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Learning How To Clarify Complex Concepts For Children Through Naturalistic Inquiry: Moving Beyond Simplification

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ABSTRACT

The authors infer that pre-adolescents don't perform to their intellectual potential, because they aren't taught how to think and research independently. Teaching to the curriculum has become a requirement and this imposes restrictions on what can be achieved. The contention of this chapter is that a child can formulate effective thought independently through naturalistic inquiry. The question is posed - How do we teach a complex concept to a 6 year old child? The authors hypothesise an experiment thus: given an academic paper, is it possible to explain, without ambiguity, the essence of that paper to a child? The ideas encapsulated in this chapter can be extrapolated for returning adult learners and are particularly relevant to second language acquisition.

Key Terms: Natural Learning, Primary Education, Higher Order Thinking, Thought, Quality, Criteria, Self-defined Reality, Truth.

INTRODUCTION

Metacognition is intellectual self-consciousness – the mind turns on itself and thinks about its own thinking (Lipman 1987). Much research on metacognition, thinking and the nature of thought emanates from the domains of psychology, education and politics (Bensley *et al.* 2010; Hasslöf and Malmberg 2015; Underwood 2015; McPeck 2016; Cottrell 2017), although there has been a marked decline in thinking and thought research in recent years. This accumulation of research has influenced the curriculum (Wood 2004) and prompted government action at primary level. Teaching thinking is now recognised as one of the priorities of primary education (Higgins 2015).

In this chapter, the authors infer that the average pupil or learner does not perform to his/her intellectual potential, particularly in the formative years, because he/she is not taught how to think and research independently, rather, they are forced to learn to a curriculum, often by rote and repetition of task, limiting their potential (Paul 1992; Carson 2007). Prawat (1992) emphasises that if "a concentration on the 'syntactic' and 'how to' aspects of thought lead us to ignore more substantive issues (what it is that we want students to think about), then the focus clearly is counterproductive" (Prawat 1992, p.378). Teachers can either teach pupils how to be thinkers or they can teach pupils content knowledge – they tend to overuse algorithmic mechanisms when teaching concepts to pupils. (Carson 2007). If primary education is to meet its core objective (transfer to second level education), teaching to the curriculum becomes a requirement and while teachers feel obligated to adopt interventions that satisfy that objective, this has left the teaching profession weary of interventional change, particularly when that change is not grounded in pre-established educational research. In addition, like most adults, teachers have forgotten how to think and view the world like children. Too often adults have the preconceived notion that they should simplify the content, but in the process they weaken concept integrity. The contention of the authors is that a child can formulate effective thought independently through naturalistic inquiry.

Caroline posed the question - How do we teach a complex concept to a 6 year old child? The authors hypothesise an experiment thus: given an academic paper, is it possible to explain, without ambiguity, the essence of that paper to a child?

BACKGROUND

Sandberg and Barnard state that "it is easily assumed that learning itself proceeds smoothly and causes no particular difficulties. When learning is confronting difficulties, often external factors are held responsible, not some inherent difficulty in the learning process itself. Explanations for poor learning results found in terms of external factors usually range from pointing out the inadequacy of the subject matter area, the inadequacy of the student sample, to the inadequacy of the didactic approach"(Sandberg and Barnard 1997, p.15) . The authors contend that the cognitive processing that engages the student in meaningful learning can be fostered by the adoption of teaching practices that stimulate cognitive activity and that are compatible with naturalistic inquiry. The authors take their definition of 'meaningful learning' from Novak who defines it as a process that builds an "integrated framework of concepts and propositions, organised hierarchically, for a given domain of knowledge" (Novak 1998, p.22). Building expertise requires a continuous process of meaningful learning (Novak 1998). The authors describe how a concept can be taught to a child as a function of a naturalistic inquiry in a manner which will promote and foster meaningful and contextualised learning.

Almost all teaching, whether primary, secondary or tertiary, follows the model of classroom instruction, illustrated by the following diagram, which implies that for a given student, certain instructional processes lead to classroom learning that is reflected in achievement score (Fisher *et al.* 1981). In this model student aptitudes are of central importance.

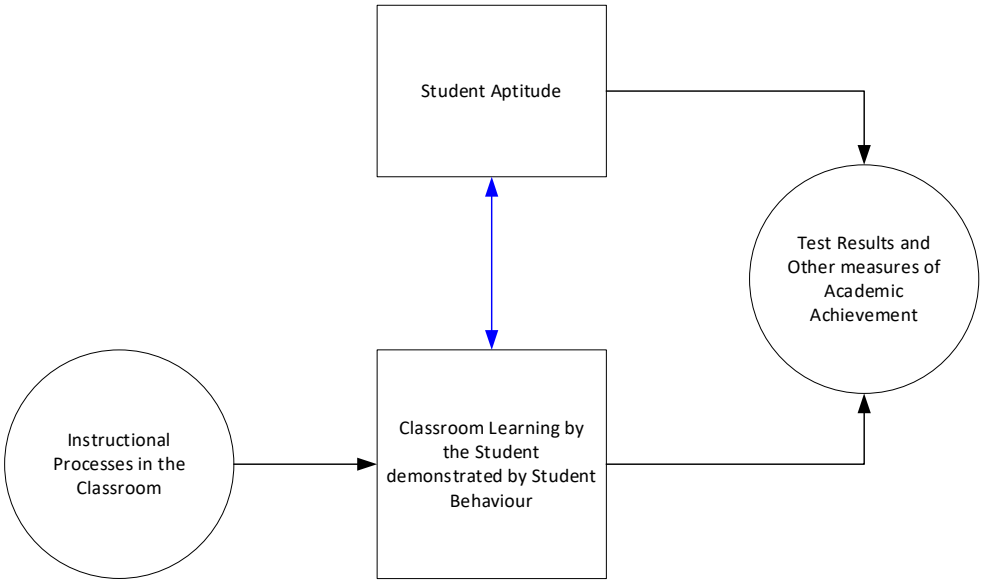

Figure 1. Learning System (Fisher *et al.* 1981)

The vast majority of the critiques of educational reform, contrary to the model presented above, have urged teachers to adopt approaches to teaching that actively involve the student in the learning process, focus on critical thinking (in addition to traditional rote learning and memorisation) and on teaching innovations that lead to longer lasting and more meaningful learning (Bennett and Desforges 1991; Troman *et al.* 2007; Van Twist *et al.* 2013; Marques 2014; McNamara *et al.* 2017). Paul (1992) makes the case succinctly when

he infers that pupils “should not unquestioningly believe what spontaneously occurs to them” and should not accept everything they are taught as valid unbiased truth (Paul 1992, p.9). Furthermore he states that “much academic learning is of a lower order … associative and inert”, occurs within a framework that values repetition and procedural mechanism (follow a series of ordered steps in to determine the correct answer) and that much of it is “an obstacle rather than an aid to education…[and]..blocks genuine understanding” (Paul 1992, p.9,10). This observation is shared by other academic writers (Paul and Binker 1990; Mitroff 1997; Doherty *et al.* 2005).

Paul argues that by focusing on the natural and rational cognitive abilities of pupils, so that they can “grasp the sense and logic of what they learn, we can make all additional learning easier for them” (Paul 1992, p.9,10). Lipman (1987) further asserts that thinking encompasses “analysing, judging, hypothesising, explaining and many other cognitive activities besides deciding and problem solving” (Lipman 1987, p.5). Lipman states that critical thinking can be defined by three characteristics (1) it is self-corrective thinking, (2) it is thinking with criteria and (3) it is thinking that is sensitive to context (Lipman 1987). In other words, encouragement of thinking is a complicated issue - if too much emphasis is placed on *simplifying,* the cognitive potential of children is not recognised and valued. Focus should be on a process of concept clarification that permits children to think in a way that is compliant with Lipman’s criteria.

This obviates the question “how much emphasis is placed on thinking in the national curriculum for primary education?”. To address the curriculum needs at the beginning of the 21st century the UK government, through the Qualifications and Curriculum Authority (QCA) in England (1998-1999, 2005-2007) and the Council for Curriculum Examinations and Assessment (CCEA) in N. Ireland (2000 – 2004) carried out a series of curriculum reviews that resulted in the adoption of the current curriculum for primary education.

The CCEA’s published curriculum, ‘The Northern Ireland Curriculum: Primary’ expresses, in several passages, the obligation on teachers to emphasise higher thought, this translates in practice into two small sections of the document. The Thinking Skills and Personal Capabilities Framework is mentioned in section 1.4 and allows teachers ‘to teach the knowledge, skills and understanding in ways that suit individual pupil’s ability Thinking skills, according to the curriculum, are ‘tools that help children to go beyond the acquisition of knowledge to search for meaning, apply ideas, analyse patterns and relationships, create and design something new and monitor and evaluate their progress’.

The prescription for thinking skills is articulated in section 1.6_4 and emphasises that thinking includes:

- sequencing, ordering, classifying, making comparisons;
- making predictions, examining evidence, distinguishing fact from opinion;
- making links between cause and effect;
- justifying methods, opinions and conclusions;
- generating possible solutions, trying out alternative approaches, evaluating outcomes;
- examining options, weighing up pros and cons;
- using different types of questions;
- making connections between learning in different contexts.

Review of the text of the curriculum indicates that there is no prescriptive guidance on how to teach these skills.

Two observations can be made at this juncture (a) the model of classroom instruction described in Fisher et al (1981) remains de-rigeur and (b) that 'thinking' in the context of a pupil developing his/her own world view of an object in the tradition of constructivism is marginal in the curriculum and fails to include the process of focus and refocus until there is a high degree of conceptual clarity.

NATURALISTIC INQUIRY AND CONCEPTUAL UNDERSTANDING

The primary goal of this chapter is to engage in the process of explaining complex concepts. Caroline posed the question, "How do we teach a complex concept to a 6 year old child?" The authors hypothesise an experiment thus: given an academic paper, is it possible to explain, without ambiguity, the essence of that paper to a child? Here the naturalistic inquiry paradigm is used as both the object of the exercise (complex concept) and as the method to explain that object. In this chapter, the authors deliberately focus the thematic centre of argument on the question "why are there clouds in the sky?"

The authors postulate an experiment whereby a child is tasked with answering the question. The child is encouraged to develop a naturalistic inquiry, the results of which reflect the child's understanding of cloud formation. The process by which this determination is made is, in turn, used by the authors to explain the concept of 'naturalistic inquiry' to a child. By focusing on child-centric naturalistic inquiry, children construct, for themselves, their own conceptual reality. We hypothesise that this process can be used to encourage individual learners to think independently and embrace learning culture.

The basic premise and process of clarity developed through naturalistic inquiry is one that can be used with learners across the lifespan. Having worked with second language learners, the authors have developed skills and strategies as teachers to clarify the language used to convey concepts. The authors examined strategies in second language acquisition which are based on making concepts comprehensible for individuals working in a new language and the two areas of focus deal with syntactical and with lexical aspects of the concepts. It is not surprising that these two areas are considered core since they are aspects of 'simplification' and feature prominently within readability formulas. The strategy that we propose of considering how you would explain something to a child generally requires individuals to select lexical items that are easy to understand, and syntactical constructions which are less complex, for example, simple present tense instead of a passive voice (Grabe 1991).

There are numerous works within the language teaching and learning literature containing prescriptions for practice, however, most tend to exhort a logico-deductive approach as opposed to approaches derived from practice. This is slowly changing as language learners of all ages and their teachers tire of pedagogical fashion. Nunan argues that if language knowledge is tentative and contingent on context, rather than absolute, then the students and teachers should adopt a research orientation (Nunan 1992). Teachers and students must formulate realistic research questions, adopt appropriate procedures for collecting and analysing data and present the results of their inquiry in a form that is accessible to others. This can be realised through the adoption of the naturalistic inquiry paradigm in precisely the same manner as with children, language concepts can be explored to enable adult learners to develop critical and analytical skills that will empower them to read and evaluate reports in an informed and knowledgeable way (Nunan 1992). As an example, a student fluent in the English language could be asked to prepare and present a short report on today's news in Italian, a language that they currently learning. To complete the task the student may watch television news channels or listen to radio channels in English. The existence of bias in media reporting creates an opportunity to explore different facets of truth and to become

aware of a range of perspectives (Fox News, CNN, Al Jazeera etc). Since 'truth' is paramount in naturalistic inquiry and since the knowledge is tentative and contingent on context, adoption of a naturalistic inquiry paradigm is appropriate.

Additionally, language ultimately conveys meaning, truth needs to be represented in words and sentences and this must be performed with respect to language localisation, for example, in Italian, Vuoi ballare con me? (would you like to dance with me?) is C'abballi cu mia? in Sicilian. While not necessarily introducing ambiguity for Italians, this can be a source of confusion for learners of the Italian language. By focusing on the concept of 'journalistic truth' and on the rigour of the exercise in establishing reliability and validity, students will come to the realisation that the language used to convey meaning must be logical, correct, contextually appropriate and audience oriented. Like ethnography, naturalistic inquiry can provide insight into conceptual systems through unregimented observation and description.

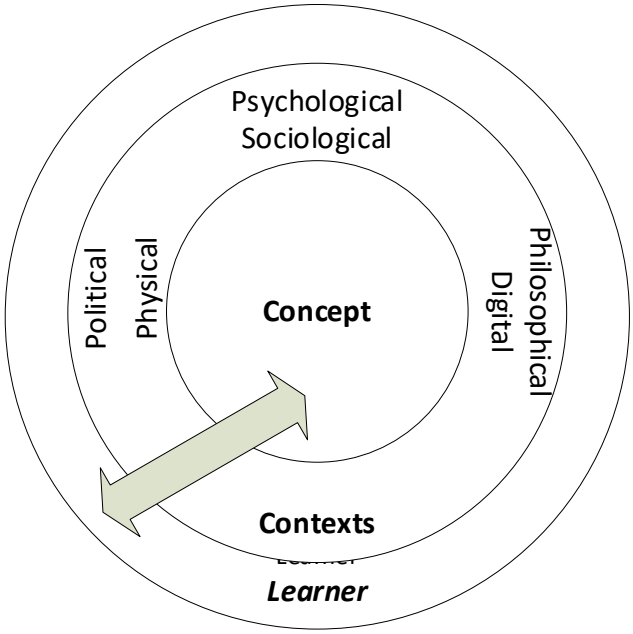

Fig. 2 The Conceptual System

While not a panacea for language teachers and learners, the paradigm of naturalistic inquiry is a tool that can be used to explore concepts through natural and authentic language in a manner that is conducive to meaningful communication, that is inclusive of a range of perspectives, where that communication takes place in a particular context and is shared by a particular audience (see Fig 2). Guba (1978) and Lincoln and Guba (1985) provide insight into the use of language learning diary studies in naturalistic inquiry and excellent insights into working with older learners can be found in Schulz and Elliot (2000) and Cummins (1981).

NATURALISTIC INQUIRY, COMPLEXITY AND CHILDREN

Guba's (1981) paper on naturalistic inquiry titled 'Criteria for Assessing the Trustworthiness of Naturalistic Inquiries' is selected as an exemplar largely because of the appeal of the naturalistic inquiry paradigm as a catalyst for higher order thinking and because it incorporates criteria for assessing the trustworthiness of inquiry outcomes. The authors

attempt to find a mechanism to serve as a framework to explain the essence of Guba's paper to a six year old child.

Guba's paper provides a framework for judging the trustworthiness of inquiries conducted within the paradigm of naturalistic inquiry. The authors ask the question 'precisely what are the criteria for judging trustworthiness that ought to be applied to this class of investigations?' Guba's paper outlines four key criteria; credibility, transferability, dependability and confirmability that are deemed to be critical in assessing the trustworthiness of a naturalistic inquiry. Naturalistic inquiry is a paradigm to support holistic disciplined inquiry, the outcome of which can represent multiple realities and truths.

It is not the intention of the authors to construct (or mimic) a child's reality, we are clearly out of our depth as adults and such a task would not be possible, however, the desired outcome of this chapter is to create a mechanism for understanding, such that, given a complex task – that is, explaining the concept of naturalistic inquiry and the nature of the criteria for assessing the truthfulness of the inquiry, a child of primary school age (6 years old) could construct a reality for the concept that would conform with that of an adult. Rather than construct that reality, the authors merely demonstrate how it could be constructed. Neither are the authors interested in providing a detailed description of naturalistic inquiry, the contrast between naturalistic inquiry and rationalism or indeed of judgement criteria, readers interested in the detail of the paradigm are referred to Guba and Lincoln (1985), wolf (1979) and wolf and Tymitz (1977). The authors are primarily interested in finding ways that a child could construct, for himself or herself, his or her own conceptual reality of a complex concept through disciplined naturalistic inquiry, given an appropriate data toolset and the ability to use that toolset. So for example, we can, in an effort to explain the 'concept' of naturalistic inquiry say to the child:

> When you ask me why there are clouds in the sky, instead of me giving you an answer, I am going to help you find a number of youtube videos and simple explanations that will help you to create a 'story' that you can use to explain the reason why there are clouds in the sky.

Here there is a need to explain to the child that the acquisition of knowledge is a process that involves the physical observation of the phenomenon (clouds in the sky) and exploration of that phenomenon through unstructured inquiry (the reason clouds exist). Observation and exploration reinforce one another in a way that uses innate human intelligence to create, what machine learning theorists refer to as conceptual clustering (Michalski and Stepp 1983). Naturalistic inquiry involves utilising "what one comes into the world with (i.e. five senses plus intuition) to gather, analyse, [frame and reframe the analysis] and construct reality from data" (Erlandson 1993, p.82). To explain the 'process' of natural inquiry to a child then the authors use the following sentence:

> You now know why there are clouds in the sky. The way that you found out this Information, by watching or observing the cloud in the sky using your senses and exploring the reasons why the clouds are in the sky is a natural way to learn. This is the whole idea behind naturalistic inquiry.

How does this fit with the naturalistic framework or paradigm? What is effectively being required of the child or target learner is to construct a self-defined reality from a myriad of possible data sources. Two (or more) children, given access to the same source material, may approach that material in completely different ways. One child may decide to view the videos in a particular order, while other children may view videos in a different order, partially view, skip or ignore the videos. Some children may selectively choose the material, other

children may elect to further research auxiliary concepts that strengthen their conceptual understanding of reality. Some children will engage with the material, others skim the material. In any event, it is likely that children will form realities that are divergent rather than convergent. This is consistent with the naturalistic paradigms assumption of multiple realities (Guba 1981; Erlandson 1993). It is critical that an explanation of the reasons that the child's interpretation of cloud formation is different from those of other children is given to that child. So to explain the 'nature of reality' the authors might say to the child;

> What is real for you is based on what you can see, taste, touch, smell and hear, but also on what you feel, what is fun and what you fear. Let's imagine that I can take away your sense of taste when you are born – your experience of eating food may now be based on the texture and colour of the food, rather than the taste. But your experience of food will now be different from other children who can taste food. That does not mean that your experience is less valid than that of other children, it is just different. Your reality will be slightly different from that of other children and can be reframed and focused. So when we consider why clouds are in the sky, It is reasonable to assume that your reality might be different from another child's reality, because you have used different text and videos to create that reality.

In relation to the methodology used by the child to conduct the inquiry, the authors follow the central tenants established by Guba (1981) (a) no prescribed discovery methodology on the part of the inquirer is implied and (b) the inquiry imposes no a priori units on the outcome. Here, the authors imply that a child should be free to choose the topic of the inquiry. A teacher may assist in formulating the question and guide the child towards an appropriate toolset, but should not influence how the child chooses to use that toolset. The inquirer and the object of study are therefore interrelated. A teacher can initiate inquiry by explaining the purpose of the inquiry to the child, i.e. to help that child think independently. The process involves conceptualisation, research, reinforcement and knowledge absorption. In explaining what the child's role is in the process and what the child should do, the authors suggest the following answer:

> You learn to think about why the cloud is in the sky (conceptualisation). You learn to find out about why there are clouds in the sky (research). You learn that different people may have different opinions of why there are clouds in the sky (reinforcement). You learn how to learn (knowledge absorption). You have to think about what you know for certain, who might be able to help you to see and touch and question things that are unfamiliar.

The child may question the nature of truth at this juncture (which of the versions of the cloud formation hypothesis is true?). Lincoln and Guba (1985) formulate truth as "a systematic set of beliefs, together with their accompanying methods; a paradigm", they state that "a paradigm is a world view" produced from a methodology, the application of which results in a set of currently held beliefs (Lincoln and Guba 1985, p.15) . Here, the authors assert that the truthfulness of an outcome of the inquiry is paramount, but all outcomes are not equally valid. When dealing with simple concepts (cloud formation) establishing truth is relatively straightforward, but when dealing with more social concepts (friendship), truth is subjective and depends on the perspective of the individual child and on that child's self-interpretation of the inquiry outcomes. Additionally, there is the issue of who judges the truth of the inquiry (and the objectivity of the judge) and the socio-moral ethics associated with the revelation of that judgement to a child. Julienne Ford (Ford 1975) discusses four types of truth: empirical truth, logical truth, ethical truth and metaphysical truth. Empirical truth, formulated

as a hypothesis or predicate, can be said to hold if it is consistent with nature and can be tested for truthfulness against some external norm (Lincoln and Guba 1985). It is this type of truth that the authors attribute to the outcomes of a simple knowledge domain inquiry where the truthfulness of the inquiry outcome is based on external validation that does two things (a) establishes conceptual truth and (b) aligns the child's perception of the outcome of his or her inquiry with that truth. That is not to say that the other truths are unimportant, they are equally valid, but given that the objective of the child's self-inquiry is to help that child develop an ability to think independently, structure knowledge and self-validate that knowledge, doing so in a way that corroborates or matches accumulated knowledge with an external norm is appropriate.

Propositional knowledge -knowledge that can be framed in language, and tacit knowledge – feelings or intuitions, are therefore equally valued. This is different or a departure from Guba's prescription for successful implementation of naturalistic inquiry but is consistent with the paradigm. Guba states that to seek an "appropriate balance between rigor and relevance seems sensible…both tacit and propositional knowledge are useful…. competent investigators translate tacit knowledge into propositional knowledge as quickly as possible (Guba 1981, p.79). In explaining the proposition of truth to a child, the authors use the following sentence;

> Truth requires evidence, it is not the same as opinion, belief or claim. Truth is about clarity, truth isn't about eliminating some of the evidence to make it easier to understand or simpler to explain, it is about keeping the core ideas and fine-tuning them to make sure they are in clear view. You need to answer the question "why are there clouds in the sky" and you need to show evidence of how you arrived at your answer. You need to make sure you keep all of the pieces of information. You need to consider who and what will provide you with evidence, what kinds of things you will ask them and what kinds of things you will look for. It is your understanding that is important.

Moreover, Guba (1981) suggests that any inquiry should demonstrate credibility. Inquiries, according to Guba, can be affected by Factor Patterning which produces the effects of non-interpretability. He suggests a number of steps to take during and after a naturalistic inquiry to mitigate these effects, but none of the during-inquiry interventions have any meaning in the context of the self-inquiry of a child, but may be appropriate for adult learners investigating more complex phenomena.

The interventions that Guba (ab. cit.) suggests post-inquiry are designed to enhance credibility and produce findings that are plausible. Here the authors diverge from Guba's prescriptive trustworthiness criteria and pragmatically introduce a methodology which we feel offers the best fit with the phenomenon, event or situation, under study. By externally validating or having an outsider check of the findings of the child's inquiry, we establish a holistic working hypothesis of the truth (one that is time bound in the present and reflects current knowledge, has credibility and produces an outcome that is plausible) (Guba 1981). External validation, while diverging from Guba's prescription, is nonetheless, compatible with the prescribed interventions of 'establishing structural corroboration or coherence', 'establishing referential adequacy' and 'member checks'. The divergent realities representing the outcomes of pupil inquiries are aligned with a commonly understood reality and this is akin to "testing every datum and interpretation against all others to be certain that there are no internal conflicts or contradictions" (Guba 1981, p.85). Collections of videos and other material used in inquiries can be assessed for appropriateness (referential

adequacy) and longitudinal approaches can support validation over time. In explaining external validity to a child the authors can use the following:

> We have established that when you say that you know why there are clouds in the sky that you need to provide evidence. We know also that this evidence must represent truth. We have also established that you can have a different idea of what the truth is than someone else. Would you trust an expert? If we compare your opinion with that of the expert and they are the same, then we have established the true reason why there are clouds in the sky.

Guba (1981) emphasises that it is possible that some transferability between two contexts may occur because of certain essential similarities between them. A pupil's ability to transfer a newly acquired conceptualisation to a new settings and the durability of that transfer (Georghiades 2000) is characteristic of the naturalistic inquiry paradigm. In the author's methodology, thick descriptions are inherent, rich amounts of detail are discovered and recorded. Lincoln and Guba (1985) argue that a thick description provides others with a repository for making judgements about the transferability of findings to other milieu (Bryman 2015). In the context of naturalistic inquiries conducted by primary school children, direct transfer of conceptualisations will depend on the complexity of the knowledge domain and transferability across contexts may occur because of shared characteristics. In the traditional study, it is the "obligation of the researcher to ensure that findings can be generalised to the population, in a naturalistic inquiry the obligation for demonstrating transferability belongs with those who would apply it in the receiving context" (Erlandson 1993, p.33). So the obligation to demonstrate transferability rests with both teachers and the pupils themselves. The authors argue that method is more transferable that conceptualisations, once children adopt the naturalistic inquiry paradigm to determine an inquiry outcome that is rich in meaning, individualised and moderated, that child will be able to apply the same method of inquiry to other knowledge domains.

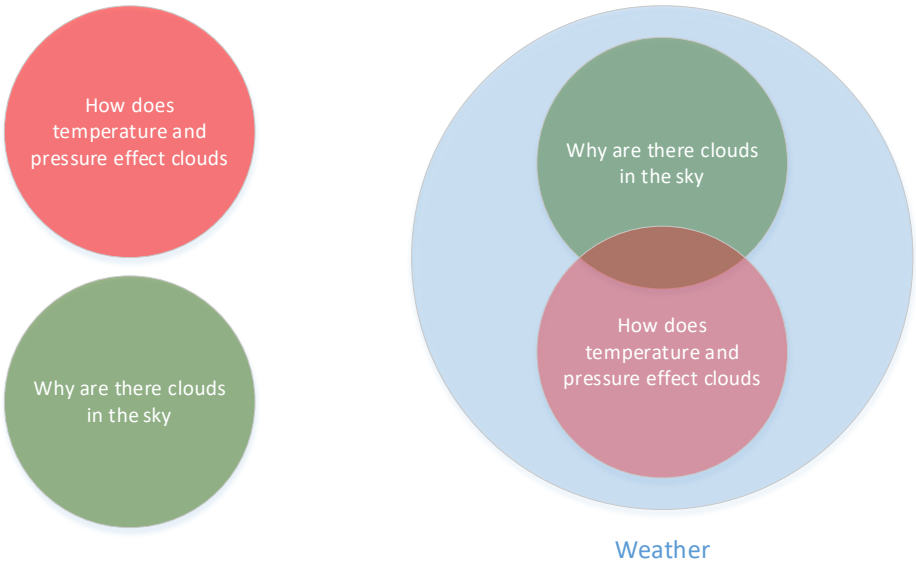

Fig 3. Conceptual Merging

The authors emphasise that the process of naturalistic inquiry is repeatable with different contexts, that the method of inquiry used by the child, although unstructured, could mutate over time as the child becomes more and more familiar with the process of inquiry and that this may be the catalyst for transferability. The cognitive concept of transferability is illustrated in the diagram above (Fig. 3). Here the child undertakes two naturalistic inquiries, the combination of the two creates a new concept of 'Weather', the intersection between the two spheres represents transferred knowledge.

A pertinent question to ask at this juncture is 'how dependable is this methodology as a catalyst for deeper thinking? In a naturalistic inquiry the relationship between findings and dependability is difficult to establish, partly because of qualitative error and reality shifts, thus the rationale put forward by naturalistic researchers (Guba 1981; Lincoln and Guba 1985; Erlandson 1993) is that the goal of inquiry for dependability is trackable variance (Guba 1981), variability in findings that can be ascribed to a particular source. To provide a check on dependability, researchers must make it possible for an external check on processes to be conducted (Erlandson 1993). In our methodology, aligning pupil inquiries with a norm conceptualisation provides dependability, given an acceptance that pupils, as individuals conducting an inquiry, may produce diverging findings that through consistent feedback and careful correction can be made conform to a norm. As a result, children given the context of the naturalistic inquiry and the tools to carry it out, should, following feedback and correction, have a common view of the context. A dependability audit on the processes used by the child to conduct the inquiry is irrational, however, the processes of alignment to a norm should be transparent and auditable. The audit step, or process of double checking, will render clarity rather than simplicity when each aspect or part of the concept has remained intact. It is important to note that with the example above the concept of temperature **and** pressure are still present.

A prominent theme in Guba (1981) is the issue of confirmability. Confirmability is the degree to which the findings of a naturalistic inquiry can be corroborated by others. Guba establishes that data and interpretational confirmability can be assessed by a process of rigorous examination of the procedures and methods for collecting data such that "the inquirers predictions are tested as strenuously as possible" (Guba 1981, p.87). Additionally, Guba argues that a researcher should "intentionally reveal to his [or her] audience the underlying epistemological assumptions which cause him [or her] to formulate a set or questions in a particular way" (Guba 1981, p.87). To confirm a naturalistic inquiry, Guba argues that a confirmability audit can be performed that certifies that "data exists to support every interpretation and that the interpretation has been made in ways consistent with the available data" (Guba 1981, p.88).

In consideration of naturalistic inquiries carried out by children, it is the view of the authors that the level of documentation required to explore and/or confirm each interpretation imposes an unnecessary cognitive and procedural load that could be counter-productive to the learning process. However, a confirmability audit should be performed on the 'norm' conceptualisation with which pupil interpretations are compared in an effort to confirm the truth of that norm interpretation and to establish the extent of originator bias. This process should be as transparent as possible and subject to critical review. To explain the concept of confirmability the authors use the following paragraph:

> We have discussed how you might arrive at the truth by comparing your ideas on why there are clouds in the sky with the expert's view. How do we know that the expert's view is the truth. If that expert's view can be compared with other expert's

views and if the ways that they arrived at their conclusions are similar, then we can confirm that the expert's view is correct.

Cognisance is given to alternative perspectives on the issue of confirmability. Susan Morrow asks two pertinent questions - "If we acknowledge multiple realities, how can we assure that those involved in the research are the "true" knowers?" and "if the researcher is the instrument of the investigation, how is it possible to conceive of confirmability?" (Morrow 2005, p.252).

ISSUES, CONTR|OVERSIES, PROBLEMS

If the preceding analysis has meaning, a number of implications can be drawn from it.

1. There is an embedded contextual duality of meaning in the substance of this chapter. The duality exists because the authors attempt to explain the concept of a naturalistic inquiry and it's criteria for trustworthiness in the context of a naturalistic inquiry conducted by a child. No procedures have been prescribed for completion of the child-centric inquiry, in fact, inquiry topic is relatively benign. However, we suggest that this method, if adopted, could act as a catalyst for instilling higher order thinking skills in young children and develop in them a culture of intellectual exploration.

2. The method of child centric inquiry is robust. Classroom inquiry outcomes, open-ended processes, are moderated against an expert derived norm. Children are encouraged to develop freeform outcomes and to justify their findings. Comparison with a norm, then, moderates their conception of the subject under inquiry. The processes taken should be open and transparent and subject to audit to ensure "intellectually sound standards for belief, truth and validity" (Paul 1992).

3. There are profound reasons for cultivating the standard of thinking that this chapter would aspire to achieve. As early as 1987 authors have suggested that only a small percentage of school leavers can reason effectively about what they read and write. "That means the majority don't have the critical thinking skills we need in an economy like ours that's based on information and knowledge" (Applebee *et al.* 1987, p.3). They argued that teaching the subjects of the curriculum might not be enough and that "thought must be taught". Generally well intentioned government initiatives have driven the educational agenda in recent years. These have met with varying degrees of success. Wood has attributed this to "detailed implementations which are not fully thought through, and piloted either insufficiently or not at all" (Wood 2004, p.371). The authors of this work contend that by teaching thought at primary school level, the principles of reasoning, questioning, comparing, deliberating and truth can form the foundation for critical and lateral thinking in later phases of the educational experience.

4. The authors also borrow lessons from working with adults who are developing skills in a language new to them and as educators believe that querying, debating, etc. can be present by making certain that the essential dimensions of a concept remain in place even if the individual words have been simplified. We have noted, albeit anecdotally, that our adult second language learners attach their own cultural and linguistic capital to the concept which can only enhance the level of criticality.

5. Wood (2004) suggests that attempts to correct old initiatives in education or create new ones can lead to initiative fatigue and teacher demoralisation. Contrary to this position, the authors would argue that the initiative is simple, it follows a simple line of inquiry that compliments the natural approach to thinking about an issue. Occam's razor states that where two (or more) explanations for an occurrence exist, the simpler one is usually better. As a consequence, we can determine that the simplicity that underpins this

paper, hides a powerful antecedent in the contextual framework of rational thought. The authors do not infer that this approach is unique, it is loosely based on Socratic questioning (Padesky 1993), is simple in orientation and is not a panacea, but it does provide a stimulus for thought. They also feel that this same naked simplicity can be applied as a means to engage adults who are second language learners.

CONCLUSION

The primary benefit of applying a naturalistic inquiry to the question 'why are there clouds in the sky?' is not the knowledge that is absorbed by the child and emerges as an output of the inquiry, it is rather the self-disciplined process which the child takes in order to arrive at a conclusion. This process is repeatable and can lead to transfer. The child learns independently how to conduct an inquiry that it meaningful, engages the child in knowledge acquisition and promotes higher order thinking. It is the rational approach to inquiry that creates the spark that initiates neural responses and meaningful educational experiences. Thus teaching higher order thinking skills to primary school pupils is "best conceptualised not as a matter of teaching isolated abilities and dispositions, but rather as fostering the initiation of students into complex critical practices that embody value-commitments and require the sensitive use of a variety of intellectual resources in the exercise of good judgement" (Bailin *et al.* 1999, p.298).

The caveat, however, is that the source material on which the inquiry is conducted must be of a standard that engages, stimulates and embodies the core principles of the topic under inquiry. Truth is a secondary consideration that can be ratified through the process of self-reflection and comparative normalisation. YouTube is not a particularly good source of explanatory videos in the context of unguided naturalistic inquiry for primary education. YouTube is largely a repository for unmoderated video distribution. A YouTube search for 'cloud formation' produces 675,000 results, a search for 'why are there clouds in the sky?' creates 545,000 results, while 'how are clouds formed?' returns 136,000 results. Better search strategies may narrow the focus but are unlikely to return videos that are (a) suitable for a specific age-group, (b) created using peer-review or (c) produced with appealing visual content.

While the child-centric videos embody the scientific concepts and principles of cloud formation, the language used to explain those concepts and principles is unsuitable for comprehension by primary school pupils. Terminology that has no contextual meaning or reference for a child is often used in adult conceptualised explanations. Words like precipitation, condensation, infiltration and evaporation are words that have abstract semantic meaning. For example, evaporation is change in the surface of a liquid as it changes to a gaseous state and this can be demonstrated by experiment. The suggestion is that the understanding of a child is predicated on the degree of ambiguity created by the descriptive language - the greater the ambiguity, the lesser the understanding. An approach to overcome this might be to decouple the auxiliary concepts from cloud formation, prior to a naturalistic inquiry, and to explore these auxiliary concepts through experimentation. This approach would clarify the underlying scientific principles and permit a child to embrace the wider cloud formation concept with greater enthusiasm. Additionally, YouTube videos are rarely peer reviewed prior to distribution, this is evidenced by the embodiment of scientific inaccuracy in a small number of the videos. A critical component of videos in educational contexts is the furtherance of understanding created by the juxtaposition of images and explanation. Videos that achieve their purpose in an educational context are those that manage this task particularly well. Video producers that assess their audience prior to video production, who manage content so that understanding is prime and who carefully construct images and sound in the furtherance of the objective of education are rare. This has implications for the approach taken in this chapter, it may be

prudent to pre-select a video repository. Context sensitivity in respect of (a) the age of the child, (b) his or her ungratified curiosity and (c) the data source is critical if learning is to occur. A short child-centric summary is tabulated below.

Critics of this approach may argue that this is just common sense. We justify our arguments with a nod to A.N. Whitehead who remarked 'you may polish up common sense, you may contradict it in detail, you may surprise it. But ultimately your whole task is to satisfy it' ('A N Whitehead addresses the British Association in 1916' 2018)

Naturalistic Inquiry Approach	Related Questions	Tentative Answers to the Questions
What is a naturalistic Inquiry? You need to look and watch, you need to observe, you need to explore.	What do you want to learn from your study? Where do you need to go to learn these things?	When you ask me why there are clouds in the sky, instead of me giving you an answer, I am going to help you find a number of youtube videos and simple explanations that will help you to create a 'story' that you can use to explain the reason why there are clouds in the sky. The way that you found out this Information, by observing the cloud in the sky using your senses and exploring the reasons why the clouds are in the sky is a natural way to learn. This is the whole idea behind naturalistic inquiry.
What is the nature of reality? What is real? What can you see, taste, touch, smell and hear? What can you feel, what is fun, what is joy, what do you fear?	What are the things you know for sure about your proposed research?	Clouds exist, you can see them So what is real for you is based on your senses but also on what you feel and what you know. Let's imagine that I can take away your sense of taste when you are born – your experience of eating food may now be based on the texture and colour of the food, rather than the taste. But your experience will now be different from other children who can taste food. Your reality will be different from that of other children.
What is the nature of the inquirer/object relationship?	What are the things you know for certain?	You learn to think about why the cloud is in the sky (water evaporation and vaporisation). You learn to

It is learning how to think about the subject of research. It is learning how to find out about the subject of research. It is learning about the opinions of others. It is learning how to learn.	Who might be able to help you figure out things you don't know for certain?	independently find out about why there are clouds in the sky (air currents and troposphere). You learn that different people may have different opinions. You have to think about what you know for certain (initially, just that clouds exist and rain and snow come from clouds). You select your sources.
What is the nature of truth statements? You need to know something and you need to have evidence.	Who will provide you with the evidence? What kind of things will you ask them? What kind of things will you look for?	Truth requires evidence, it is not the same as opinion, belief or claim. You need to answer the question "why are there clouds in the sky" and you need to show evidence of how you arrived at your answer. You must have sufficient information to back up your opinion and you need to tell us where you got that information. You need to show how you arrived at your opinion as to why there are clouds in the sky.
What is external validity? You need to know why there is a need to align your opinion with that of an expert.	Who is the expert? Can the expert be wrong? Is the expert's opinion the same as other expert's opinions?	We have established that when you say that you know why there are clouds in the sky that you need to provide evidence. We know also that this evidence must represent truth. We have also established that you can have a different idea of what the truth is than someone else. Would you trust an expert? If we compare your opinion with that of the expert and they are the same, then we have established the true reason why there are clouds in the sky.
What is transferability? When you research why there are clouds in the sky, you are introduced to other concepts, like rainfall. When clouds carry rain over land and rainfall occurs we have weather.	What type of concepts lead to transfer? Is method transferable?	Transferability is the idea that you can learn from researching one concept and use what you've learned to better understand another. Simple concepts are best. It is your and your teacher's responsibility to

		show that you have transferred what you know. You can use the same method to research other concepts and go about the task of researching in the same way but with a different set of resources.
What is the nature of dependability? To check for dependability we need to be able to say that if a class were to carry out a naturalistic inquiry, that each member of the class would eventually have a common view of why there were clouds in the sky	Why does aligning an inquiry's output to an expert create dependability?	Dependability is achieved when two or more inquiries result in the same opinion. Aligning your opinion of why there are clouds in the sky with that of an expert provides that dependability.
What is confirmability? It is the degree to which the findings of a naturalistic inquiry is the same as others	What data did the expert use? How did the expert arrive at his opinion? What other experts will be used to corroborate opinions?	We have discussed how you might arrive at the truth by comparing your ideas on why there are clouds in the sky with the expert's view. How do we know that the expert's view is the truth? If that expert's view can be compared with other expert's views and if the ways that they arrived at their conclusions are similar, then we can confirm that the expert's view is correct.

REFERENCES:

A N Whitehead Addresses the British Association in 1916 [online] (2018) available: http://www-history.mcs.st-and.ac.uk/Extras/BA_1916_1.html [accessed 26 Feb 2018].

Applebee, A.N., Langer, J.A., Mullis, I.V. (1987) 'The nation's report card: Learning to be literate in America: Reading', *Princeton, NJ: Educational Testing Service*.

Bailey, K.M., Nunan, D. (1996) *Voices from the Language Classroom: Qualitative Research in Second Language Education*, Cambridge University Press.

Bailin, S., Case, R., Coombs, J.R., Daniels, L.B. (1999) 'Conceptualizing critical thinking', *Journal of curriculum studies*, 31(3), 285–302.

Bennett, N., Desforges, C. (1991) 'Primary education in England: A system in transition', *The Elementary School Journal*, 92(1), 61–78.

Bensley, D.A., Crowe, D.S., Bernhardt, P., Buckner, C., Allman, A.L. (2010) 'Teaching and assessing critical thinking skills for argument analysis in psychology', *Teaching of Psychology*, 37(2), 91–96.
Bryman, A. (2015) *Social Research Methods*, Oxford university press.
Carson, J. (2007) 'A problem with problem solving: Teaching thinking without teaching knowledge', *The mathematics educator*, 17(2).
Cottrell, S. (2017) *Critical Thinking Skills*, Macmillan Education.
Cummins, J. (1981) 'Age on arrival and immigrant second language learning in Canada: A Reassessment1', *Applied linguistics*, 2(2), 132–149.
Doherty, J.J., Hansen, M.A., Kaya, K.K. (2005) 'Teaching information skills in the information age: the need for critical thinking'.
Erlandson, D.A. (1993) *Doing Naturalistic Inquiry: A Guide to Methods*, Sage.
Fisher, C.W., Berliner, D.C., Filby, N.N., Marliave, R., Cahen, L.S., Dishaw, M.M. (1981) 'Teaching behaviors, academic learning time, and student achievement: An overview', *The Journal of classroom interaction*, 17(1), 2–15.
Ford, J. (1975) 'Paradigms and fairy tales: An introduction to the science of meanings, vol. 1', *London & Boston: Routledge & Kegan Paul*.
Georghiades, P. (2000) 'Beyond conceptual change learning in science education: Focusing on transfer, durability and metacognition', *Educational Research*, 42(2), 119–139.
Grabe, W. (1991) 'Current developments in second language reading research', *TESOL quarterly*, 25(3), 375–406.
Guba, E.G. (1981) 'Criteria for assessing the trustworthiness of naturalistic inquiries', *Educational Technology Research and Development*, 29(2), 75–91.
Guba, E.G. (1978) 'Toward a Methodology of Naturalistic Inquiry in Educational Evaluation. CSE Monograph Series in Evaluation, 8.'
Hasslöf, H., Malmberg, C. (2015) 'Critical thinking as room for subjectification in Education for Sustainable Development', *Environmental Education Research*, 21(2), 239–255.
Higgins, S. (2015) 'A recent history of teaching thinking', *The Routledge International Handbook of Research on Teaching Thinking*, 19–28.
Lincoln, Y.S., Guba, E.G. (1985) *Naturalistic Inquiry*, SAGE.
Lipman, M. (1987) 'Critical thinking: What can it be?', *Analytic Teaching*, 8(1).
Marques, S. (2014) 'Can we teach to think in primary schools? A comparative analysis of the English and the Brazilian National Curriculum and the impact of a small-scale cognitive enhancement study in Brazil.', *Procedia-Social and Behavioral Sciences*, 137, 138–146.
McNamara, O., Murray, J., Phillips, R. (2017) *Policy and Research Evidence in the'reform'of Primary Initial Teacher Education in England*, Cambridge Primary Review Trust.
McPeck, J.E. (2016) *Critical Thinking and Education*, Routledge.
Michalski, R.S., Stepp, R.E. (1983) 'Learning from observation: Conceptual clustering', in *Machine Learning, Volume I*, Elsevier, 331–363.
Mitroff, I. (1997) *Smart Thinking for Crazy Times: The Art of Solving the Right Problems.*, ERIC.
Morrow, S.L. (2005) 'Quality and trustworthiness in qualitative research in counseling psychology.', *Journal of counseling psychology*, 52(2), 250.
Novak, J.D. (1998) *Learning, Creating, and Using Knowledge*, Mahwah, NJ: Erlbaum.
Nunan, D. (1992) *Research Methods in Language Learning*, Cambridge University Press.
Padesky, C.A. (1993) 'Socratic questioning: Changing minds or guiding discovery', Presented at the A keynote address delivered at the European Congress of Behavioural and Cognitive Therapies, London.
Paul, R. (1992) 'Critical thinking: What, why, and how', *New directions for community colleges*, 1992(77), 3–24.
Paul, R.W., Binker, A. (1990) *Critical Thinking: What Every Person Needs to Survive in a Rapidly Changing World.*, ERIC.
Prawat, R. (1992) *Teachers' Beliefs about Teaching and Learning: A Constructivist Perspective*.

Sandberg, J., Barnard, Y. (1997) 'Deep learning is difficult', *Instructional Science*, 25(1), 15–36.
Schulz, R.A., Elliott, P. (2000) 'Learning Spanish as an older adult', *Hispania*, 107–119.

Troman, G., Jeffrey, B., Raggl, A. (2007) 'Creativity and performativity policies in primary school cultures', *Journal of education policy*, 22(5), 549–572.
Underwood, M.J. (2015) 'Searching for commonalities in the teaching of critical thinking skills, from Masters' to sixth form to primary'.
Van Twist, M., van der Steen, M., Kleiboer, M., Scherpenisse, J., Theisens, H. (2013) 'Coping with very weak primary schools: Towards smart interventions in Dutch education policy', *OECD Education Working Papers*, (98), 0_1.
Wolf, R. (1979) 'An overview of conceptual and methodological issues in naturalistic evaluation', Presented at the meeting of American Educational Research Association, San Francisco.
Wolf, R.L., Tymitz, B. (1977) 'Toward more natural inquiry in education', *CEDR Quarterly*, 10(3), 7–9.
Wood, E. (2004) 'A new paradigm war? The impact of national curriculum policies on early childhood teachers' thinking and classroom practice', *Teaching and Teacher Education*, 20(4), 361–374.

KEY TERMS AND DEFINITIONS:

Criteria: The criteria used to assess the quality of a naturalistic inquiry.

Higher Order Thinking: The atypical thinking that emanates from a naturalistic inquiry.

Natural Learning: An approach to learning in a manner that emulates nature.

Primary Education: elementary education for pre-teenage children.

Quality: mechanisms applied to a naturalistic inquiry to gauge truth.

Self-Defined Reality: A reality emerging as a result of a naturalistic inquiry.

Thought: The process of thinking, conceptualising and transfer.

Truth: The idea of a universal constant.