

Faculty of Education

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**Title:**

*Now with Feeling: The Impact of “Emotional Intelligence” on  
Everyday Problem Solving*

**Name:** Ronald Dean Balzan

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**Supervisor:** Professor Christine Howe

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## **Declaration**

*I hereby declare that the sources of which I have availed myself have been stated in the body of the thesis and references, and the rest of the work is my own. This thesis is no more than 20,000 words in length.*

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Ronald D. Balzan

## Abstract

This correlational, mixed methods study investigated the relationship between trait emotional intelligence and everyday problem solving. Most problems in life are ill-defined, or everyday, problems. Well-defined problems have been favoured in research, however, perhaps due to the ease with which they may be studied and their superior reliability and validity. The solution of well-defined problems is reliant on cognitive intelligence. Well-defined problems seem to have been studied under the assumption that knowledge gains will transfer to ill-defined problems, but this transfer has failed to occur. Cognitive intelligence seems to play only a minor role in everyday problem solving. Common sense suggests emotions, or emotional intelligence, empathy and self-awareness in particular, may play a role in everyday problem solving. Constructs of emotional intelligence underpinned by cognitive intelligence, however, may be disadvantaged in everyday problem solving. As a consequence, this study considered an emotional intelligence construct that is independent of cognitive intelligence, trait emotional intelligence, a personality trait. The Trait Emotional Intelligence Questionnaire Version 1.50 (Petrides, 2009) measured participants' dimensions of trait emotional intelligence. Due to the measurement challenges posed by everyday, or ill-defined, problems in research, everyday problem solving was construed to be the quality of argumentation as defined by Toulmin's (1958) Argument Pattern. Thirty University of Cambridge students were recruited to participate, each having teaching or teacher training experience. There was a significant relationship between trait empathy scores and the number of basic argument elements in the participants' responses to a hypothetical ill-defined classroom problem,  $r = .40$ ,  $p$  (two-tailed)  $< .05$ , and a medium effect. With  $R^2 = 0.16$ , trait empathy, therefore, shares approximately 16 per cent of variance in the number of basic argument elements. This finding suggests further research on the relationship between empathy and everyday problem solving may be warranted.

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# Now with Feeling: The Impact of “Emotional Intelligence” on Everyday Problem Solving

## 1. Introduction

You have a problem. In fact, you have many problems. As do I. We all have problems. And we will have many more. These problems are the problems of living. While it is also, of course, much more, life is a series of problems. Usually the problems are small, such as figuring out how to prepare a meal or indeed what to prepare. Sometimes, though, the problems are big, such as figuring out what to do with one’s professional life or how to educate a child.

Each of these problems is different. Yet, in a sense, they are the same. Each is an ill-defined problem. Every problem will be either well defined or ill defined. We are given everything we need to solve *well-defined problems*, including the way to solve them (Minsky, 1961). In life, however, well-defined problems are relatively rare. They can be found in mathematics books and cognitive psychology studies, but seldom elsewhere.

Most problems in life are ill defined. *Ill-defined problems* lack clarity in some critical respect, and solution strategies are largely ad hoc (Reitman, 1965). We need to decide, for instance, whether or not to attend university. That decision will depend on many things, including what it is we want to do with our lives, and we may not know.

Galotti (1989) refers to well-defined problems as *formal problems*; ill-defined problems, such as finding a job, educating a child, or saving a marriage, are *informal*, or *everyday, problems*. Everyday refers to ill-defined problems’ prevalence; informal refers to their loose natures. Formal, on the other hand, refers to the self-contained nature of well-defined problems. These terms—ill defined, informal and everyday; well defined and formal—will be used interchangeably throughout this thesis.

Calling ill-defined problems everyday problems, however, is not to belittle them. In the words of Fromm (1941):

Modern man lives under the illusion that he knows what he wants, while he actually wants what he is *supposed* to want. In order to accept this it is necessary to realize that to know what one really wants is not comparatively easy, as most people think, but one of the most difficult problems any human being has to solve (pp. 251-252).

To solve everyday problems is to successfully navigate life, but in their lack of clarity, these problems can be very difficult to solve.

When faced with an ill-defined problem, the solver invariably faces a sub-problem, that of attempting to clarify it, which often requires determining exactly that which is relevant to solution (Galotti, 1989). While all ill-defined problems are similar in their ill definition, they may be ill defined for two reasons. A problem may be ill defined due to its poor *representation* (Novick & Bassok, 2005), or modelling, by the solver, or it may be ill defined due to its nature. A problem may be ill defined due to either reason or both. Finding a cure for cancer, for instance, may be difficult because we have failed to accurately represent the problem, but we also may not yet possess the knowledge necessary to represent it any better.

The literature and we rarely, if ever, make this distinction. In failing to do so, we may default to a problem's nature to excuse a lack of progress, yet it is the representation we control. We may think we absolve ourselves of further responsibility for solving a problem, but we will only think we do. A poor representation will remain poor and the responsibility of the solver; nature's role neither increases nor decreases. If a representation distorts the true problem, a different problem will have been created, the wrong problem. Solution of the real problem will be at best inefficient and most likely unattainable.

In observing the poor quality and misdirected nature of cancer research, Watson (1973) predicted the propagation of well-intentioned, but mediocre work. To date, there is no

cure for cancer. Similarly, in “The Trouble With Brain Science,” Marcus (2014) attributed our relatively few answers in part to a lack of agreement regarding the questions being asked. And despite much research, we do not seem to have become markedly better at solving everyday problems (Galotti, 1989). After a reasonable effort has been made to solve a problem without success, we must ask ourselves if we are defining a problem to the best of our knowledge before we can legitimately chalk up the lack of progress to a problem’s nature. Perhaps we are too often trying to solve the wrong problem.

Assessing the impact of “emotional intelligence” on everyday problem solving is itself an ill-defined problem. Therefore, if we are genuinely interested in the problem’s solution, it behoves us to attempt to clarify its representation before we attempt to solve it. Should our solution then be unsatisfactory, marked progress in effect still eluding us, only then can we legitimately look to the problem’s nature for reasons.

The definition of *emotional intelligence*, for instance, like that of *intelligence* itself, is unclear and without consensus. Everyday problems, too, pose major challenges in research. As a consequence, to rely on either emotional intelligence or everyday problems in research without refinement will most likely lead us to a “solution” in name only, for we will most likely fail to advance our understanding and enhance our performance.

This thesis first surveys the problem solving, intelligence and emotional intelligence literature in pursuit of greater clarity. After attempting to clarify the problem and research question, this thesis then presents and discusses a correlational study that relates a measure of emotional intelligence to the quality of argumentation in attempting to solve a hypothetical ill-defined problem.

It is only by solving the right problems that we progress. To not try to solve a problem that is ours to solve over empowers the hands of fate, and chance is indifferent to our dreams. If we do nothing but hope our problems go away and wish for effortless progress, we will be

endlessly disappointed. And solving the wrong problem achieves nothing more. The ultimate goal in solving everyday problems and this study's problem seems clear and agreed: the successful navigation of life. Let us now seek to clarify the rest of the problem.

## 2. Literature Review

### 2.1 Problem Solving

What is a *problem*? Duncker's (1941) definition is often cited:

A problem arises when a living creature has a goal but does not know how this goal is to be reached. Whenever one cannot go from a given situation to the desired situation simply by action, then there has to be recourse to thinking. (p.1)

The thinking to which Duncker refers, of course, is *problem solving*.

Problem solving then requires devising a plan of action to achieve a desired goal (Holyoak & Morrison, 2005). The solver's representation of a problem is a model that summarises their understanding of a problem's components—the initial state, the goal, their interdependencies and the permissible steps to solution (Novick & Bassok, 2005). A well-defined problem has clearly defined components and a systematic solution process (Minsky, 1961).

In an ill-defined problem, at least one of the components is unclear, and solution strategies are largely non-systematic (Reitman, 1965). Therefore, Duncker's definition falls short in the narrowness of its scope. Whereas Duncker assumes we have a goal, problems also arise when we have no goal or our goal is unclear, ill-defined problems.

We often do not know (or are not willing to admit) the reasons for the current state of things. We often do not know what it is we want with great, if any, clarity. We may have a child, for instance, be it a pupil or one of our own, and we may believe they are troubled. We ourselves may be unhappy. Or we may simply have a thesis to write. If we misdiagnose the child's trouble, fail to understand (or admit) the true source of our unhappiness, or do not set clear goals for our thesis, however, progress will elude us. We may work, and we may work very hard, but we will be trying to solve different problems, the wrong problems.

Therefore, when we speak of an ill-defined problem, we are speaking of a problem that is in some important way deficient in its representation. Whereas Newell and Simon (1972) focused their research on the process of problem solving, Greeno (1977) focused his research on the importance of the representation itself in problem solving. And both background knowledge and context may influence a problem's representation. A solver's background knowledge may refer to their experience with similar or analogous problems (Gick & Holyoak, 1980), general schemas in memory (e.g., Bassok & Holyoak, 1989; Gick & Holyoak, 1983) or expertise (e.g., Chase & Simon, 1973). A problem's context may refer to its perception (Weisberg & Alba, 1981), story content and text (Hayes & Simon, 1977; Kotovsky, Hayes, & Simon, 1985) or objects (Duncker, 1945). This list is most likely not exhaustive.

A problem representation, in turn, may influence one's choice of solution strategy (Wertheimer, 1961). In other words, one problem represented in two different ways may suggest solution using two distinct strategies. Two general step-by-step problem solving processes have been identified, *algorithms* and *heuristics* (Novick & Bassok, 2005). An algorithm guarantees a solution; heuristics, or efficient shortcuts, promise only that a solution is likely. Whereas algorithms are useful in solving well-defined problems only, heuristics can be useful regardless. In fact, heuristics are often used in everyday problem solving (Evans, 1989; Newell & Simon, 1972; Tversky & Kahneman, 1982). Both algorithms and heuristics are reliable, however, only to the extent a problem's premises are true (discussed below).

**Problem solving versus reasoning.** According to Bruner (1974), to *reason* is to go beyond the information given. Tversky (2005) proposes that to go beyond the information given is, amongst other things, to transform it. There are various types of transformations, including additions, inferences, and judgments; reasoning and problem solving are two

others. It is in the nature of their transformations that the definitions between reasoning and problem solving begin to overlap, and the difference begins to blur.

Reasoning and problem solving are both goal-directed cognitive activities (DeLoache, Miller, & Pierroutsakos, 1998). Both require representations and the formulation of strategic processes for solution. Therefore, it is likely that reasoning and problem solving are not mutually exclusive concepts. For the remainder of this thesis, reasoning and problem solving will be considered one and the same, acknowledging important similarities rather than emphasizing unknown differences; the terms will be used interchangeably.

***The limitations of deductive and inductive reasoning.*** Reasoning emphasises the drawing of inferences, or *conclusions*, from given information, or *premises*. When we speak of reasoning, we typically speak of deductive and inductive reasoning. An inference is *deductive* when given true premises, the structure of the argument guarantees a logically true conclusion (Holyoak & Morrison, 2005). Its conclusions can also be logically true, however, if its premises are false

Evans (2005) illustrates deductive reasoning with a syllogism, a valid form of logical argument:

All C are B.  
No A are B.  
Therefore, no A are C.

However, as mentioned, with false premises a conclusion can also be logically true:

All dogs are animals.  
No cats are animals.  
Therefore, no cats are dogs.

False premises make the argument, while logically true, nonsensical.

Reasoning is *inductive* when true premises enhance the odds of a conclusion being true, but they do not guarantee it; while uncertain, the inferences are to varying degrees plausible (Holyoak & Morrison, 2005). Both *similarity* (e.g., Goldstone & Son, 2005; Quine,

1970) and *causality* (e.g., Lipton, 1991; Miller, 1987) are suggested to be important to effective inductive reasoning. Induction typically involves the relevant application of similar and causal relations to new stimuli and representations (Sloman & Lagnado, 2005).

In inductive reasoning, there are two general approaches: *similarity-based induction* and *induction as scientific methodology* (Sloman & Lagnado, 2005). Whereas similarity-based induction confidently projects the attributes of one thing on to another that is believed to be similar (e.g., Osherson, Smith, Wilkie, López, & Shafir, 1990), induction as scientific methodology subscribes to a more rigorous form of induction, similar to that used by scientists, such as the use of rational, probabilistic models (e.g., Chater & Oaksford, 1999; Gopnik & Schulz, 2004; Howe, Nunes, & Bryant, 2011; Johnson-Laird & Byrne, 2002).

Under both deductive and inductive reasoning, the truth of the premises is all-important. It is only with true premises that deductive reasoning can be used reliably. And it is only with true premises that inductive reasoning can be used, even if less reliably than deductive reasoning. Unfortunately, premises in ill-defined problems are often false, perhaps not intentionally so, but false nonetheless.

***Formal reasoning.*** *Formal reasoning* refers to the solving of well-defined problems (Galotti, 1989). In well-defined problems, all premises are given and true; therefore, deductive reasoning can be reliably used in solving them; inductive reasoning can be used, too, of course, just less reliably. The rarity of well-defined problems, however, and their limited role in life underscore deductive reasoning's limited relevance.

From a research perspective, however, the initial appeal of well-defined problems is apparent. As well-defined problems typically involve only one correct answer, evaluations of performance are unambiguous (Hambleton & Murphy, 1992). Their relatively clear structure also leads to superior reliability (Linn, 1994) and hence validity over informal reasoning tasks.

***Informal reasoning.*** *Informal reasoning* refers to the solving of ill-defined problems (Galotti, 1989). With their propensity for false premises, ill-defined problems fail to reliably benefit from deductive reasoning. As inductive reasoning only provides for the possibility of true conclusions if the premises are true, it, too, is largely unreliable. Therefore, the onus is on the problem solver to ensure the premises and representation as a whole are as true as possible before attempting to solve a problem; to not is to increase the risk of solving the wrong problem.

Informal reasoning requires one to consider information in addition to that given, a variety of possible paths to solution, and the possibility of more than one correct solution (Garnham & Oakhill, 1994). As a consequence, informal tasks are not easy to design and administer, make control of information used impossible, and are difficult to score (Perkins, 1985). As a consequence, acceptable levels of reliability and therefore validity remain elusive (Hambleton & Murphy, 1992; Linn, 1994). No well-defined informal problem solving methodology has evolved, so informal tasks have attracted relatively little empirical attention (Garnham & Oakhill, 1994).

***The relationship between formal and informal reasoning.*** Formal reasoning is studied with the expectation that it will predict performance on informal reasoning tasks (Galotti, 1989). Three predominant views of the relationship between formal and informal reasoning, however, exist. The first is that formal reasoning is a subset of everyday reasoning (e.g., Halpern, 2013; Wason & Johnson-Laird, 1972), formal reasoning being easier than informal. The second view is that the two are different, but they share similar processes (e.g., Johnson-Laird, 1982). The third view asserts that the two processes are distinct and, therefore, have few similarities (Perkins, 1985). Formal arguments, for instance, need only argue one side of a case given their logical validity whereas informal arguments typically

involve pros and cons. It is only under the first two of these views that a predictive relationship between formal and informal reasoning is likely to exist.

Whereas problem solving and reasoning seem sufficiently similar, formal and informal reasoning seem meaningfully different. Table 1 summarises the differences between the two:

Table 1

*Differences Between Formal and Informal Reasoning Tasks*

Formal	Informal
All premises are supplied.	Some premises are implicit; some are not supplied.
Problems are self-contained.	Problems are not self-contained.
There is typically one correct answer.	There are typically several possible answers.
Established methods of inference often apply.	There are rarely established procedures for solution.
Solution is typically unambiguous.	It is often unclear whether solution is good enough.
Problem content is often of limited, academic interest.	Problem content typically has personal relevance.
Problems are solved for their own sake.	Problems are often solved in achieving other goals.

*Note.* Adapted from “Approaches to Studying Formal and Everyday Reasoning,” by K. M. Galotti, 1989, *Psychological Bulletin*, 105(3), p. 335. Copyright 1989 by the American Psychological Association.

The relationship between formal and informal problem solving is questionable (Galotti, 1989). To date, the conclusions drawn from formal reasoning tasks haven’t meaningfully informed our understanding of everyday problems or enhanced our performance on everyday problem-solving tasks (Galotti, 1989; Hambleton & Murphy, 1992; Rogers, Maguire, & Leighton, 1998). The differences between formal and everyday reasoning may overshadow any similarities. Perkins (1985) may be justified in suggesting the only way to understand informal problem solving is to study informal problem solving tasks.

**Argumentation.** Kuhn (1991) suggests that argument is central to everyday thinking. Modern psychology has treated thinking largely as problem solving and thereby reasoning; therefore, argument may be at their core. The significant early philosophers considered

reasoned argument as fundamental to thinking, and logic was central to those arguments. Centuries later, however, Toulmin (1958) suggested the limitations of logic in our thinking and put forward a case for studying how people argue in natural settings. The de-emphasis of logic and deductive reasoning, in particular, reflects a significant shift in understanding thinking (Halford & Andrews, 2006).

It was Billig (1996), however, who suggested argument's relevance to psychology. In the words of Kuhn (1991):

Billig suggests, much of the thinking we do, certainly about issues that are important to us, involves silently arguing with ourselves—formulating and weighing the arguments for and against a course of action, a point of view, or a solution to a problem.... It arises every time a significant decision must be made. Hence, it is at the heart of what we should be interested in and concerned about in examining people's thinking (pp. 2-3).

Our knowledge of how this thinking works, however, is limited. While we often look at what people think, we neglect to study why they think it (Kuhn, 1991). A reasoned view is often incorrectly assumed.

There are essentially two types of argument, *didactic* and *dialogical* (Boulter & Gilbert, 1995). Whereas didactic argument is undertaken to tell and persuade others with regard to a case being made, dialogical argument involves the examination of different perspectives to reach agreement on courses of action or assertions. While both forms of argument can take place between people, dialogical argument can also be internal. In “silently arguing with ourselves” (p. 2), it is dialogical arguments to which Kuhn (1991) refers.

**Measurement of argument quality.** Over the past 15 years, various attempts have been made at developing tools to assess the quality of argumentation (von Aufschnaiter,

Erduran, Osborne, & Simon, 2008). Most of these tools, however, have relied on Toulmin's (1958) framework for everyday argumentation, also known as Toulmin's Argument Pattern (TAP). As such, the tools typically employ an analysis of an argument's content for evidence of TAP's elements, their presence effectively moving an argument from simply opinion to genuine argument.

Toulmin (1958) identified four basic argument elements:

*Claim* – conclusion whose merits are to be established; a thesis or goal

*Data* – facts appealed to in support of a claim; specific and appealed to explicitly

*Warrant* – reasons suggested to justify a connection between the data and a claim; general and appealed to implicitly

*Backing* – basic assumptions justifying particular warrants; theoretical or historical supporting statements

To help us better understand the basic TAP model, Driver, Newton and Osborne (2000) conveniently summarise the framework in applied form, “Because (data)...since (warrant)...on account of (backing)...therefore (conclusion)” (p. 193).

In addition, Toulmin identified two elements found in more complex arguments:

*Rebuttal* – specific conditions under which the claim will be false; acknowledges limitations of a claim or supports an opposing thesis or claim

*Qualifier* – specific conditions under which a claim can be taken as true

Kuhn (1991) argues that the incremental complexity of arguments incorporating rebuttals comes from the requirement of having to integrate original and alternative theories to argue the original theory's relative correctness. These competing theories are analogous to the pros and cons to which Perkins (1986) refers in distinguishing formal from informal reasoning.

In focusing on the elements of an argument, TAP permits a quality of argumentation analysis at the individual argument level independent of interactive discourse (Garcia-Mila, Gilabert, Erduran, & Felton, 2013). TAP also poses challenges in operationalization, however, chiefly with regard to an ambiguity regarding its elements (e.g., Duschl, 2008;

Kelly, Drucker, & Chen, 1998; Osborne, Erduran, & Simon, 2004). A lack of clarity regarding the element definitions, in turn, leads to a lack of clarity regarding the differences between them. For instance, few studies seek to identify qualifiers, perhaps suggesting that while indicative of complex arguments, the nuances between the definitions of qualifier, warrant and backing make the identification of qualifiers too difficult. And while TAP can be used to assess the quality of argumentation, it cannot be used to make judgments about an argument's correctness. Judgment requires the incorporation of subject knowledge (Driver et al., 2000). TAP is also decontextualized, thereby ignoring any social and cultural forces that may influence argumentation.

In light of these shortcomings, additional approaches to argumentation theory have since been suggested (e.g., Blair & Johnson, 1987; Kuhn, 1993). Most of these, too, however, are rooted in Toulmin's work and, therefore, fail to overcome or circumvent TAP's perceived shortcomings. Perhaps not surprisingly, none of these approaches have yet become as influential as TAP. Erduran (2008) suggests the challenges associated with TAP have more to do with the researchers' adaptations of the model for their own purposes, purposes that are different from what Toulmin intended, rather than deficiencies in TAP itself.

## **2.2 Intelligence**

While a significant amount of research on intelligence has been conducted over the past century, the definition of *intelligence* remains largely in dispute (Sternberg & Kaufman, 2011). Disagreement regarding intelligence's definition undermines our ability to measure it. Two researcher's intending to measure intelligence could, in fact, be measuring different things (Galotti, 1989). Our knowledge of intelligence, therefore, is limited at best, rendering our definitions and measurements of it to some extent inadequate.

The only reason to measure intelligence is the belief that people differ in it (Mackintosh, 2011). That difference, real or perceived, can matter, sometimes a lot, for it can

affect the opportunities available to us. We often accept people into schools or hire them into jobs, for instance, based in part on some assumption of their “intelligence.” In our everyday lives, we often assume knowledge of our own and others’ intelligence that we do not possess. We neglect to consider it could be anything other than what we think it is or that it could be measured in another, better way.

The poorer our assumption of someone’s intelligence and the greater the assumption’s weight in our argument, the higher the probability our decision will be a poor one. As a consequence, opportunity will be misdirected. For those accepted, they may not possess what is necessary to succeed in the job or course of study. For those denied places, they may question whether or not they possess “what it takes” to succeed in general. They may indeed possess “it,” of course; it was only the decision maker who made a poor assumption, for they did not know what “it” was. They only thought they did.

Our assumptions regarding intelligence can cause hearts to break. Self-esteem, something to which we are all entitled, can soon become a steep mountain at which a child finds themselves at the foot. They may spend a lifetime trying to scale it, often without success, that is, if they even try. The costs, financial and otherwise, of these poor decisions can be not just high, but immeasurable. And we are not just where we were to begin, without progress; we are poorer.

Every ill-defined problem suffers from its lack of clarity. And every problem in which intelligence may be a factor is more rather than less ill defined. Therefore, it is in our best interest to wrestle with not just intelligence’s definition, then measurement and rely on it only in proportion to the clarity achieved, but to ultimately determine its relevance to the matter at hand. It is more rather than less effortful problem solving, but the potential benefits may far exceed the costs. And we will enhance the odds of solving the right problem and thereby

progressing. Perhaps the only thing worse than a broken heart is one that has been broken unnecessarily, even if unintentionally.

**Cognitive intelligence.** When we speak of intelligence, we are usually referring to the cognitive skills employed in well-defined problem solving. Gardner (1983) cites them as the linguistic and logical-mathematical skills typically emphasised in school; Sternberg (1996) refers to them more generally as the skills involved in valid abstract reasoning. It is the type of intelligence commonly measured by IQ tests.

Binet, however, thought it was more. One of intelligence's earliest measurers, Binet was reluctant to quantify a child's intelligence in part because he noticed different children might achieve the same total score on his tests, but with a different pattern of correct and incorrect answers (as cited in Mackintosh, 2011). This pattern variance confirmed Binet's belief that intelligence involves somewhat independent abilities, including memory, common sense and imagination. To Binet, "intelligence" refers to one's ability to successfully navigate the world by solving everyday problems, not just solve well-defined problems.

In attempting to improve upon Binet's work, Terman (1916) created the Stanford-Binet Test. Terman stressed the test's practical value in facilitating the identification of the intelligent from those less so. Binet's concerns with regard to its limitations as a measurement tool, however, were ignored. In the absence of real evidence, the Stanford-Binet Test's power to measure intellectual ability was claimed to be definitive (Yoakum & Yerkes, 1920). Seemingly no sooner had Binet's tests and the Stanford-Binet Test been introduced than their misapplication had begun (e.g., Goddard, 1914). Those who scored poorly were labelled "feeble-minded" (Terman, 1916); educational and employment opportunities were denied them. The Stanford-Binet Intelligence Scales are currently in their fifth edition (Roid, 2003).

So began the history of intelligence tests that are independent of a rigorous definition of intelligence grounded in psychological theory. “Intelligence tests could not be based on a psychological theory of intelligence because there was no such theory” (Mackintosh, 2011, p. 9). And while they may help us in assessing our proficiency in solving well-defined problems, IQ tests largely fail to identify what is helpful in solving everyday problems. Indeed, the majority of real world performance is not predicted nor accounted for by intelligence test performance (Sternberg, Wagner, Williams, & Horvath, 1995). Something else matters.

**Theory of multiple intelligences.** In acknowledging that “something else,” yet within a context of intelligence, Gardner’s (1983) theory of multiple intelligences is perhaps the best known of the pluralist theories. While including the linguistic and logical-mathematical intelligences primarily associated with well-defined problem solving, the aim of the multiple intelligences is the solution of everyday problems.

To qualify, Gardner (1983) suggests intelligences must meet the following criteria:

- Certain individuals should demonstrate high or low levels of the capacity relative to other capacities.
- It should have a distinct neural representation.
- Different intelligences should develop at different rates along distinct paths.
- It should have some basis in evolutionary biology.
- It should be susceptible to capture in symbol systems.
- It should be psychometrically measurable.
- It should be distinguishable from other intelligences through experimental psychological tasks.
- There should be identifiable mental processes that handle related information.

In effectively broadening the definition of intelligence from just linguistic and logical-mathematical, or cognitive, Gardner (1999a) posits that an individual possesses at least eight relatively independent intelligences:

- *Linguistic* – Ability to analyse information and create products involving oral and written language
- *Logical-mathematical* – Ability to develop equations and proofs, make calculations and solve abstract problems

- *Spatial* – Ability to recognise and manipulate large-scale and fine-grained spatial images
- *Musical* – Ability to produce, remember and make meaning of different sound patterns
- *Bodily-kinaesthetic* – Ability to use one's own body to create products or solve problems
- *Naturalistic* – Ability to identify and distinguish among different types of plants, animals and weather formations found in the natural world
- *Interpersonal* – Ability to recognise and understand other people's moods, desires, motivations and intentions
- *Intrapersonal* – Ability to recognise and understand one's own mood, desires, motivations and intentions

In accordance with Binet's pattern variance, the relative strength and weakness of each intelligence will vary from person to person, and an individual with a particular strength in one intelligence will not necessarily demonstrate a similar strength in another.

Unfortunately, Gardner did not focus on psychometrics in conceptualising his theory, nor are his criteria for intelligences widely agreed. While others since have investigated the theory from a psychometric perspective, the results have been mixed. For instance, Visser, Ashton, and Vernon (2006) showed a strong loading on Spearman's (1904) *g*, a general factor seemingly shared by most cognitive tests, of the cognitive intelligences amongst the theory's eight as well as inter-correlations amongst them, effectively undermining a multiple intelligences theory.

Chen and Gardner (1997), however, using separate tests for each of the eight intelligences, successfully identified strengths across a number of intelligences in a group of at-risk first graders. The value of identifying a child's strengths versus overlooking them under a narrower definition of intelligence is obvious. In stressing that intelligences can be shaped by our cultures and educations, Chen and Gardner (1997) suggest their study benefits from naturalistic observations; the intelligences cannot be observed in isolation, but only in the performance of tasks in a cultural context.

While the theory of multiple intelligences seeks to expand the definition of intelligence, perhaps even correctly and wisely, it does so without advancing clarity or

gaining consensus. Therefore, the greatest value of the theory of multiple intelligences may lie in its challenge to the common conception of intelligence rather than in its tangible movement of intelligence's definition to a clearer, more measurable place. While discernable movement may not have been achieved, it is important to note that the intended direction of the movement is seemingly toward a definition of intelligence that is consistent with the one that Binet intended.

**Emotional intelligence.** Gardner (1983) did not identify emotional intelligence per se as one of the multiple intelligences, for it failed to meet his criteria for the identification of an intelligence. Rather, he denied the possibility of its existence (Gardner, 1999b). Gardner did, however, identify the previously mentioned interpersonal and intrapersonal intelligences. In all likelihood, emotional intelligence and the interpersonal and intrapersonal intelligences are not mutually exclusive.

It is Salovey and Mayer (1990) who are largely credited with proposing the first theory of emotional intelligence. Mayer and Salovey (1997) define *emotional intelligence* as “the ability to perceive and express emotion, assimilate emotion in thought, understand and reason with emotion, and regulate emotion in the self and others” (p. 11). This ability is to be evaluated with regard to how successfully an individual navigates their world (Salovey & Mayer, 1990). In other words, emotional intelligence should matter to everyday problem solving.

Daniel Goleman's (1995) popular book, *Emotional Intelligence*, a lay work based on Salovey and Mayer's (1990) theory, introduced emotional intelligence to the general population. At the time of its publication, however, little emotional intelligence research had been conducted (Goleman, 2005), and no means of measuring emotional intelligence existed (Salovey, 2011). Regardless, strong claims were made as to its power (Goleman, 1995). *Time*

magazine's (1995) cover stated it "may be the best predictor of success in life, redefining what it means to be smart."

The heuristic value of emotional intelligence, however, may have undermined its proper study (Barrett & Salovey, 2002). Since 1995, a great deal of emotional intelligence research has been conducted, and several tools that profess to measure emotional intelligence have been developed. Yet important disagreements over emotional intelligence's definition remain.

*Ability versus trait.* As a consequence, emotional intelligence has been conceptualised and measured in various ways (Roberts, Zeidner, & Matthews, 2001). Petrides and Furnham (2000) suggest two predominant emotional intelligence models have evolved, *ability* and *trait*. Ability models (e.g., Mayer & Salovey, 1997) emphasise the differences amongst people in cognitively processing emotional information. Trait models (Petrides & Furnham, 2003) incorporate non-intelligence factors, namely personality.

Mayer, Salovey, Caruso, and Cherkasskiy (2011) perhaps more accurately distinguish between *mixed* and ability models. Trait models are treated as a subset of mixed models, perhaps a misclassification. In addition to trait models, the mixed model category captures models that are effectively a mix of trait and ability models (e.g., Bar-On, 1997; Goleman, 1995). Incorporating personality traits, mixed models rely on self-report questionnaires to claim valid assessments of mental ability. Mental abilities, however, cannot be assessed by self-reports; self-reports assess only self-perceptions (Field, 2009; Petrides, 2009). Whereas trait assessments often demonstrate significant levels of reliability and validity (discussed below), ability and mixed models often do not (Keele & Bell, 2008).

Trait models, however, are not mixed—they claim trait emotional intelligence to be a personality trait, nothing more. Trait emotional intelligence theory conceptualises emotional intelligence as a personality trait, rather than an intelligence, located at the lower levels of

personality hierarchies (Petrides, Pita, & Kokkinaki, 2007). Indeed, Petrides (2009) asks us to consider renaming trait emotional intelligence as *trait emotional self-efficacy*, thereby sidestepping a murky and perhaps ultimately irrelevant intelligence debate. And similarly, before the concept of emotional intelligence per se, Steiner (1984) proposed the existence of *emotional literacy* with a definition wider than that of emotional intelligence. As a personality trait, trait emotional intelligence does not overlap with cognitive ability (Carroll, 1993). Galotti (1989) finds that IQ correlates only slightly, if at all, with trait emotional intelligence measurements; others (e.g., Amelang & Steinmayr, 2006; Warwick & Nettelbeck, 2004) report no or negative correlations between them.

In incorporating non-intelligence factors such as personality, trait models have come under criticism (e.g., Mayer, Roberts, & Barsade, 2008; Mayer et al., 2011). The criticism chiefly emanates from the models' divorce from intelligence. The intelligence to which the criticism refers, however, is seemingly cognitive in nature. As we have seen, cognitive intelligence explains little real-world performance (Sternberg et al., 1995). Therefore a construct of emotional intelligence pinned to cognitive intelligence seems at odds with an objective of proficiency in solving everyday problems. As a consequence, the criticism seems unwarranted.

**Measurement.** Numerous tools profess to measure emotional intelligence. The ability scales tend to be classified as either *specific-ability* or *integrative-model* measures (Mayer et al., 2011). Whereas specific-ability tests concentrate on singular dimensions of emotional intelligence, integrative-model tests focus on several dimensions simultaneously. Specific-ability tests to date are essentially of two types: 1) assessment of emotions in faces, postures and voice; and 2) the understanding and management of emotions in emotional situations of varying degrees of complexity. Integrative-model tests essentially seek to evaluate more

comprehensively defined emotional intelligence. Trait and mixed models, on the other hand, rely primarily on self-report questionnaires to capture personality traits.

Rather than in their broader theoretical conceptualisations, Petrides (2009) suggests ability and trait model differ primarily in their measurement approach. Those championing ability emotional intelligence contend that it, like all cognitive intelligences, are mental abilities that are employed to solve problems with right and wrong answers (Mayer et al., 2011). Trait emotional intelligence advocates contend that the subjective nature of emotions does not make emotional intelligence amenable to IQ-type scoring. As such, ability models stress maximal performance; trait models emphasise typical performance as measured by self-report questionnaires (Petrides, 2009).

These tests are scored in a variety of ways. An individual's results may be evaluated against a general population's consensus, the consensus of experts or against a target, who may have been photographed, for instance, and whose feelings at the time a picture was taken have been documented. A triangulation of results strengthens the case for emotional intelligence's presence.

As a consequence, participants' perceptions are largely measured, rather than their actual abilities. Therefore, measurement error is introduced, for factors other than the ones for which measurement is sought will influence responses (Field, 2009). Yet the subjective nature of emotion legitimises the self-report methodology. To ask if self-perceptions are accurate runs counter to trait theory (Petrides, 2009). Most aspects of trait emotional intelligence are not amenable to objective scoring. But if self correlates with observer ratings, convergence can be interpreted as an indication of accuracy.

With the definition of emotional intelligence unclear and without agreement, there is little value in comparing one tool's ability to measure emotional intelligence to another's, for they may be measuring different constructs, yet this is commonly done. There is value,

however, in comparing the relative strengths and weaknesses of one emotional intelligence measurement tool to another's. A test that is relatively reliable and valid, meaning one that successfully measures what it intends to measure and does so consistently, is preferred to one that does not do so.

**A note on faux intelligences.** Gardner's (1983) theory of multiple intelligences suggests there are at least eight intelligences. Chapters in *The Cambridge Handbook of Intelligence* (Sternberg & Kaufman, 2011) suggests there may be several others: successful, practical, social, cultural and mating, for instance. The sheer number of potential intelligences suggests there may be something opaque and loose about intelligence's definition.

The tendency to classify almost any behaviour as an "intelligence" is longstanding and well-documented (Eysenck, 1998). These faux intelligences are intuitively appealing in that they reintroduce personality traits as cognitive abilities (Furnham, 2006; Waterhouse, 2006). As cognitive abilities, these faux intelligences suggest they will be amenable to IQ-type testing; yet they are not. With its cognitive underpinnings, reliability and validity issues, ability and mixed emotional intelligences may indeed be faux intelligences.

### **2.3 The Impact of "Emotional Intelligence" on Everyday Problem Solving**

In *The Emperor of All Maladies*, a "biography" of cancer, Mukherjee (2011) describes a joke once told by the Nobel Prize-winning biochemist Arthur Kornberg:

The discipline of modern biology in its early days often operated like the man in the proverbial story who is frantically searching for his keys under a streetlamp. When a passerby asks the man whether he lost his keys at that spot, the man says that he actually lost them at home—but he is looking for the keys under the lamp because "the light there is the brightest" (p. 349).

This analogy seems equally appropriate describing a great deal of the research concerning intelligence and problem solving.

Perhaps marked progress in the knowledge of and ability to solve everyday problems should not have been expected. Much of the effort, after all, seems to have been misdirected. Implicitly assuming sufficient similarity and that knowledge gains in one will transfer to the other, researchers have neglected the study of informal problems in favour of formal problems. Formal problems are more accommodating than informal problems due to the ease with which they can be managed, their superior reliability and therefore validity (Hambleton & Murphy, 1992; Royer, Cisero, & Carlo, 1993). The similarities assumed, however, are questionable; the knowledge has seemingly failed to transfer (Galotti, 1989).

With its centrality to formal problem solving, cognitive intelligence has also been emphasised despite its role in everyday problem solving being seemingly minor (Sternberg et al., 1995). Binet, however, asserted that “intelligence” consists of a variety of abilities, some of which may fall outside of this definition (as cited in Mackintosh, 2011). The presence of Binet’s “intelligence” was to be evidenced in one’s ability to solve everyday problems. Weschler (1940), too, acknowledged that individuals with identical IQs might differ significantly in their ability to navigate their worlds. And “intelligent” people themselves fail to solve everyday problems often enough to suggest something else may matter.

With a goal of greater understanding of and proficiency in everyday problem solving, researchers have seemingly gravitated to where the “light is the brightest.” They may have tried to solve the problem, but perhaps they only thought they have. Despite a great deal of effort, they may have been trying to solve the wrong problems.

When an ill-defined problem endures despite much effort, we must ask if it endures due to its nature or to the solvers’ representation of it. Only once we are confident in the quality of its representation can we legitimately claim nature to be the barrier. In defaulting to

nature to explain (or defend) a lack of progress, however, we neglect to pursue enhanced representations that may not be nature dependent. Therefore, perhaps there is a third kind of problem. In addition to those that are well and ill defined, there are ill-defined problems that are well defined, meaning they have been represented to the best of our ability at a point in time. They remain ill defined only due to their nature.

Ill-defined problems, in their lack of clarity, are more likely to be misrepresented than well-defined problems. And the solver's representation will influence their solution strategies (Novick & Bassok, 2005). Shortcuts to solution will be appealing given the difficulty inherent in ill-defined problems. Heuristics may be helpful, but only to the extent premises are clear and true. The more ill defined the problem, however, the greater the risk of untrue premises, or the greater the odds of representing a different, the wrong, problem. In short, we will be relying on heuristics, with their need for true premises, just when we should not.

While it is seemingly clear something other than intelligence matters in solving everyday problems, the general construct of intelligence seems to have inhibited our progress in identifying what that something is. There may be multiple intelligences, but in tying themselves to the construct of intelligence, a construct that's poorly defined, their measurement becomes problematic as does understanding the role they in turn may play in everyday problem solving. Emotional intelligence suffers the same fate. Criteria for identifying an intelligence may be available, but they are not agreed upon. Perkins et al. (2000) suggest intelligence, rather than being abilities-centric depends on thinking *dispositions*, or not what abilities people have, but how they are disposed to use them; they are stable traits.

Largely academic debates over classification may be obscuring issues and hindering progress, the opposite of what they should be doing, making ill defined problems worse rather than better. Categories exist to simplify our thinking and help us navigate our world,

yet a category's poor definition can jeopardise its usefulness and therefore value. While a well-defined category can facilitate our understanding, an ill-defined one can cause us to ignore or overlook important considerations or see things that are not really there. And perhaps such is the case with intelligence.

Classifying something as a category member enables people to bring their category knowledge to bear on that something (Medin & Rips, 2005). Therefore, classifying something as intelligence enables us to apply our knowledge of intelligence to further our understanding of that something. But, as mentioned, the definition of intelligence remains largely in dispute.

To the extent our definition is unclear or without agreement, our knowledge may be deficient; at worst, it may not be knowledge at all. In short, to classify something as intelligence, given the category's seemingly poor definition, rather than help in that something's definition and understanding, only lends confusion. The accuracy of the classification itself becomes a moot point.

While human interests and perhaps self-interest saw to a narrowing of intelligence's definition, it was not a better definition. Gardner's (1983) theory of multiple intelligences in some ways took us back to the concept of intelligence's roots by asking us to consider expanding our definition.

Emotional literacy sidesteps the intelligence debate and brings focus to what matters—Steiner (1984) argued that greater emotional awareness could improve a person's wellbeing, and one could argue that is the same goal intended in the original spirit of intelligence. But does it matter what we call it? If we examine the nature and origins of the thinking involved independent of classification, perhaps knowledge since lost or undiscovered will be found.

A number of researchers have suggested the importance of emotion in good decision-making (e.g., Damasio, 1994; DeSousa, 1987). Emotional intelligence refers in part to one's ability to solve problems having recognised the potential meaning of emotional patterns (Mayer & Salovey, 1997; Salovey & Mayer, 1990). Ability emotional intelligence seemingly suffers in its cognitive intelligence underpinnings.

Whereas ability emotional intelligence is intended to facilitate everyday problem solving, cognitive intelligence does not. Champions of ability emotional intelligence must then reconcile this misalignment of objectives by either expanding the definition of intelligence to include non-cognitive factors or defining ability emotional intelligence as something other than intelligence. Salovey et al. (2011) are reluctant to do either in their belief that emotional intelligence is indeed an intelligence and due to the 100-year legacy of intelligence as a construct. Unmooring cited as a weakness/legacy, but perhaps it is its strength as sticking to it is not advancing us with regard to everyday problems. Perhaps it is the definition of intelligence that needs to be expanded rather than the trait models being discounted, and it is the ability models, with their narrower definition, that fall short.

Whereas ability emotional intelligence pins itself to cognitive intelligence and is reluctant to unmoor itself for legacy reasons, trait emotional intelligence does no such thing. If the objective is to become more proficient in solving everyday problems, unmooring may be the wisest thing to do. As long as tie to cognitive, we will not move in the right direction in this regard.

Common sense suggests *self-awareness* and *empathy*, often cited as dimensions of emotional intelligence, could play a role in solving everyday problems. Self-awareness, or our understanding of how we ourselves feel, and empathy, the ability to feel what others may feel, could enhance our understanding of a problem's components, particularly those problems involving the self and others, respectively. The classification of self-awareness and

empathy, meaning whether they are to be considered intelligences or emotional intelligences or something else, may become secondary, if not altogether irrelevant.

Variety of ill-defined problems and uniqueness of each makes studying them difficult if not impossible, but given centrality of quality of argumentation, study of a (standardised under tap/toulmin)

In light of the prevalence and importance of ill-defined problems, the main goal of education is to prepare students to solve everyday problems (Leighton, Rogers, & Maguire, 1999; Perkins, 1986). By and large, education emphasises the development of formal problem-solving skills; they are easier to teach and measure. To the extent education does not nurture everyday problem-solving skills, perhaps it should. As most problems in life are everyday problems, it behoves us to become our best at solving them. And only by solving the right problems do we progress.

This study's problem is an ill-defined one. Therefore, to what extent is the problem ill defined due to its nature, or the limits of our current knowledge, versus its representation? This investigation sought first to enhance the problem's representation before attempting to solve the problem, thereby seeking to leave only its nature to account for any lack of further progress.

This study set out to explore the impact of "emotional intelligence," or rather emotions, on everyday problem solving. In light of our limited knowledge of intelligence in general and cognitive intelligence's limited role in everyday problem solving specifically, the investigation sought a measure of emotion that is independent of these constructs. This study defines "emotional intelligence" as trait emotional intelligence, a personality trait. Everyday problems also posed obstacles to research. To circumvent these largely measurement challenges, this investigation focused on the perhaps more easily measured quality of argumentation as defined by TAP. Those challenges, however, still making experimentation

difficult if not impossible, coexistence rather than impact, or causality, was investigated.

Therefore, this study hypothesises a correlational relationship between trait emotional intelligence and the quality of argumentation in everyday problem solving.

### 3. Method

A correlational study was designed to investigate the relationship between trait emotional intelligence and the quality of argumentation in a hypothetical everyday problem-solving task. Given the investigation's non-experimental nature, the variables cannot be claimed to be either dependent or independent, predictor or outcome. Therefore, the establishment of causality was not possible. This study investigates significant coexistence between the variables only.

In brief, University of Cambridge students with teaching or teacher training experience were recruited. Each participant received a written description of a hypothetical classroom situation concerning a potentially troubled student, an everyday problem. Participants wrote their responses to a standard set of questions regarding their solution. The quality of argumentation in their responses was then evaluated using TAP. Participants also responded to a questionnaire that intended to assess their trait emotional intelligence levels. Finally, quality of argumentation and trait emotional intelligence scores were analysed to see if a significant correlational relationship existed between them.

**Research methodology.** In an effort to best understand this potential relationship, a mixed methods research methodology was employed (Teddlie & Tashakkori, 2009). From a quantitative perspective, the trait emotional intelligence questionnaire generated participant scores that became a basis for analysis. From a qualitative perspective, the quality of argumentation assessment required the identification of TAP's argument elements. While not a search for emergent themes, in a sense, the identification process was thematic analysis nonetheless, only the themes, so to speak, were prescribed. While categorical, the approach was not without its challenges given the TAP element definition issues previously described.

Highlighting the philosophy underlying the qualitative-mixed methods-quantitative data collection continuum and the theory that qualitative and quantitative methods are not

dichotomous and distinct (Teddlie & Tashakkori, 2009), the quality of each participant's argumentation was translated to a score. With scores for both variables, quality of argumentation and trait emotional intelligence, quantitative analysis could be performed, namely descriptive and inferential statistical analysis.

**Ethics and risk.** The *Code of Ethics and Conduct* (British Psychological Society, 2009), *Code of Human Research Ethics* (British Psychological Society, 2010) and *Ethical Guidelines for Educational Research* (British Educational Research Association, 2011) were adhered to throughout the study. University of Cambridge, Faculty of Education, Psychology and Education course ethics and risk assessment forms were approved prior to initiating the investigation. No significant ethical concerns or study risks were identified.

In accordance with these guidelines and codes, in both letter and spirit, the rights and dignity of each participant were respected throughout the study. The activeness of their participation was stressed, including their right to withdraw from the study at any time without consequence. Participants were recruited primarily by e-mail solicitation (see Appendix A), the e-mail serving as an information sheet explaining the study's aim and nature.

This information was then reviewed verbally with each participant immediately prior to participation. Confidentiality and anonymity were assured. Individuals were also reminded of their agreement to participate, their right to withdraw from the study without explanation, and the confidentiality and anonymity of their participation in the voluntary informed consent form (see Appendix B) they signed prior to participation. Each participant received a debrief letter (see Appendix C) at the end of their participation, in which they were invited to read this thesis. Should the participants have any questions or concerns post participation, the contact information for the principal investigator was also provided in the debrief letter.

As stated in the *Code of Ethics and Conduct* (British Psychological Society, 2009), “No code can replace the need for psychologists to use their professional and ethical judgement.... Thinking is not optional” (pp. 4-5). Therefore, while the aforementioned codes and guidelines were followed, they were explicit guides and established parameters, yes, but perhaps even more so, they were influencers. Their internalisation impacted all aspects of this study and the thinking behind them.

### **3.1 Participants**

Thirty University of Cambridge students (23 women, 6 men, 1 unreported;  $M_{\text{age}} = 32$  years,  $SD_{\text{age}} = 10.51$  years, age range: 22 – 58 years, 4 ages unreported) were recruited through e-mail and word-of-mouth campaigns. Participants were compensated £15 for their participation; they were also offered a choice of snack and drink during the study. Although the participants were predominantly White, race was not a criterion for participation.

The only criteria for participation were enrolment at the University of Cambridge and teaching or teacher training experience. Enrolment at the University of Cambridge was assumed to be a proxy (and therefore control) for a relatively high level of cognitive intelligence. The teaching or teacher training experience was assumed to not just facilitate comprehension of the hypothetical classroom situation with which participants were presented, but again, background knowledge and context having been shown to influence problem representations and solution strategies (Novick & Bassok, 2005).

### **3.2 Materials**

**Trait Emotional Intelligence Questionnaire.** In light of their cognitive intelligence underpinnings that seem at odds with the objective of furthering our understanding of everyday problem solving, ability emotional intelligence models were considered inappropriate to the research question. Similarly, mixed emotional intelligence models, with their relatively weak reliabilities and validities and perhaps more implicit ties to cognitive

intelligence, manifested in their measurement, were also discounted. Given its relatively strong reliability, claim and proof of independence from cognitive intelligence, ease of use and availability for academic purposes free of charge, the Trait Emotional Intelligence Questionnaire Version 1.50 (TEIQue; Petrides, 2009) was used to assess participant levels of trait emotional intelligence.

The TEIQue comprises 153 items that map to 15 facets. While a copy of the TEIQue can be found in Appendix D, Table 2 summarises the facets' definitions.

Table 2

*Summary Facet Definitions*

Facet	Definition
Adaptability	Flexible and willing to adapt to new conditions
Assertiveness	Forthright, frank, stand up for their rights
Emotion expression	Capable of communicating their feelings
Emotion management (others)	Capable of influencing other people's feelings
Emotion perception (self and others)	Clear about their own and other's feelings
Emotion regulation	Capable of controlling their emotions
Impulsiveness (low)	Reflective and less likely to succumb to urges
Relationships	Capable of maintaining fulfilling relationships
Self-esteem	Successful and self-confident
Self-motivation	Driven and unlikely to give up
Social awareness	Accomplished networker, superior social skills
Stress management	Ability to withstand pressure, regulate stress
Trait empathy	Ability to take someone else's perspective
Trait happiness	Cheerful and satisfied with their lives
Trait optimism	Confident and with a positive disposition

*Note.* Adapted from the Technical Manual for the Trait Emotional Intelligence Questionnaires (TEIQue), by K. V. Petrides, 2009, p. 14. Copyright 2009 by K. V. Petrides.

TEIQue is hierarchical in nature, and the 15 component facets map onto four factors that in turn map onto a global trait emotional intelligence construct. Table 3 summarises this mapping.

Table 3

*Factor-Facet Mapping*

Factor	Facet
Emotionality	Emotion perception Trait empathy Emotion expression Relationships
Self-control	Emotion regulation Stress management Impulsiveness (low) Adaptability Self-motivation
Sociability	Assertiveness Emotion management Social awareness
Well-being	Self-esteem Trait happiness Trait optimism

*Note.* Adapted from the Technical Manual for the Trait Emotional Intelligence Questionnaires (TEIQue), by K. V. Petrides, 2009, p. 23. Copyright 2009 by K. V. Petrides.

With only one exception, the facets have high loadings on their respective factors exclusively (Petrides, 2009). The exception is the self-esteem facet, which loads highly on both the well-being and sociability factors; self-esteem, however, is outside of the interests of this study. Otherwise, the factor structure is clear and replicable (Freudenthaler, Neubauer, Gabler, Scherl, & Rindermann, 2008; Mikolajczak, Luminet, Leroy, & Roy, 2007; Petrides, 2009). In support of the hierarchical structure of trait emotional intelligence, the four factors are also inter-correlated, implying that while they may be mutually exclusive, the factors can co-exist within an individual (Petrides, 2009).

The TEIQue is scored at the facet, factor and global trait emotional intelligence levels. In light of the scope of this study, only four measures of trait emotional intelligence as measured by the TEIQue were investigated: global trait emotional intelligence, emotionality,

trait empathy and emotion perception, emotion perception being deemed the facet most closely aligned to self-awareness, albeit not exclusively.

The value of research is a function of its reliability and validity (Dunbar, 2005). While value increases in proportion to both properties, research must first be reliable for validity to matter; validity is a necessary, but insufficient condition (Field, 2009). Given the study's reliance on TEIQue, the extent to which the questionnaire itself possesses these properties is a critical determinant of the study's ultimate value.

**Reliability.** *Reliability* refers to the consistency of measurements across situations. *Test-retest reliability*, derived from testing the same group of people twice, and *internal consistency*, corroboration of responses to different questions related to the same construct within a test, are two measures of reliability (Dunbar, 2005). *Cronbach's alpha* is the most common measure of internal consistency (Field, 2009). In general, alphas above .70 to .80 are acceptable; markedly lower values suggest an unreliable scale. Kline (1999) further suggests that while .80 is appropriate for cognitive tests, such as intelligence tests, .70 is more appropriate for tests of psychological constructs given their diversity.

As the number of items in a scale increases to more than 12 with relatively high correlations between them ( $r > .5$ ), alpha will increase independent of reliability (Cortina, 1993). However, of the four TEIQue measures considered, only global trait emotional intelligence depends on more than 12 items. Emotionality is a function of 4 items; emotion perception and trait empathy are a function of 10 and 9 items, respectively. In addition, if a measure has subscales, the subscale alphas matter, as data with the same composite alphas can have different underlying structures (Cortina, 1993; Cronbach, 1951; Grayson, 2004).

Based on a sample comprised of 1,721 individuals (912 female, 764 male, 61 unreported;  $M_{\text{age}} = 29.65$  years,  $SD_{\text{age}} = 11.94$  years, range 15.7 – 77 years) of primarily White UK and White European origins (58% and 19.2%, respectively), global trait emotional

intelligence scores have high internal consistency ( $\alpha = .90$ ) and, therefore, are highly reliable in aggregate as well as for males and females separately ( $\alpha = .92$  and  $\alpha = .89$ , respectively) (Petrides, 2009).

These high alphas could be explained in part by the number of items on which global trait emotional intelligence is a function, 15 (Cortina, 1993). The impact of the correlations between these items, however, is not clear. The 15 items are the 15 TEIQue facets, and while they correlate significantly only within their factors, again, with the exception of self-esteem. The internal consistencies for each factor and facet, however, are satisfactory. The alphas for emotionality, trait empathy and emotion perception, in particular, are 0.71, 0.77 and 0.81, respectively. Alphas remain robust in research involving small samples ( $N < 50$ ) (Petrides, 2009).

With the exception of trait empathy, test-retest reliability, or the stability of scores, for facet, factor and global scores seems significantly stable. Whereas the trait empathy stability coefficient is .19, the stability coefficients for global trait emotional intelligence and emotion perception are .78 and .66, respectively,  $p < .01$  (Petrides, 2009). The stability coefficient for emotionality is .59,  $p < .01$  (Petrides, 2009). Personality traits in normal adults have been shown to be relatively stable, ranging from .6 to .8 (Terracciano, Costa, & McCrae, 2006). As trait emotional intelligence has been construed as such a trait, similar stability is expected. With the exception of trait empathy, that expectation seems to have been largely met.

**Validity.** *Validity* refers to the extent to which a test measures what it intends to measure (Dunbar, 2005). Every aspect of a test can affect its validity. As a consequence, several types of validity have been identified, yet most can be categorised as either *internal* or *external*. Internal validity refers to the strength of the connection between the variables measured and conclusions drawn in light of the research question. Examples of internal validities include construct, content and criterion validities. External validity, on the other

hand, refers to the generalizability of findings to other situations and other people, ecological validity being an example. With everything potentially affecting validity, this list is not, of course, exhaustive. And there is no optimal list. A relevant list of validities is a function of the research question being investigated. As a general rule, however, the more valid a test is, the better.

*Construct validity* refers to the test's ability to measure a clearly defined construct (Cronbach & Meehl, 1955) and it is central to validity in general. In other words, a test cannot measure what it intends to measure if it does not know what it is intending to measure. *Incremental validity* refers to the degree to which a test enhances measurement beyond existing tests; *discriminant validity* refers to the degree to which a test is indeed incremental. If viewed hierarchically and interdependent, something done infrequently, if at all, incremental and discriminant validities seemingly supporting construct validity, discriminant, in turn, supporting incremental. The trait emotional intelligence construct as measured by TEIQue appears to be reasonably well defined with meaningful degrees of construct, incremental and discriminatory validity over other measures (Freudenthaler et al., 2008; Mikolajczak et al.; Petrides, 2009). In light of trait emotional intelligence theory, *content validity*, or a test's appropriateness given what it is intended to measure, seems reasonable to assume.

*Criterion validity*, however, is more difficult to substantiate. Both *predictive* and *concurrent* validities comprise criterion validity. Predictive validity refers to the degree to which performance on a test predicts future related performance. Concurrent validity refers to the degree to which a test confirms a current state. While a case for concurrent validity is seemingly supported (for a summary see Petrides, 2009), the inherently subjective nature of emotions and the self-report nature of TEIQue limit its predictive validity. One's emotional state is unique as is one's own perception of it, undermining both its predictive abilities and

generalisation power. As previously discussed, while the TEIQue may possess some predictive validity with regard to the individual who has taken the questionnaire, it is more difficult to generalise these findings to others.

Nevertheless, TEIQue relies on self-report measures. In the words of Petrides (2009), "...no self-report questionnaire can yield valid assessments of mental abilities, competencies, or skills. Such instruments assess self-perceptions..." (p. 12). Indeed, perhaps unsurprisingly, TEIQue scores seem to be susceptible to social desirability effects (Mikolajczak et al., 2007). As a consequence, participants' perceptions of their abilities are largely being measured, rather than their actual abilities. Therefore, measurement error has been introduced, for factors other than the ones for which measurement is sought will influence responses (Field, 2009). However, trait emotional intelligence theory asserts that trait emotional intelligence is a personality trait, not an ability, thereby legitimising self-report. TEIQue's questionnaire-based nature, however, does undermine its *ecological validity*, or how closely behaviour studied approximates what occurs in the real world.

**Hypothetical situation.** A written description of a hypothetical situation was created to simulate the experience of confronting an emotionally charged ill-defined problem. A copy of the hypothetical situation can be found in Appendix E. The hypothetical situation provided a means of measuring the quality of argumentation.

The hypothetical situation was set in a classroom and concerns a pupil who appears to be troubled as evidenced by his performing below expectations. While a change in his behaviour was described, the reason for his changed behaviour was not, although suspicion of trouble in the student's home was suggested, the trouble perhaps being with or between his parents.

As the situation was set in a classroom, teaching or teacher training experience was a participant criterion, as described above. Each participant was asked to answer four standard questions, each from the perspective of the pupil's teacher:

1. What would become your goals with regard to this student?
2. What would you do to realise those goals?
3. What problems do you envisage in implementing your strategy?
4. How would you evaluate its success?

Responses were written, and no further instructions were given.

**Reliability.** As the hypothetical situation was created specifically for this study, no pre-existing reliability assessments of the tool exist. As an ill-defined problem, the hypothetical situation, like all ill-defined problems, posed challenges with regard to reliability. The information considered and the premises used are uncontrollable; the possible paths to solution are many. And there may be more than one “correct” answer. As a consequence, neither test-retest reliability nor internal consistency was established.

This study, however, is not seeking to judge the correctness of responses. It only seeks to establish the quality of argumentation utilising TAP. Therefore, the ill-defined problem is perhaps slightly less so—instead of seeking to evaluate premises and paths to solutions, only the TAP elements need to be identified. The challenges in operationalizing TAP, however, in light of the lack of clarity regarding the definition of its elements, leave reliability difficult to establish. In the absence of internal consistency and test-retest reliability measures, inter-rater reliability was measured; it is discussed in the “Scoring” section below.

**Validity.** In the absence of established reliability, the hypothetical situation's internal or external validities cannot be established. The hypothetical situation's ill-defined nature, however, is indisputable. It may legitimately enable the assessment of quality of

argumentation, or it may not; it may provide for the measurement of another construct entirely or in addition. External validity is similarly difficult to ascertain—the unique nature of an ill-defined problem poses inherent challenges with regard to generalizability. A case for ecological validity is perhaps relatively stronger, or at least less weak, although the situation’s hypothetical and written natures only approximate what might actually happen in real life. In the absence of reliability, however, validity is a moot point.

While the nature of ill-defined problems poses serious challenges to the establishment of reliability and validity, it should not serve as a deterrent to their study. As most problems we encounter in life are ill defined, and the knowledge gained in the study of well-defined problems has proven to be of little benefit in the understanding of ill-defined problems (Galotti, 1989), these are challenges worth accepting.

### **3.3 Procedure**

Participant recruitment began 15 January 2014 and ended 19 March 2014. Participant data were collected between 12 February 2014 and 19 March 2014. A minimum sample size of 30 participants was sought in the interest of seeking a normal distribution of the data collected under the central limit theorem.

Data were collected at a variety of locations in the Faculty of Education at the University of Cambridge, Cambridge, United Kingdom; most often they were collected in a classroom. Some participants took the tests alone; others took the tests at the same time as other participants.

Participants committed to up to one hour of testing time, and that hour was split into two 30-minute periods. In one of the periods, participants took the TEIQue, and in the other period, participants responded to the four standard hypothetical situation questions listed earlier. In the interest of counterbalancing the results, 11 participants answered the hypothetical situation questions first; the remaining 19 participants took the TEIQue first.

As described earlier, consent forms were signed prior to taking the tests. Test instructions were given verbally as well as in written form. Paper versions of each test were administered, and all responses were in writing. Each participant put a matching alphanumeric string of characters at the top of each test, so the hypothetical situation and TEIQue responses could be paired, but the identity of the person to whom the responses belonged remained anonymous.

While a broader study was not undertaken for the reasons mentioned, in hindsight perhaps it would have failed to enhance the current study. The data suggest the targeted dimensions of emotional intelligence as measured by TEIQue are independent of cognitive intelligence. The mean scores for these dimensions are similar between the study and standardisation samples, yet the mean cognitive intelligence levels of each sample are likely different. While this study sought to hold cognitive intelligence levels constant in an attempt to avoid confounding the results, cognitive intelligence levels may not be confounding regardless. And as Galotti (1989) concludes that skill in everyday reasoning correlates only slightly, if at all, with cognitive intelligence levels, varying intelligence levels within the study would likely have failed to contribute to its value.

### **3.4 Scoring**

**TEIQue.** Each TEIQue item is a Likert item. Seven responses to each item, a statement, are possible, each response being a whole number. For instance, Item 12 reads, “Others admire me for being relaxed” (TEIQue, 2009). Each participant then chooses one of those seven responses. The response set ranges from 1, which means the participant completely disagrees with the statement, to 7, which means the participant completely agrees with the statement. Each participant’s responses were input into an SPSS file and sent to the test’s developer, K. Petrides, University College London, for questionnaire scoring.

**TAP.** TAP (Toulmin, 1958) formed the basis of the coding scheme used in evaluating the quality of each participant’s argument in responding to the four hypothetical situation questions. Each participant’s argument was coded by identifying these components in their responses. Examples of each element as previously defined are listed below; the examples were taken from participant responses.

Claim (C)	“...figure out if my classroom is unique for this student’s behaviour”
Data (D)	“...discuss the situation with fellow teachers [to assess uniqueness]”
Warrant (W)	“If this hypothetically were a student I had a good rapport with...”
Backing (B)	“...keep in mind that the student’s behaviour is not about me”
Rebuttal (R)	“...other teachers may interpret the student’s behaviour in a different way”
Qualifier (Q)	“...this assumes a fairly high level of social awareness/ability to discuss their problems”

A fully coded hypothetical situation response with a high quality of argumentation can be found in Appendix F; a fully coded hypothetical situation response with a low quality of argumentation can be found in Appendix G. Each response was scored twice based on the presence of each of these six components.

Inter-rater reliability was measured under two different scoring methodologies, Scoring Methodology 1 and Scoring Methodology 2, which are described below. The assessments were conducted on a subset of six of the 30, or 20%, of the participants’ hypothetical situation responses with a fellow Year 2 University of Cambridge Master of Education in Psychology and Education student. The index of agreement under Scoring Methodology 1 was 86.1%, and Cohen’s Kappa was 0.65, suggesting a good level of agreement; the index of agreement under Scoring Methodology 2 prior to a negotiated

agreement of ratings was 54.9% and 78.9% after negotiations, suggesting a similar fair-to-good level of agreement.

**Scoring Methodology 1.** If one of these components was present in a participant's response to any of the four questions, a score of 1 was received for that component regardless of how often the component was present amongst the four responses. If a component was absent from their responses, a score of 0 was received. As a consequence, the maximum total score a participant could receive for argument quality was 6, and the minimum total score they could receive was 0.

In implementing this methodology, however, questions arose regarding its discriminatory power. With only one of seven scores possible, would there be meaning in any correlation that was performed? As a consequence, a second scoring methodology was developed.

**Scoring Methodology 2.** Under this methodology, the frequency of each component's presence was counted. Therefore, while the theoretical minimum total score a participant could receive for argument quality was 0, the maximum total score was not capped. Osborn, Erduran, and Simon (2004), however, noted a difficulty in accurately classifying TAP's elements in light of their ambiguity. To circumvent this difficulty, *first-order* elements were distinguished from *second-order* elements in an argument. First-order elements were claims, grounds, and rebuttals; second-order elements were the components of the grounds for the claim, or the data, warrants, and backings. The quality of an argument was then assessed based on genuine episodes of oppositional analysis and dialogic argument.

In an attempt to overcome these same challenges in the investigation, the elements were further grouped into two categories: simple components and complex components. The total simple component score was the sum of the number of times a claim, data, warrant or backing appeared in the essay; the total complex component score was the sum of the number

of times a rebuttal or qualifier appeared in the essay. Rebuttals and qualifiers tend to be found in more complex arguments and, therefore, may represent higher ordered thinking (Kuhn, 1991; Toulmin, 1958).

## 4. Results

The analyses focused on four distinct measures of participants' trait emotional intelligence as measured by the TEIQue and the quality of their argumentation in their written responses to a standard set of questions concerning a hypothetical classroom situation. The four measures of trait emotional intelligence considered were participant TEIQue scores for global trait emotional intelligence, emotionality (factor), trait empathy (facet) and emotion perception (facet). TAP was applied to the participants' written responses to the hypothetical situation questions to assess the quality of their argumentation.

As previously discussed, quality of argumentation was measured under two methodologies, Scoring Methodology 1, which concerned the presence of TAP elements in an argument, and Scoring Methodology 2, which concerned the frequency of TAP elements in an argument. Scoring Methodology 2 was devised in response to Scoring Method 1 results.

Under Scoring Method 1, each participant could receive one of seven possible scores. There being six TAP argument elements, and each participant receiving a score of 1 for each element present in their argument, participants were like to receive a score ranging from 1 to 6. The participant could also receive a score of 0, however, if no TAP argument elements were present. For example, if a claim and data were present, two elements were present, and the participant would receive a score of 2. If two claims and one warrant were present, only two elements were present, and the participant would receive a score of 2. Again, Scoring Methodology 1 concerned itself with element presence rather than the frequency of elements' presence. Therefore, under Scoring Method 1, each participant would receive a score of 0, 1, 2, 3, 4, 5 or 6.

Table 4 shows the frequency of scores under each scoring method.

Table 4

*Frequency of Scores Under Each Scoring Method*

Score	Quality of argumentation Scoring Method			
	1	2	2-Simple	2-Complex
0	-	-	-	3
1	-	-	-	2
2	7	-	1	10
3	6	-	2	6
4	6	1	3	7
5	7	2	5	1
6	4	2	6	-
7	-	2	8	-
8	-	7	1	-
9	-	7	2	-
10	-	4	2	-
11	-	2	-	-
12	-	-	-	1
14	-	2	-	-
19	-	1	-	-

Under Scoring Method 1, while seven different scores were possible, the actual range of scores was 2 to 6; therefore, only five different scores were achieved, and the number of participants receiving each of those scores was largely equal. Given the definitional challenges between elements previously discussed, a concern arose as to whether or not the quality of argumentation variable as measured under Scoring Method 1 was sufficiently discrete, thereby undermining the meaningfulness of any correlation analyses that relied on it.

In an effort to enhance the quality of argumentation variable's discreteness, Scoring Methodology 2 concerned itself with the frequency of each argument element's presence rather than simply its presence. The implicit assumption underlying Scoring Methodology 2 was that the greater the number of elements present, the higher the quality of argumentation. Indeed, under Scoring Methodology 2, the theoretical range of possible scores increased from seven under Scoring Methodology 1 to an unlimited number. Scores ranged from 4 to 19 under Scoring Methodology 2; the frequency distribution of the scores can be found in Table 4. Nearly half of the participants scored either an 8 or 9, and the distribution of scores looks relatively normal.

While Scoring Methodology 2 may be superior to Scoring Methodology 1 in terms of variable discretion, by increasing dependency on the elements, so to speak, the importance of the ability to discern them and between them increased. Yet, as discussed, the ability to discern them and between them is one of the chief weaknesses cited in operationalizing TAP. As a consequence, Scoring Methodology 2 was recast in an attempt to mitigate this weakness.

Similar to the way Osborn, Erduran, and Simon (2004) circumvented this difficulty by classifying the elements as either *primary* or *secondary*, elements in this study under Scoring Methodology 2 were classified as either *simple* or *complex*. That classification aligns with TAP. Simple elements are the basic TAP elements: claim, data, warrants and backings; complex elements are those Toulmin cited as being found in more sophisticated arguments: rebuttals and qualifiers.

While researchers were still required to discern argument elements and discern between them, the ability to discern between them became less important. Now, rather than distinguish between six different elements, researchers effectively only had to discern between those that were simple and those that were complex. However, it was arguably

easier to discern between simple and complex elements than between data, warrants and backings.

Whereas sophistication levels, argument structure and word choices often highlight a straightforward difference between simple and complex elements, the difference between data, warrants and backings are often more nuanced and may be context and assumption dependent. For instance, when a participant states that they want to "...discuss the situation with fellow teachers" to assess the uniqueness of a potentially troubled student's situation, they effectively sought to triangulate data; therefore, they may have been viewing those hypothetical discussions as data. The participant could also have been relying on other data in making their claim, thereby viewing the discussions with fellow teachers as either warrants, justifying connections between the data and the claim that they had already made, or backings, justifying those discussions as warrants. Given the countering nature of rebuttals, however, they are relatively easy to distinguish.

In light of the aforementioned predictive validity shortcomings inherent in any trait emotional intelligence model and the implicit generalizability objectives of this study, correlational analysis, rather than regression, was the more relevant and appropriate analysis. Its self-report nature means that the TEIQue assesses only, of course, self-perceptions. While one's feelings may have some predictive ability with regard to their own future, the uniqueness of those feelings and their context undermine greater predictive powers. Therefore, investigating a predictive relationship between the TEIQue scores for a number of people and their quality of argumentation becomes meaningless, and it is that sort of relationship that regression would seek to analyse in this study.

Correlation, on the other hand, simply investigates the nature of the co-existence of the variables being evaluated; no predictive relationship between the variables is implied. In light of TEIQue's predictive shortcomings, correlation is entirely appropriate. As no

prediction was made as to the nature of the relationship between the variables being investigated, two-tailed statistical analyses were used to test for a significant relationship between them. For parametric analyses, Pearson's correlation coefficient was calculated; for non-parametric analyses, Spearman's correlation coefficient was calculated.

#### **4.1 Descriptive Statistics**

**Trait emotional intelligence.** As mentioned, participants were current or former University of Cambridge students, and their student status served as a proxy for cognitive intelligence levels. In other words, given the University of Cambridge's standing, each participant was assumed to have a high level of cognitive intelligence; if they had taken IQ tests, their scores would presumably be high. By holding cognitive intelligence levels relatively constant between participants, its potential to confound results was minimised.

In a sense, however, this move was merely precautionary, and this aspect of the study was in hindsight confirmatory. Trait emotional intelligence is hypothesised to lay outside of cognitive ability—that is, by definition, one of the key differences between ability and trait emotional intelligence. Whereas ability emotional intelligence pins itself to cognitive intelligence, trait emotional intelligence lies amongst personality traits. This hypothesis has been confirmed time and time again with no or negative correlation being found between measures of trait emotional intelligence and IQ (e.g., Amelang & Steinmayr, 2006; Saklofske, Austin, & Minski, 2003).

As shown in Table 6, the study mean scores for global trait emotional intelligence, emotionality, emotion perception and trait empathy were higher in every case than those mean scores for Petrides' (2009) standardisation sample, but not markedly so.

Table 5

*TEIQue Descriptive Statistics – Study Sample Versus Standardisation Sample*

Level	<i>n</i>	<i>M</i>	<i>SD</i>	$\alpha$	Range		Skew	Kurtosis
					Potential	Actual		
GTEI								
Study	30	4.98	0.54	NA	1-7	3.5-6.2	-0.26	0.79
Standard	1,712	4.90	0.59	.90	1-7	NA	-0.11	-0.17
Emotionality								
Study	30	5.38	0.71	NA	1-7	3.7-6.7	-0.53	-0.01
Standard	1,712	5.05	0.71	.78	1-7	NA	-0.27	-0.16
Perception								
Study	30	5.23	0.91	NA	1-7	2.8-6.7	-0.78	0.35
Standard	1,712	4.84	0.81	.73	1-7	NA	-0.37	0.26
Empathy								
Study	30	5.42	0.85	NA	1-7	3.0-7.0	-0.90	1.31
Standard	1,712	5.12	0.77	.87	1-7	NA	-0.33	0.01

*Note.* NA = not available. Adapted from the Technical Manual for the Trait Emotional Intelligence Questionnaires (TEIQue), by K. V. Petrides, 2009, p. 14. Copyright 2009 by K. V. Petrides.

The cognitive intelligence levels of the standardisation sample participants are unknown. As cognitive intelligence was not a criterion for inclusion in the standardisation sample, however, the sample's size ( $n = 1,712$ ) could lead one to infer a normal distribution of the sample and an average level of cognitive intelligence. Differences in trait emotional intelligence between this study's sample and the standardisation sample, should they have been significant, should not be attributed to differing cognitive intelligence levels.

In the standardisation sample, the emotionality factor, trait empathy facet, emotion perception facet and global trait emotional intelligence scores are normally distributed

(Petrides, 2009). Consistent with Petrides' findings, the TEIQue scores of relevance to this study were also normally distributed: global trait emotional intelligence scores,  $D(30) = 0.20$ ,  $p > .05$ ; emotionality factor scores,  $D(30) = 0.16$ ,  $p > .05$ ; emotion perception facet scores,  $D(30) = 0.15$ ,  $p > .05$ ; trait empathy facet scores,  $D(30) = 0.15$ ,  $p > .05$ . As the TEIQue generates scores, the data were assumed to be interval in nature. As the study was not a repeated-measures design, and the data were collected from different participants, the behaviour of one not influencing the behaviour of another, the scores between participants were assumed to be independent. Therefore, the criteria for parametric analysis were met.

**Quality of argumentation.** As previously discussed, the quality of argumentation was measured in two ways, under Scoring Methodology 1, which counts argument element presence, and under Scoring Methodology 2, which counts the frequency of element presence. The counts under Scoring Methodology 2 were then categorised as either simple or complex elements. See Table 6 for the related descriptive statistics.

Table 6

*Hypothetical Situation Quality of Argumentation Descriptive Statistics*

Method	<i>n</i>	<i>M</i>	<i>SD</i>	$\alpha$	Range		Skew	Kurtosis
					Potential	Actual		
1	30	3.83	1.39	NA	0-6	2-6	0.72	1.27
2	30	8.93	2.95	NA	NM	4-19	1.43	3.91
Simple	30	6.10	1.97	NA	NM	2-10	0.08	2.56
Complex	30	2.83	2.17	NA	NM	0-12	-0.09	10.74

*Note.* NA = not available. NM = not meaningful.

As quality of argumentation was scored, the data were assumed to be interval in nature. For the reasons cited in the discussion of the TEIQue descriptive statistics, quality of

argumentation scores between participants were assumed to be independent. The normality of the quality of argumentation data's distribution, however, is unclear.

Under Scoring Method 1, quality of argumentation scores,  $D(30) = 0.17, p < .05$ , were non-normal. However,  $Z_{skewness} = 0.17$ , and  $Z_{kurtosis} = 1.52$  suggest a normal distribution of the scores. In light of the normality contradiction, parametric and non-parametric assumptions were made in the analysis. Under Scoring Method 2 and Scoring Method 2 - Complex, quality of argumentation scores,  $D(30) = 0.19, p < .01$ , and  $D(30) = 0.23, p < .001$ , respectively, were non-normal. Therefore, the criteria for parametric testing were not met. Under Scoring Method 2 – Simple, however, quality of argumentation scores,  $D(30) = 0.16, p > .05$ , were normal. The criteria for parametric testing were met.

With the data from all other participants having Z-scores of 1.96 or less, the data from one participant was an outlier in terms of total elements and complex elements under Scoring Methodology 2. That participant's number of complex elements, 12, drove a total elements score of 19, and both of those scores translated to Z-scores of greater than 3.29. In removing this participant's data from the analysis, the total element scores for the remaining 29 participants became normally distributed; the complex element scores remained non-normally distributed. The total element scores,  $D(29) = .06, p > .05$ , were normal; the complex element scores,  $D(29) = .02, p < .05$ , were non-normal.

## 4.2 Inferential Statistics

**Under Scoring Method 1.** Given the conflicting information regarding the normality of the quality of argumentation data's distribution, parametric and non-parametric tests were performed. Again, the *TEIQue* data was normally distributed. With quality of argumentation Z-scores indicating normally distributed data, Pearson's correlation coefficients were calculated in investigating the relationship between Scoring Method 1 quality of argumentation scores and each of the following scores: global trait emotional intelligence,

emotionality, emotion perception and trait empathy. No significant relationship was found between any of the pairings (see Table 7).

Table 7

*Summary of Correlation Coefficients Under Scoring Methods 1, 2-Total, 2-Simple, and 2-Complex*

Level	Quality of argumentation Scoring Method				
	1		2-Total	2-Simple	2-Complex
	Pearson's	Spearman's	Spearman's	Pearson's	Spearman's
Global Trait	-.04, <i>ns</i>	-.01, <i>ns</i>	.06, <i>ns</i>	.17, <i>ns</i>	-.04, <i>ns</i>
Emotionality	-.17, <i>ns</i>	-.09, <i>ns</i>	.15, <i>ns</i>	.27, <i>ns</i>	.08, <i>ns</i>
Perception	-.19, <i>ns</i>	.23, <i>ns</i>	.20, <i>ns</i>	.26, <i>ns</i>	.15, <i>ns</i>
Empathy	-.08, <i>ns</i>	-.04, <i>ns</i>	.28, <i>ns</i>	.40*	-.01, <i>ns</i>

*Note.* *ns* =not significant.

\*  $p < .05$ .

Given the Kolmogorov-Smirnov test results regarding Scoring Method 1 quality of argumentation scores, implying those scores are significantly non-normal in their distribution, Spearman's correlation analysis, a non-parametric test, was also performed. The results under Pearson's and Spearman's analyses were the same. No significant relationship was found to exist between any of the trait emotional intelligence and quality of argumentation pairings.

**Under Scoring Method 2.** Given the non-parametric nature of the total quality of argumentation scores and the complex element scores using Scoring Method 2, Spearman's correlation coefficients were calculated to investigate the relationships between these scores and each of the following TEIQue scores: global trait emotional intelligence, emotionality, emotion perception and trait empathy. No significant correlational relationships were found

to exist between any of these quality of argumentation and TEIQue pairings under Scoring Method 2.

Given the normal distribution of the simple element quality of argumentation scores under Scoring Method 2, Pearson's correlation analysis was used to investigate the relationship between those scores and each of the following scores: global trait emotional intelligence, emotionality, emotion perception and trait empathy. No significant relationship was found to exist between any of the simple element quality of argumentation and TEIQue pairings, bar one: there was a significant relationship between empathy scores and Scoring Method 2 simple component scores,  $r = .40$ ,  $p$  (two-tailed)  $< .05$ , and a medium effect (Field, 2009). With  $R^2 = 0.16$ , trait empathy, therefore, shares approximately 16% of variance in quality of argumentation scores under Scoring Method 2 – Simple.

When the outlier participant was removed, none of the correlational relationships between the TEIQue score and quality of argumentation score pairings changed. In other words, none of them became significant. Under Pearson's correlation, there were no significant relationships between total quality of argumentation element scores and scores for global trait emotional intelligence,  $r = .02$ , emotionality,  $r = .21$ , emotional perception,  $r = .28$ , and trait empathy,  $r = .33$  (all  $ps > .05$ ). Similarly, under Spearman's correlation, there were no significant relationships between complex quality of argumentation element scores and scores for global trait emotional intelligence,  $r = -.11$ , emotionality,  $r = .05$ , emotional perception,  $r = .13$ , and trait empathy,  $r = -.02$  (all  $ps > .05$ ).

These results suggest that while there may be no significant correlational relationship between the broader measures of trait emotional intelligence of global trait emotional intelligence and emotionality or emotion perception and the quality of argumentation in a hypothetical ill-defined problem as measured by TAP, such a relationship may exist between trait empathy and this quality of argumentation measure.

## 5. Discussion and Conclusion

This study investigated the relationship between trait emotional intelligence and the quality of argumentation in responses to a hypothetical everyday problem. In partial support of the hypothesis, a significant correlation was identified between the quality of argumentation scores under Scoring Method 2 – Simple and trait empathy facet scores with medium effect. The analysis, however, failed to identify significant correlations between quality of argumentation scores and global trait emotional intelligence, emotionality factor and emotion perception facet scores under both of the quality of argumentation scoring methodologies employed. The analysis also failed to identify significant correlations between trait empathy facet scores and the quality of argumentation scores under Scoring Methods 1, 2 – Total and 2 – Complex.

Potential reasons for the absence of significant correlational relationships between global trait emotional intelligence, emotionality and emotion perception scores and quality of argumentation scores under each scoring method as well as trait empathy scores and quality of argumentation scores under all but Scoring Method 2 – Simple are many. The reasons of least concern, however, include the appropriateness of the sample itself and the incentive given to participants. The sample seemed reasonably appropriate given the teaching or teacher training experience criterion and the relevance of background information to problem representation and solution steps (Novick & Bassok, 2005). As a consequence, their background knowledge was relevant and should have meaningfully influenced and enhanced their problem representation. While the incentives of £15, snack and drink may have influenced participant behaviour, the compensation was deemed to be commensurate with the expectations of the participants.

As discussed, this study's problem is an ill defined one. As such, and in light of the findings, it behoves us to revisit the problem's representation in explaining the findings.

Despite our initial attempt to refine it, the representation may still be distorted. If it is distorted, have we failed to represent it to the best of our knowledge, or is it due to the problem's nature? Regardless, if it is distorted, we are asking the wrong question. And if we are asking the wrong question, the findings, significant and not, are irrelevant.

Perhaps the most obvious reason for the lack of significant correlation between the variables is that the variables simply are not related. However, on the basis of one study, this study, and the discussion that follows, it would be premature to draw any firm correlation conclusions. Similarly, while one significant correlation has been identified, that finding, too, needs to be triangulated and confirmed.

**Variable definition.** Emotional intelligence was defined as trait emotional intelligence as measured by TEIQue scores. The definition was further narrowed to refer only to scores for those TEIQue facets relating to empathy and self-awareness, trait empathy and emotion perception, respectively; the emotionality factor, to which both of those facets map; and global trait emotional intelligence, the overarching construct to which each of TEIQue's hierarchical facets and factors map, including those just mentioned. Common sense suggested this narrowing.

Everyday problems can involve the self as well as others. To the extent everyday problems involve the self, common sense suggests self-awareness, or perceiving how you yourself feel or may feel, may matter. The better you know how you feel, the better you may be at representing a problem involving you. To the extent problems involve or may involve others, common sense suggests empathy, or perceiving how others feel or may feel, may matter. The better you understand how others potentially impacted by your decision may feel, the better you may be at representing a problem involving them. The factorial relationships between these facets and the emotionality factor and the global trait emotional intelligence construct suggested the investigation's inclusion of the latter two.

Global trait emotional intelligence, however, is comprised of 15 facets of which trait empathy and emotion perception are only two. In scoring TEIQue, its facets feed directly into the global trait emotional intelligence score; they do not go through the four factors (Petrides, 2009). Similarly, the emotionality factor is comprised of four facets of which trait empathy and emotion perception are only two. Trait empathy is comprised of nine items; emotion perception is comprised of ten items.

While common sense may suggest a correlational relationship between trait empathy and emotion perception and the solving of everyday problems, it may not suggest a correlational relationship between one or more of the 13 other facets that comprise global trait emotional intelligence and the solving of everyday problems. Common sense also may not suggest that the two facets that together with trait empathy and emotion perception comprise the emotionality factor have a correlational relationship with the solving of everyday problems. To the extent that these other facets are extraneous to the problem, correlational relationships between everyday problem solving, or rather this study's measure of everyday problem solving, and both global trait emotional intelligence and emotionality will be diluted, perhaps to the point of insignificance.

There is, of course, the question of whether trait emotional intelligence itself is an appropriate measure of emotional intelligence. This study concerned itself with emotional intelligence only as it relates to everyday problem solving. While a seemingly great debate wages in academic circles as to whether or not emotional intelligence is indeed an intelligence, that debate is ultimately irrelevant to our research question. With intelligence largely meaning cognitive intelligence, and cognitive intelligence having no significant relationship with everyday problem solving (Sternberg et al., 1995), it seems inconsistent to investigate a construct of emotional intelligence with cognitive intelligence underpinnings, such as the ability or mixed models. Trait emotional intelligence is construed to be a

personality trait (Petrides et al., 2007), and as such, it sidesteps the intelligence debate. Whereas intelligence and emotional intelligence, with their lack of agreed definition, invite debate, the definitions of more specific constructs, such as empathy, self-awareness and personality traits seem more readily agreed. What matters is whether or not they correlate with everyday problem solving; their categorisation is secondary, if even relevant.

Everyday problem solving, on the other hand, was construed to be the quality of one's argumentation in addressing a hypothetical ill-defined problem as measured by TAP. The uniqueness of each everyday problem makes everyday problems impossible to standardise. As a consequence, reliability and validity are hard to establish. TAP attempts to enable standardisation, albeit by looking at the quality of argumentation. Quality of argumentation scores were derived by applying TAP to participants' written responses to a standard set of questions concerning the hypothetical situation. The relationship between the quality of argumentation and proficiency in solving everyday problems, however, was not investigated. Therefore, this study investigates the relationship between aspects of trait emotional intelligence and quality of argumentation only.

Although an effort was made to employ meaningful tools within the scope of the investigation, the analysis was inherently limited by the shortcomings of the tools available. A potential weakness of TAP, for instance, is its use of broad, general categories in characterising arguments, Toulmin himself being vague, ambiguous and inconsistent in his use of terms (Duschl, 2008). The main difficulty has been the classification of what counts as a claim, data, warrant, backing, rebuttal and qualifier. As a consequence, elements were classified as either simple or complex.

From a problem representation perspective, the trait emotional intelligence variable seems to enhance our representation; the quality of argumentation measurement, however, does not. The challenges TAP poses in operationalization, namely with regard to the

definition of its elements fail to bring much needed clarity to the quality of argument variable and therefore to the representation. In addition, in the absence of evidence suggesting a correlation between the quality of argumentation and one's ability to solve everyday problems, the relationship between the two is unknown. In seeking to enhance the representation of our problem, trait emotional intelligence seemingly does so whereas the quality of argumentation does not.

**Variable measurement.** As with intelligence, disagreement regarding the definition of terms begs potentially important questions regarding their measurement. Indeed, the measurement tools may play a meaningful role in explaining the study's findings, particularly with regard to the hypothetical situation quality of argumentation scores using TAP.

The value of any research is a function of its reliability and validity (Dunbar, 2005). The reliability and validity of any research will be in part a function of the reliability and validity of any measurement tools upon which the research relies. With regard to reliability, TEIQue is acceptably high in terms of alphas; in fact, its alphas are higher than those for most personality inventories, such as NEO PI-R (Petrides, 2009). High reliabilities are desirable when decisions affecting specific individuals are to be made (Cronbach, 1990). While test-retest correlations are significant,  $p < .01$ , for global trait emotional intelligence, emotionality and emotion perception, they are unacceptable with regard to trait empathy (Petrides, 2009). As a consequence, the reliability of the one significant relationship found in this study stands to be enhanced, although the acceptable alpha may be sufficient.

With reasonably high reliability, it is legitimate to question TEIQue's validity. The trait emotional intelligence construct, however, appears to be reasonably well defined with proven construct validity and meaningful degrees of incremental, discriminatory and criterion validity over other measures (Freudenthaler et al., 2008; Mikolajczak et al., 2007; Petrides, 2009). While TEIQue scores may possess some degree of predictive validity with regard to

the individual being tested, they have also been demonstrated to be susceptible to social desirability effects due to its reliance on self-report measures. The study's test-based nature similarly undermines its ecological validity. In sum, however, relatively strong internal and external validities can be argued, and overall, the TEIQue seems to possess acceptable levels of reliability and validity.

TEIQue's scoring, however, may provide for concern. For data to be amenable to parametric testing, it must be interval in nature. And indeed, for purposes of this study, such an assumption has been made. An interval, or continuous, variable assumption is often made when each participant receives a score. The difference between two interval variables, however, is assumed to represent an equal difference in the property being measured (Field, 2009). The potential for difference between what constitutes a score of 1 versus 2 and 3 versus 4, for instance, suggests the variable may in fact be ordinal. Scoring Method 1, however, under parametric and non-parametric assumptions demonstrates this assumption regarding the TEIQue variable may not make a difference.

While the hypothetical situation's analysis under TAP shares the same concern with regard to its scoring, the hypothetical situation posed significantly more challenges in its operationalization. With the exception of inter-rater reliability, the tool is unproven with regard to reliability; as an ill-defined problem, it will suffer the same reliability issues suffered by every ill-defined problem. In short, reliability should not be expected. Given the reliability concern, validity concerns become secondary here and, therefore, irrelevant. Nevertheless, while the hypothetical situation's ill-defined nature may suggest some construct validity in the sense it is an ill-defined problem, it cannot be proven, and it may be, in fact, measuring something else. And the unique nature of virtually every ill-defined problem undermines its generalizability. Regardless, weak internal and external validity should be assumed.

The challenges of using TAP to score the hypothetical situation's quality of argumentation have been discussed. First and foremost, the ambiguity of TAP's elements make consistent implementation difficult. This study's use of a simple versus complex classification system intended to circumvent this challenge, but in doing so, a level of discernment may have been lost, much like that of Scoring Method 1. TAP does not concern itself with context and judgements of correctness, which is dependent on background knowledge, yet context and background knowledge have proven to matter in quality of problem representation and solution strategy (and they, too, are interdependent). Therefore, TAP seems at odds with a sub-goal in solving everyday problems of enhancing the problem's definition, TAP ignoring two things that matter to it.

In sum, whereas trait emotional intelligence as a construct and TEIQue in general seem to enhance the representation of our problem, the use of TAP may be a case of looking where "the light is brightest." Despite TAP's shortcomings, this study and many others have relied on it over the last several decades. While TAP may indeed be easier to manage than everyday problems themselves, quality of argumentation is a proxy for everyday problem solving at best, and the ends that TAP and quality of argumentation ultimately serve is unclear. Assessing the quality of argumentation for its own sake is of little to no value, yet its impact on everyday problem solving is unclear. Just as the study of formal reasoning has not led to improvements in and greater understanding of informal reasoning, TAP may not lead to better everyday problem solving. Common sense might suggest otherwise, but at the moment, we lack proof. And quality of argument may impact everyday problem solving despite TAP, meaning TAP may not be the quality of argument's best measurement. The imprecision of the quality of argumentation measurement and its lack of reliability and validity perhaps suggest a search for a better tool, for under TAP generalizability of the study is severely hampered.

**Procedure.** With regard to context, a potential problem regarding ecological validity emerged, not with the classroom context, for that is appropriate, but with the problem as it was presented. Our situation was hypothetical, and it was described in written form; therefore, the richness afforded by a real-world problem has been compromised. While certain critical information with regard to the problem was communicated, rest assured, some was not. Participants did not have the benefit of observation and interaction over time, and the specific relevance of their background knowledge was uncertain. In addition, task instructions for argumentative discourse can lead to different outcomes in the quality of student's written argument (see Felton, 2004; Felton & Kuhn, 2001).

**Conclusion.** In revisiting the representation of our ill-defined problem, it seems to still be deficient, primarily with regard to everyday problems. As to where responsibility for that deficiency lies is less clear. The problems in studying everyday problems suggested a shortcut in TAP, yet perhaps it was a shortcut that should not have been taken in light of our problem. The scope of this study, however, prevented the development of a better tool; perhaps so does the nature of ill-defined problems. Therefore, it may very well be the nature of the problem that explains its continued ill definition.

Virtually every problem in life is an everyday problem. Bar luck, the only way to progress is to solve them. Therefore, it behoves us to become our best at solving them. The main objective of education is to prepare us to solve these problems (e.g., Leighton, Rogers, & Maguire, 1999; Perkins, 1985); to the extent it does not, it should. Indeed, post-primary education seems to have little impact on informal reasoning, suggesting that present educational practices do little to foster the development of informal reasoning skills (Perkins, 1985).

It is, however, only by solving the right problems that we progress. In a sense, solving the problem is secondary. We must ask the right question to solve the right problem. Galotti's (1989) sub-problem of clarifying the representation, in effect, becomes primary.

Research suggests intelligence, meaning cognitive intelligence, matters little to the solving of everyday problems. Background knowledge and context do matter, however (Novick & Bassok, 2005). Indeed, results suggest students can acquire a high quality of argumentation that relies on well-grounded knowledge with a relatively low level of abstraction (von Aufschnaiter et al., 2008). Common sense suggests empathy and self-awareness may matter too. Perhaps emotion overlaps with context. To rely on intelligence in everyday problem solving requires a recasting of intelligence to include more than just cognitive. Such a recasting would move toward a spirit of intelligence that was perhaps originally intended. Many, however, are reluctant to do so, perhaps preferring to stay where "the light is brightest."

If the definition of intelligence is not recast, then we must entertain factors outside of cognitive intelligence may impact everyday problem solving. Such is the case with trait emotional intelligence—it is a personality trait, rather than an intelligence. To rely on intelligence seemingly undermines a genuine desire to solve everyday problems. In the words of Spearman (1927),

The most enthusiastic advocates of intelligence become doubtful of it themselves. From having naively assumed that its nature is straightway conveyed by its name, they now set out to discover what this nature really is. In the last act, the truth stands revealed, that the name really has no definite meaning at all; it shows itself to be nothing more than a hypostatized word, applied indiscriminately to all sorts of things.

(p. 24)

In addition to perhaps being right, looking outside of intelligence allows us to sidestep an intelligence debate. If we don't know what intelligence is, we cannot know what emotional intelligence is.

Concern should be with what matters to solving ill-defined problems, not what those things are classified as. We cannot rely on a construct of emotional intelligence pinned to intelligence, for there is no agreement as to what that is. By expanding the definition of intelligence or going outside of it, the perhaps original spirit of intelligence can be recaptured and it can once again become relevant to everyday problem solving. Our real interest is in solving everyday problems proficiently, not the classification of the factors that matter. On the other hand, emotional intelligence too broad defined, may overstep its relevance; its components, however, might correlate. The very reason trait emotional intelligence is not considered an intelligence may be the very reason for its consideration.

As discussed, our knowledge of intelligence is limited at best, rendering our definitions and measurements of it to some extent inadequate. The same can be said for everyday problems. Yet in our everyday lives we often assume knowledge that we do not possess. We neglect to consider things could be anything other than what we think they are or that they could be measured in another, better way. It is only at this point, when we think we have the answers, that trouble begins.

The extent to which we rely on heuristics may be symptomatic of such behaviour. In theory, we can rely on heuristics only to the extent premises are true. As we know, premises are often false in ill-defined problems, even if unintentionally. But whether it is in frustration or laziness, we often take shortcuts in solving ill-defined problems nonetheless. Again, just when we should not look for shortcuts, we do, perhaps over-relying on them. In our efforts to simplify, perhaps we are losing critical components in our problem representation.

Interestingly, Kuhn, Phelps, and Walters (1985), in an examination of willingness to infer

causal relations with incomplete frequency data, while there were some improvements with age, even college subjects were remarkably willing to infer based on minimal data. No subjects indicated need for information missing. In addition, participants commonly fail to construct two-sided arguments or to distinguish evidence and explanations in support of their claim (Kuhn, 1991; Perkins, 1985).

Toulmin was bold and prescient over 60 years ago to suggest the shortcomings of logic in solving everyday problems and search for other options. Everyday problems, with their propensity for false premises, were not being served by deductive and inductive reasoning, given their dependency on true premises. While TAP is compelling, its shortcomings suggest it may be only a step in a right and necessary direction rather than a solution, *per se*.

While the problem triggered reflective and interesting responses from the participants, TAP concerns itself with the quality of argumentation only as defined by the presence of essential elements. It does not claim to lead to enhanced everyday problem solving. Yet this emphasis, while easy, is of no benefit. It does not enhance our understanding of everyday problem solving nor our efficiency in solving them. In assessing the impact of emotional intelligence on everyday problem solving, our ill-defined problem is no clearer. The time we've spent under the streetlight is time we've spent solving the wrong problem, if any. Progress is not to be expected. They are not allowing us to define problems well, and we end up solving the wrong problems, if any.

Decades on, TAP remains relatively unchallenged, however; when not relied on directly, it is often the foundation for "alternative" approaches. Presumably, we are interested in the quality of argumentation in so far as it leads to enhanced everyday problem solving; this relationship, however, remains to be established. To the contrary, TAP does not judge argument quality; to do so requires background knowledge as well as context (Driver et al.,

2000), both of which TAP is independent, and both of which have been shown to influence problem representation and solution strategy. In the interest of better representing our research question, further research of the quality of argumentation, its measurement, and its relationship to everyday problem solving outcomes is recommended.

While sheer probability could lead to one of the quality of argumentation and “emotional intelligence” score pairing to have a significant correlational relationship, further investigation of the impact of empathy on the solving of everyday problems seems warranted. Petrides (2009) recommends using dedicated measurement tools when facets become primary areas of research interest. This study was broad and primarily exploratory in nature; as a consequence a theoretically comprehensive trait emotional intelligence measurement tool, the TEIQue, was used. The scope of this study prohibited further investigation. In doing future empathy-specific research, empathy-specific measurement tools should be used.

But if the objective is the successful navigation of one’s life, shouldn’t we focus on the contributing factors rather than their classification? And this wider, perhaps more meaningful definition exists, even within the current emotional intelligence literature, although it is often dismissed. The reference is to mixed, versus ability, models. Mixed models are considered by some to be of lesser significance because of the breadth of emotional intelligence’s definition under them, but perhaps it is the ability models, with their narrower definition, that fall short.

And perhaps the tide is changing. Yet in a study by Leighton, Rogers, and Maguire (1999), when posed with an informal task, higher achieving students preferred multiple approaches to problem solving. Higher-level thinking strategies were involved, like planning and evaluating, meta-evaluating, and evaluating how others solve problems. Their results mirror to a significant extent the problem solving of everyday tasks. Interestingly, Leighton et al. also cited how performance-based assessment closely mirrors the goal of education, which

is to prepare students to deal with real-life problems. Indeed, Royer, Cisero, and Carlo (1993) cite a shift in schools toward more performance-based assessment that measures problem solving skills as manifested in everyday tasks. Even Salovey & Mayer (1994) have expressed an openness to intersubdisciplinary collaboration between the fields personality and intelligence fosters.

In sum, we must represent our problems to the best of our abilities before we try to solve them; the only legitimate reasons for ill definition are due to nature. If we face a problem that endures despite reasonable effort, perhaps that is a warning. When facing those problems, perhaps we should ask ourselves, are those problems more ill defined than they need to be? Is a better representation possible that it is within our power to create?

Whenever we have an ill-defined problem, our priority is its definition, then its solution. Tremendous amounts of time and effort are spent on solving the wrong problems and to no avail. Just as we spend a lot of time studying what we think and seemingly little time on why we think it (Kuhn, 1991), we spend a lot of time seemingly trying to solve the wrong problems without understanding why, that is when we're even aware of it. And progress only comes by solving the right problems. To solve the right problems, we must ask the right questions. And we should think of the costs if we do not.

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## **Appendices**

### **A. Participant Solicitation E-mail**

**£15 FOR ONE HOUR OF YOUR TIME**  
**SEEKING THESIS RESEARCH PARTICIPANTS FEBRUARY THROUGH APRIL**

Hi,

My name is Ron Balzan, and I'm a 2<sup>nd</sup>-year MEd student in the Psychology and Education route. As such, I'm beginning to conduct the research necessary for my thesis. And this is where you come in...

In my thesis, I'm attempting to evaluate the potential impact of emotional intelligence, namely self-awareness and empathy, on our ability to solve ill-defined problems. An ill-defined problem is essentially every problem we encounter in our lives. They are problems for which we either aren't clear as to their current state, don't have clarity regarding our goal in its solution, haven't clearly identified the obstacles and constraints between those starting and end points, or any combination of those factors.

I've chosen to look at this potential relationship in a hypothetical classroom setting, and that's why I'm seeking to recruit student-teacher participants at Cambridge, both students who will be teachers and teachers who are students. I'm targeting Cambridge students as I want to assume a constant level of cognitive intelligence, or IQ, amongst the participants, at Cambridge, that being high, of course!

**What's required is one hour of your time:**

**-30 minutes of which will be spent taking the Trait Emotional Intelligence Questionnaire, or TEIQue, and**

**-30 minutes of which will be spent writing responses to a standardised set of questions regarding a hypothetical classroom problem.**

**I fully appreciate the value of your time, and I will pay you £15 for your participation. I understand that many of you will be in the Faculty of Education on 24 February, 3 March, and 3 and 4 April, as well as Wednesdays between now and 19 March, and I'd like to conduct the research on those dates. If you tell me an hour that works for you on one of those dates, I'm happy to accommodate. I will provide drinks and snacks as well. If you'd like to participate, but are unable to spare an hour on one of those dates, please let me know as well—if I fail to get a sufficient number of participants on the dates listed, I may conduct some research virtually.**

Many, many thanks for your consideration, and I sincerely hope you'll participate. I'd greatly appreciate it!

Please send me an e-mail if you would like to participate:

Best regards,

Ron Balzan

## **B. Consent Form**



## **C. Debrief Letter**

Flat 6, 19 Grosvenor Gardens  
London SW1W 0BD

12 February 2014

Dear Participant,

I'm a 2<sup>nd</sup>-year MEd student in the Psychology and Education route. As such, I'm conducting the research necessary for my thesis, and I greatly appreciate your participation.

In my thesis, I'm attempting to evaluate the potential impact of emotional intelligence, namely self-awareness and empathy, on our ability to solve ill-defined problems. An ill-defined problem is essentially every problem we encounter in our lives. They are problems for which we either aren't clear as to their current state, don't have clarity regarding our goal in its solution, haven't clearly identified the obstacles and constraints between those starting and end points, or any combination of those factors.

I've chosen to look at this potential relationship in a hypothetical classroom setting, and that's why I'm seeking to recruit student-teacher participants at Cambridge, both students who will be teachers and teachers who are students. I'm targeting Cambridge students as I want to assume a constant level of cognitive intelligence, or IQ, amongst the participants, at Cambridge, that being high, of course!

What's required is one hour of your time:

-30 minutes of which will be spent taking the Trait Emotional Intelligence Questionnaire, or TEIQue, and

-30 minutes of which will be spent writing responses to a standardised set of questions regarding a hypothetical classroom problem.

You are free to withdraw from the experiment at any time. Just let me know if you'd like to do so.

While I'm hoping my thesis will be available for all to read starting late this year or early next year. Regardless, should you have any questions for me, you can contact me at the address above or at 225 W 25th St, Apt 6A New York, NY, 10001, USA; (through August 2014) or [rbalzan@yahoo.com](mailto:rbalzan@yahoo.com); or at 07563 373576 (UK) or +1 646 418 7990 (US).

Again, many thanks for your participation. I greatly appreciate it!

Best regards,

Ron Balzan

**D. Trait Emotional Intelligence Questionnaire Version 1.50 (Petrides, 2009)**

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## Instructions

- Please complete this questionnaire on your own and in quiet conditions.
- Please answer each statement below by putting a circle around the number that best reflects your degree of agreement or disagreement with that statement. *There are no right or wrong answers.*
- Work quickly, and don't think too long about the exact meaning of the statements.
- Try to answer as accurately as possible.
- You have seven possible responses, ranging from 1=Completely Disagree to 7=Completely Agree
- Many thanks for your time and interest

		DISAGREE COMPLETELY					AGREE COMPLETELY	
1.	I'm usually able to control other people	1	2	3	4	5	6	7
2.	Generally, I don't take notice of other people's emotions	1	2	3	4	5	6	7
3.	When I receive wonderful news, I find it difficult to calm down quickly	1	2	3	4	5	6	7
4.	I tend to see difficulties in every opportunity rather than opportunities in every difficulty	1	2	3	4	5	6	7
5.	On the whole, I have a gloomy perspective on most things	1	2	3	4	5	6	7
6.	I don't have a lot of happy memories	1	2	3	4	5	6	7
7.	Understanding the needs and desires of others is not a problem for me	1	2	3	4	5	6	7
8.	I generally believe that things will work out fine in my life	1	2	3	4	5	6	7
9.	I often find it difficult to recognise what emotion I'm feeling	1	2	3	4	5	6	7
10.	I'm not socially skilled	1	2	3	4	5	6	7
11.	I find it difficult to tell others that I love them even when I want to	1	2	3	4	5	6	7
12.	Others admire me for being relaxed	1	2	3	4	5	6	7
13.	I rarely think about old friends from the past	1	2	3	4	5	6	7
14.	Generally, I find it easy to tell others how much they really mean to me	1	2	3	4	5	6	7
15.	Generally, I must be under pressure to really work hard	1	2	3	4	5	6	7
16.	I tend to get involved in things I later wish I could get out of	1	2	3	4	5	6	7
17.	I'm able to "read" most people's feelings like an open book	1	2	3	4	5	6	7
18.	I'm usually able to influence the way other people feel	1	2	3	4	5	6	7
19.	I normally find it difficult to calm angry people down	1	2	3	4	5	6	7
20.	I find it difficult to take control of situations at home	1	2	3	4	5	6	7
21.	I generally hope for the best	1	2	3	4	5	6	7
22.	Others tell me that they admire me for my integrity	1	2	3	4	5	6	7
23.	I really don't like listening to my friends' problems	1	2	3	4	5	6	7
24.	I'm normally able to "get into someone's shoes" and experience their emotions	1	2	3	4	5	6	7
25.	I believe I'm full of personal weaknesses	1	2	3	4	5	6	7
26.	I find it difficult to give up things I know and like	1	2	3	4	5	6	7
27.	I always find ways to express my affection to others when I want to	1	2	3	4	5	6	7
28.	I feel that I have a number of good qualities	1	2	3	4	5	6	7
29.	I tend to rush into things without much planning	1	2	3	4	5	6	7
30.	I find it difficult to speak about my intimate feelings even to my closest friends	1	2	3	4	5	6	7
		DISAGREE COMPLETELY					AGREE COMPLETELY	
31.	I'm not able to do things as well as most people	1	2	3	4	5	6	7
32.	I'm never really sure what I'm feeling	1	2	3	4	5	6	7
33.	I'm usually able to express my emotions when I want to	1	2	3	4	5	6	7

34.	When I disagree with someone, I usually find it easy to say so	1	2	3	4	5	6	7
35.	I normally find it difficult to keep myself motivated	1	2	3	4	5	6	7
36.	I know how to snap out of my negative moods	1	2	3	4	5	6	7
37.	On the whole, I find it difficult to describe my feelings	1	2	3	4	5	6	7
38.	I find it difficult not to feel sad when someone tells me about something bad that happened to them	1	2	3	4	5	6	7
39.	When something surprises me, I find it difficult to get it out of my mind	1	2	3	4	5	6	7
40.	I often pause and think about my feelings	1	2	3	4	5	6	7
41.	I tend to see the glass as half-empty rather than as half-full	1	2	3	4	5	6	7
42.	I often find it difficult to see things from another person's viewpoint	1	2	3	4	5	6	7
43.	I'm a follower, not a leader	1	2	3	4	5	6	7
44.	Those close to me often complain that I don't treat them right	1	2	3	4	5	6	7
45.	Many times, I can't figure out what emotion I'm feeling	1	2	3	4	5	6	7
46.	I couldn't affect other people's feelings even if I wanted to	1	2	3	4	5	6	7
47.	If I'm jealous of someone, I find it difficult not to behave badly towards them	1	2	3	4	5	6	7
48.	I get stressed by situations that others find comfortable	1	2	3	4	5	6	7
49.	I find it difficult to sympathize with other people's plights	1	2	3	4	5	6	7
50.	In the past, I have taken credit for someone else's input	1	2	3	4	5	6	7
51.	On the whole, I can cope with change effectively	1	2	3	4	5	6	7
52.	I don't seem to have any power at all over other people's feelings	1	2	3	4	5	6	7
53.	I have many reasons for not giving up easily	1	2	3	4	5	6	7
54.	I like putting effort even into things that are not really important	1	2	3	4	5	6	7
55.	I always take responsibility when I do something wrong	1	2	3	4	5	6	7
56.	I tend to change my mind frequently	1	2	3	4	5	6	7
57.	When I argue with someone, I can only see my point of view	1	2	3	4	5	6	7
58.	Things tend to turn out right in the end	1	2	3	4	5	6	7
59.	When I disagree with someone, I generally prefer to remain silent rather than make a scene	1	2	3	4	5	6	7
60.	I wanted to, it would be easy for me to make someone feel bad	1	2	3	4	5	6	7
61.	I would describe myself as a calm person	1	2	3	4	5	6	7
62.	I often find it difficult to show my affection to those close to me	1	2	3	4	5	6	7
63.	There are many reasons to expect the worst in life	1	2	3	4	5	6	7
64.	I usually find it difficult to express myself clearly	1	2	3	4	5	6	7
65.	I don't mind frequently changing my daily routine	1	2	3	4	5	6	7
66.	Most people are better liked than I am	1	2	3	4	5	6	7
67.	Those close to me rarely complain about how I behave toward them	1	2	3	4	5	6	7
68.	I usually find it difficult to express my emotions the way I would like to	1	2	3	4	5	6	7
69.	Generally, I'm able to adapt to new environments	1	2	3	4	5	6	7
70.	I often find it difficult to adjust my life according to the circumstances	1	2	3	4	5	6	7
71.	I would describe myself as a good negotiator	1	2	3	4	5	6	7
72.	I can deal effectively with people	1	2	3	4	5	6	7
73.	On the whole, I'm a highly motivated person	DISAGREE COMPLETELY						AGREE COMPLETELY
74.	I have stolen things as a child	1	2	3	4	5	6	7
75.	On the whole, I'm pleased with my life	1	2	3	4	5	6	7
76.	I find it difficult to control myself when I'm extremely happy	1	2	3	4	5	6	7
77.	Sometimes, it feels like I'm producing a lot of good work	1	2	3	4	5	6	7

	effortlessly							
78.	When I take a decision, I'm always sure it is the right one	1	2	3	4	5	6	7
79.	If I went on a blind date, the other person would be disappointed with my looks	1	2	3	4	5	6	7
80.	I normally find it difficult to adjust my behaviour according to the people I'm with	1	2	3	4	5	6	7
81.	On the whole, I'm able to identify myself with others	1	2	3	4	5	6	7
82.	I try to regulate pressures in order to control my stress levels	1	2	3	4	5	6	7
83.	I don't think I'm a useless person	1	2	3	4	5	6	7
84.	I usually find it difficult to regulate my emotions	1	2	3	4	5	6	7
85.	I can handle most difficulties in my life in a cool and composed manner	1	2	3	4	5	6	7
86.	If I wanted to, it would be easy for me to make someone angry	1	2	3	4	5	6	7
87.	On the whole, I like myself	1	2	3	4	5	6	7
88.	I believe I'm full of personal strengths	1	2	3	4	5	6	7
89.	I generally don't find life enjoyable	1	2	3	4	5	6	7
90.	I'm usually able to calm down quickly after I've got mad at someone	1	2	3	4	5	6	7
91.	I can remain calm even when I'm extremely happy	1	2	3	4	5	6	7
92.	Generally, I'm not good at consoling others when they feel bad	1	2	3	4	5	6	7
93.	I'm usually able to settle disputes	1	2	3	4	5	6	7
94.	I never put pleasure before business	1	2	3	4	5	6	7
95.	Imagining myself in someone else's position is not a problem for me	1	2	3	4	5	6	7
96.	I need a lot of self-control to keep myself out of trouble	1	2	3	4	5	6	7
97.	It is easy for me to find the right words to describe my feelings	1	2	3	4	5	6	7
98.	I expect that most of my life will be enjoyable	1	2	3	4	5	6	7
99.	I am an ordinary person	1	2	3	4	5	6	7
100.	I tend to get "carried away" easily	1	2	3	4	5	6	7
101.	I usually try to resist negative thoughts and think of positive alternatives	1	2	3	4	5	6	7
102.	I don't like planning ahead	1	2	3	4	5	6	7
103.	Just by looking at somebody, I can understand what he or she feels	1	2	3	4	5	6	7
104.	Life is beautiful	1	2	3	4	5	6	7
105.	I normally find it easy to calm down after I have been scared	1	2	3	4	5	6	7
106.	I want to be in command of things	1	2	3	4	5	6	7
107.	I usually find it difficult to change other people's opinions	1	2	3	4	5	6	7
108.	I'm generally good at social chit-chat	1	2	3	4	5	6	7
109.	Controlling my urges is not a big problem for me	1	2	3	4	5	6	7
110.	I really don't like my physical appearance	1	2	3	4	5	6	7
111.	I tend to speak well and clearly	1	2	3	4	5	6	7
112.	On the whole, I'm not satisfied with how I tackle stress	1	2	3	4	5	6	7
113.	Most of the time, I know exactly why I feel the way I do	1	2	3	4	5	6	7
114.	It is difficult to calm down after I have been strongly surprised	1	2	3	4	5	6	7
115.	On the whole, I would describe myself as assertive	1	2	3	4	5	6	7
116.	On the whole, I'm not a happy person	1	2	3	4	5	6	7
117.	When someone offends me, I'm usually able to remain calm	1	2	3	4	5	6	7
118.	Most of the things I manage to do well seem to require a lot of effort	1	2	3	4	5	6	7
		1	2	3	4	5	6	7
		DISAGREE COMPLETELY						AGREE COMPLETELY
119.	I have never lied to spare someone else's feelings	1	2	3	4	5	6	7
120.	I find it difficult to bond well even with those close to me	1	2	3	4	5	6	7
121.	I consider all the advantages and disadvantages before making up	1	2	3	4	5	6	7

	my mind							
122	I don't know how to make others feel better when they need it	1	2	3	4	5	6	7
123	I usually find it difficult to change my attitudes and views	1	2	3	4	5	6	7
124	Others tell me that I rarely speak about how I feel	1	2	3	4	5	6	7
125	On the whole, I'm satisfied with my close relationships	1	2	3	4	5	6	7
126	I can identify an emotion from the moment it starts to develop in me	1	2	3	4	5	6	7
127	On the whole, I like to put other people's interests above mine	1	2	3	4	5	6	7
128	Most days, I feel great to be alive	1	2	3	4	5	6	7
129	I tend to get a lot of pleasure just from doing something well	1	2	3	4	5	6	7
130	It is very important to me to get along with all my close friends and family	1	2	3	4	5	6	7
131	I frequently have happy thoughts	1	2	3	4	5	6	7
132	I have many fierce arguments with those close to me	1	2	3	4	5	6	7
133	Expressing my emotions with words is not a problem for me	1	2	3	4	5	6	7
134	I find it difficult to take pleasure in life	1	2	3	4	5	6	7
135	I'm usually able to influence other people	1	2	3	4	5	6	7
136	When I'm under pressure, I tend to lose my cool	1	2	3	4	5	6	7
137	I usually find it difficult to change my behaviour	1	2	3	4	5	6	7
138	Others look up to me	1	2	3	4	5	6	7
139	Others tell me that I get stressed very easily	1	2	3	4	5	6	7
140	I'm usually able to find ways to control my emotions when I want to	1	2	3	4	5	6	7
141	I believe that I would make a good salesperson	1	2	3	4	5	6	7
142	I lose interest in what I do quite easily	1	2	3	4	5	6	7
143	On the whole, I'm a creature of habit	1	2	3	4	5	6	7
144	I would normally defend my opinions even if it meant arguing with important people	1	2	3	4	5	6	7
145	I would describe myself as a flexible person	1	2	3	4	5	6	7
146	Generally, I need a lot of incentives in order to do my best	1	2	3	4	5	6	7
147	Even when I'm arguing with someone, I'm usually able to take their perspective	1	2	3	4	5	6	7
148	On the whole, I'm able to deal with stress	1	2	3	4	5	6	7
149	I try to avoid people who may stress me out	1	2	3	4	5	6	7
150	I often indulge without considering all the consequences	1	2	3	4	5	6	7
151	I tend to "back down" even if I know I'm right	1	2	3	4	5	6	7
152	I find it difficult to take control of situations at work	1	2	3	4	5	6	7
153	None of my responses on this questionnaire are not 100% honest	1	2	3	4	5	6	7

## QUESTION SECTION 2

Please note that in this section you are occasionally asked to write in your answer.

### About you

What is your gender?

MALE     FEMALE

What is your year of birth?

☞ 19...

## **E. Hypothetical Situation**

## **Hypothetical Situation**

One of your students is performing below expectations. Based on your own experience with the student early in the year as well as feedback from his teacher last year, you believe he is able to perform better. Once more vibrant, he has become quieter and more withdrawn as the year has progressed. On certain days, you believe he comes to school tired and visibly distressed. You suspect there may be trouble in the student's home, perhaps with or between his parents.

Explain your strategy in handling the situation. What would become your goals with regard to this student? What would you do to realise those goals? What problems do you envisage in implementing your strategy? How would you evaluate its success?

Please use the next 30 minutes to write your responses.

## **F. Sample Hypothetical Situation Response – High Quality of Argumentation**

Throughout my teaching experiences, I have tried to keep in mind that students' behaviour is not about me (B). It is not personal and is often confounded by (many) other variables. (I find this especially true in high school.) If I suspected trouble in a student's home, I would try to make myself emotionally available for that student and let them know they had a safe space (C) to talk about any issue they wanted. Assuming I had a good rapport with the student prior to the behaviour change, I would try to have one-on-one conversations with the pupil (D), showing my concern that they are not meeting their potential and making myself available for deeper conversations before and after class and school. If the behaviour/achievement continued to decline, I would try to brainstorm a plan of action (C) with the student and hold the student responsible to concrete actions agreed upon in the plan. If no progress was noted, I would discuss the situation with fellow teachers (D)/(W), and if my classroom was not unique in regards to the student's behaviour/achievement, I would phone their parents to ask for collaboration (C) we could work on to ensure my student and their child is achieving their best. Rapport with the student, developing a safe space of trust, and patience would be the 3 central things (components) to my strategy of supporting this student.

*Goals:* create safe space for student to share feelings (C); create opportunities for student to see me one on one (D); figure out if my classroom is unique for this student's behaviour (D)/(W); involve parents in problem-solving (C); build student confidence (C).

*(Note: With the exception of building confidence, codes under "Goals" are duplicates of those above.)*

Actions: be honest with student; take interest in their extracurricular activities; have clear inclusion policy in classroom; be available before and after class and school hours;

share e-mail address and school phone (if available); encourage student contact; speak to other teachers; observe student outside classes in common spaces; call parents to communicate concern and support; continuous positive reinforcement; clear, reasonable consequences for consistent actions (positive and negative).

*Potential problems:* other students introduce language of hate into class (R); overcoming social expectations for “normalcy”; limited time availability (R); student interaction outside work hours impacts family (my own) relationships (R); student lacks initiative to call me (R); other teachers interpreting student behaviour in different ways (R); may affect trust levels with student if they feel I am “watching/policing” (R); parents uninterested (R); parents too busy (R); parents don't know reason for change in behaviour (R); illegal issues (abuse, drugs, etc.) (R); moments of “tough love” backfire (R); student struggles with self-image and social cohesion in class (R).

*Evaluation of success:* if most students feel they can be honest/are honest (90%); if most students engage in controversial debate (80%); if I am truly available and “on call”; if teacher visits completed; if call to parents placed (longer than six minutes); if student shows pride in any assignment; if one positive action explicitly noted every day.

## **G. Sample Hypothetical Situation Response – Low Quality of Argumentation**

I think this is something that would concern me a fair amount. I would attribute the symptoms as a clear sign the student is struggling to cope.

My main goal would be to ensure the wellbeing of the student (C) and preferably put in place action to help them. If I felt that the student would be responsive to an intervention that I myself could lead then I would try this: I would want to privately talk with the student (D) and ascertain what their primary concerns are/what they are finding difficult. A problem here could be dishonesty (R) and this assumes a fairly high level of social awareness/ability to discuss their problems. However, if I didn't think they were being honest, and if this hypothetically were a student I have a good rapport with, I would be confident I could get to the underlying problem through talking. If after a few talks I was still concerned about this student, I would instruct a counsellor to take over. I would hope to be kept in the loop about their progress with the counsellor.

If I thought it unlikely the student would be responsive with me, I believe I would still try perhaps once, then maybe ask a member of staff I thought would be useful to that particular student.

If neither of those actions seemed appropriate, I would recommend them straight to the councillor. I would be hopeful that these meetings/chats could help the student, but I imagine if they didn't, they may talk to their GP about medication, have some form of CBT or psychotherapy.

I think these forms of interventions discussed would be measured by how the child sees themselves feeling happier and more at ease. Also, however, I would hope they would stop being withdrawn and appear much more like their former, happier self.

Therefore, I would measure the success of these approaches based upon whether an improvement in the self-esteem of the child was noticeable. I would also hope that this experience of discussing their issues may lead to their dealing better with the problems that arise in the future. Both that they would begin to feel better equipped at coping and be willing to talk to people and seek help, if necessary.

One problem that could occur which has not yet been mentioned is communicating this advice with the parents (R). It is not possible to say how they would react. If I know something about them already, then I think this may affect the way I handled the situation with them. For instance, if I thought they would be supportive, I would want them on board every step and discuss matters and recommendations with them. However, if I did not think this and suspected their child's troubles may stem from their own, I may be more discreet in helping the child. The problem here is if I thought the child needed counselling or to see their GP, etc., I would be apprehensive the parents could be apprehensive about this and block attempts to get to the bottom of the situation with professional help.