection of qualitative data of the singular phenomenon of teacher perceptions.

I chose to conduct a small-scale case study as my interpretive research as I was seeking to identify patterns and develop a theory based on teachers' perceptions; I was therefore not beginning with a theory or hypothesis (Creswell, 2003). The case study, in itself, is not a research method, but the researcher is able to generate material through selected methods of data collection which can be analysed using different theories (Willig, 2001). I was aiming to gain a comprehensive insight into a specific topic of creativity which will in turn inform my professional practice as this is a case study's primary purpose (Simons, 2009). The subjects, in my research case study, are the teachers, and the analytical frame is the teachers' perceptions in relation to theory, practice and policy.

Different methods of data collection within the case study were considered

before being ultimately rejected. A mixed method approach was undertaken as it brings together quantitative and qualitative research approaches as both types of data are gathered and analysed in a single study (Creswell, 2003); this approach has both its advocates and opponents (Newby, 2010). I ultimately decided to use a questionnaire followed by a semi-structured interview as my data collection points.

The questionnaire used closed questions followed by a single open-ended question. The closed questions were posed as I felt there was a need for the actual completion of the questionnaire to be quick and relatively easy and this was effective in gathering a school-wide data harvest (Newby, 2010). Therefore, I carefully chose the vocabulary of the questions keeping in mind the participants who would be answering (Newby, 2010). I did not want to inhibit the respondents' daily work, which is the main priority (Hopkins, 2008), and I kept the questions short and straightforward as I did not want to give rise to 'cognitive overload' (Newby, 2010: 309). The closed questions were based on a five-point Likert scale (strongly agree to strongly disagree) on how the teachers felt against each statement. By designing a Likert scale, I was able to draw on a set of common experiences, expectations and beliefs and then differentiate the strength or intensity of the person's response (Newby, 2010). The statements were designed to allow a measurement of belief, opinion and attitude (Li, 2013) and may have clarified the meaning of a question for the participant (Bryman, 2012).

The closed question led to a single open-ended question where the respondents were asked their thoughts about the Academy's utilisation of the word 'creativity' in their mantra. This was to allow the respondents a chance to voice their own opinion in their own words, to gain a richer picture of teacher perceptions and to be sure I had not omitted a significant response (Newby,

2010). It must be noted that I cannot be sure of this due to the experience of completing the previous closed questions (Newby, 2010).

From the responses gathered in the questionnaire, themes were addressed and then discussed in follow-up voice-recorded semi-structured interviews (Koshy, 2005). As the researcher, I had to maintain a distinct awareness of the direction the interview is going in (Cohen et al., 2011). Before the interview, a list of ideas was drawn up to discuss with the interviewee, an agenda that we could both explore (Thomas, 2010). The interviewees were given the space to develop their reflections on the ideas appropriately (Gillham, 2000).

FINDINGS

A total of 25 questionnaires were handed out and I had an above-average response rate of 60% (Baruch & Holtom, 2008), while the non-response rate was 40%. All of the questions were answered on the questionnaires including the open-ended question.

A total of three teachers were interviewed for this study; all three had over ten years' experience of teaching as class teachers, subject leads and year group leads. At some point in their career all three teachers had taught in Year 1 and Reception. The interviewees believed that creativity was 'problem-solving, risk-taking and collaboration' and they themselves are creative due to experience and reflection. Creativity to Interviewee B meant 'being able to choose, make new connections and being able to communicate their ideas'. They also noted that to allow creativity to flourish the children needed basic motor skills such as 'cutting with scissors and being able to hold a pencil'. They believe creative children 'think outside the box, are risk takers with quirky natures and are practical'.

Through a thematic analysis of the results, I was able to discern 11 themes, which I

discussed in the original dissertation. Here I will discuss three of these themes.

A prevalent idea which emerged was the notion that everyone has the ability to be creative, and, although creativity was not considered an inborn talent, it could be found in children. There was 100% consensus that creativity is a fundamental skill, which needs to be developed within school; however, there were mixed opinions on whether it could be taught. Although considered a fundamental skill, 86% of respondents were unsure if creativity was necessary in the primary science lesson and whether it was present. This could be linked to the prevalent perception, as discussed earlier, that creativity can only be relevant in the traditional art subjects; the link between science, problem-solving and creativity, it seems, has not been made. This is where an agreed definition would be beneficial and create a school-wide ethos centred on the use of creativity across the curriculum.

In contrast, the interviewees claimed problem-solving was an integral part of creativity and the primary science lesson and allowed children 'a deeper understanding' (Interviewee C). Interviewee B discussed a heuristic task they had given a Year 3 class: the children, in mixed ability groups, had to move a bucket of water across the classroom without carrying it. One group, through collaboration and discussion combined with their knowledge of forces, created a pulley system. The teacher was sceptical, but they took a risk and allowed the children to proceed. Although there was some spillage, the pulley system worked and the children moved the water across the classroom. The children were able to make unexpected connections, which were found to be a significant attribute of a successful scientist according to Neumann's (2007) study. Through this inquiry-based teaching, a child's scientific creativity is cultivated (Haigh, 2007; Longo, 2010). This realistic and authentic situation combined with the teacher's

promotion of curiosity and innovation allowed the children the ability to solve the problem (Liker et al., 2015) and ultimately deepened and developed their understanding of scientific ideas (Anderson, 2002).

This collaborative social process was also used as an activity in a Reception class; the children were presented with the problem of rehoming mini-beasts. They had to 'find out what they needed and how they could create the right habitat for them' (Interviewee B). Using their knowledge and imagination, the children were able to create different homes for the mini-beasts and explain why they had chosen certain materials. Using imagination is an integral part of the Early Years Foundation Stage (EYFS) curriculum and is intrinsically linked as a characteristic of creativity (Sharp, 2004). By allowing the children to collaborate, investigate, question and make connections, the teacher was developing their creativity.

In both these tasks the children were influenced by the creative teacher as they promoted the creativity of others (Cremin, 2009); they have filled a creative void by using an environment, as Liker et al. (2015) discussed, where new ideas are generated and the children's imagination and curiosity have been promoted.

One of the most pervasive and prevalent notions the teachers held about creativity was problem-solving and this was a concurrent theme found in both the interviews and the questionnaires: allowing children 'to think outside the box to solve problems' and 'challenge them to consider what if scenarios'. The children need to be able to 'look at the tasks, questions, activities with an open mind'. Creativity, as Csikzentmahalyi (1996) stated, is about problem-finding and -solving and about the individual choosing to adopt a creative attitude (Cremin, 2009). As discussed earlier, heuristic tasks should be given to children to develop skills, which are fundamental to creativity and through the universal use of problem-solving across all subjects.

Problem-solving, however, was the only personality trait specifically mentioned in the questionnaire and it could be concluded that the teachers are unable to recognise their students' creativity-related personality traits (Karwowski 2007).

An unexpected finding from the interviews was the interviewee's identification of an actual point in a child's education when they start to lose their creative abilities. In the first interview conducted, it was stated there was a loss of creativity as a child progressed through primary school, and this was most evident in the transition from Reception to Year 1. I pursued this line of enquiry in the subsequent interviews and it emerged there was a common thread of consensus about the perceived loss of creativity in children due to this transition.

During the transition from Reception to Year 1, the children move from a play-based curriculum in EYFS to an English/maths-based curriculum in Year 1. This is supposed to be a managed and deliberate change; however, Interviewee A reported, 'but when by Christmas the data isn't there the transitions are cut short the next year.' Therefore, as interviewee A continued, 'being so data driven in year 1 means creativity is sidelined.' This echoed an evaluation by Her Majesty's Inspectorate (HMI; Ofsted, 2004: 2) which stated:

> *constraints of timetabling and the need to make sure that pupils make good progress towards the standards expected in the national end of Key Stage 1 tests sometimes lead to abrupt transitions to more formal approaches in year 1.*

Furthermore, the interviewees believed that when they taught in Key Stage 1 they were trapped between the expectations of EYFS stage and the National Curriculum tests (SATs) in Year 2.

As an HMI evaluation (2004) found, this imbalance between the two curriculums does not allow an adequate period for using creative and expressive areas in

which to improve standards.

Interviewee B stated that the EYFS curriculum offered few barriers to creativity flourishing in the classroom, as they can

> *'be as creative as you like. It is the EYFS culture to be creative. All seven areas of the curriculum are equal unlike other year groups. They are assessed on being creative and being imaginative.'*

This contrasts with the curriculum of Key Stages 1 and 2 where being imaginative and creative is only mentioned in the traditional art subjects such as design technology. Nevertheless, this decline in creativity could be due to the school experience or even the natural development of the child (Meador 1992). To test the notion that the loss of creativity is due to the curriculum it would be beneficial to conduct further research. This would also determine the effects of transition on the child from the EYFS curriculum to the Year 1 curriculum.

CONCLUSION

This exploration of teacher views on creativity and how it relates to primary science was an interesting and fulfilling experience. I originally endeavoured to discover how creativity was used in the primary science classroom as it stated in the Academy mantra that all members of staff are to develop a child's creativity. It became apparent during the literature review that there was not one universally agreed definition of creativity and I had to explore all the differing views and accept there could be more than one. Therefore, restricting the case study to the subject of science would not give an overall picture of perceptions. I began by focusing on creativity within the primary science lesson, but, as previously discussed, creativity is a set of skills which can be deployed across the curriculum. From this slightly new position, I encompassed the teachers' perceptions of creativity within their classroom, the school and themselves.

My first concluding thought after reading through the responses was that the Academy needed to remove the word creativity from its mantra, as I felt including it limited its deployment. It caused confusion and teachers were unsure of what the Academy meant by creativity. However, as shown in the themes identified for consideration, a more beneficial response would be to define the skills they wanted to develop and then deploy these across the curriculum.

To encourage the development of the skills within creativity within schools, the government could introduce a policy which clearly states how and where it can be used across the curriculum. The introduction of the new National Curriculum has led to a narrower curriculum and therefore creativity has been squeezed out. Having a clear and defined stance on creativity would give schools the autonomy to implement it and have a positive effect on teaching and learning.

Within the Academy, creativity could be defined and embedded across the curriculum and within teaching and learning. Teachers should be encouraged to develop children's creative skills across all subjects. Through practitioner research and being critically reflective, teachers' professional development would provide support, therefore promoting children's learning. Through the course of this research I have learnt how creativity is an essential area of development within school. Through being critically reflective of my own practice and discussing other teachers' perceptions I have developed and embedded new ideas into my own practice.

A statement about the loss of creativity in the transition from EYFS to Year 1 in the first interview piqued my interest and I made sure I asked the other interviewees about their views on this. This unexpected finding has led to me believe that there are other aspects to how and why children lose their creativity and that to

do further research in this area would be beneficial. It is this finding that has led me to investigate further whilst completing an EdD Education. ■

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