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Dr. Jennifer Walinga

jwalinga@uvic.ca

250-472-4775

University of Victoria
3800 Finnerty Road
Victoria BC V8P 5C2
CANADA

Abstract

The purpose of this research was to develop a model for how individuals unlock creative insight. Creative problem solving (CPS) is inherent to effective decision making, innovation, and organizational development tasks but insight, innovation and creativity remain intangible concepts. The study describes the what, how, and why of creative insight. The model, built from in-depth interviews with 325 participants tackling a variety of problems demanding insight, proposes that creative insight involves an eight stage cyclical process – Identification, Analysis, Representation, Appraisal, Focus, Solution Generation, Evaluation, and Restructuring or ‘Stuckedness’– linked by the cognitive mechanisms of interpretation and readiness and resulting in either a state of insight, impasse, or ‘stuckedness’. The research has implications for individual, team and organizational settings suggesting that performance on a wide variety of problems may be improved by utilizing an integrated focus.

Unlocking Creative Insight and Overcoming Performance Barriers

Introduction

Creative problem solving (CPS) is an important component of high performance in a variety of realms. CPS is inherent to effective decision making, innovation, and organizational development tasks (Ketchen, Snow & Street, 2004; Nutt, 2002, 2004; Vance, Groves, Paik & Kindler, 2007) as well as individual physical, artistic, and mental tasks (Durand-Bush & Salmela, 2002; D'Zurilla, & Sheedy, 1992; Kovác, 1998; Pugh, 1991; Smith, Carlsson, Sandström, 1985; Wang & Horng, 2002; Wanish, 2000). Discussion abounds as to what creative problem solving involves (Callahan, 1991; Khatena, 1982). Those familiar with the recurrent waves of interest in the field will note an emerging framework that emphasizes divergent thinking coupled with convergent thinking (Cropley, 1999; Runco, 2004). Researchers have come to agree that training CPS involves facilitating both divergent and convergent thinking skills beginning with the father of brainstorming, Alex Osborn (1963). However, others have since added to the literature on divergent thinking including:

- Bill Gordon (1956; 1961) and George Prince (1970) and their Synectics approach which attributes creativity to connection-making
- Mednick's (1962) concept of Remote Associations spurring creativity
- Torrance's (1962) creativity tests and Guilford's (1967) Alternative Uses Task and which suggests that creativity is grounded in idea generation, originality, flexibility, elaboration, and fluency.
- Edward deBono (1971) and the Six Hats or Lateral Thinking approach in which creativity is described in terms of new ideas *and* new perceptions
- Isaksen and Treffinger (1985) and Isaksen and Dorval (1994) who focus on evaluating ideas using a Criterion Matrix
- Rickards (1990) who explores intuitive and structured techniques for 'choosing wisely'

Most intriguing in the problem solving literature, and perhaps most useful, is the concept of creative insight. Insight is described as the 'out of the box' or 'aha!' solution to a problem. A historical example of creative insight occurred within the Mann Gulch

fire of 1949. Mann Gulch occurred when a wildfire in the Helena National Forest, Montana, United States, spread out of control and ultimately claimed the lives of 13 firefighters. Foreman Wagner Dodge led the team towards the Missouri River. The fire, however, spread faster than anticipated and had already cut off the path to safety. The men had to turn around. When Dodge realized that they would not be able to outrun the fire, he started an escape fire and ordered everyone to lie down in the area he had burnt down. The other team members hurried towards the ridge of Mann Gulch instead (achieving heroic speeds in their desperate attempts to escape!). Only two of them, Bob Sallee and Walter Rumsey, managed to escape through a crevice and find a safe location, a rock slide with little vegetation to fuel the fire. Two other members survived with heavy injuries and died within a day. Only Dodge had the creative insight to remove fuel so as to reduce the chance of being burned by the fire. Ironically the two other survivors benefited from the same principle Dodge applied in his solution; the rocky slope they reached had no fuel for the fire though they reached it purely by chance. Insight appears to require the ability to ‘shake loose’ from assumptions and prior knowledge as well as the ability to clearly define the problem.

Those who emphasize the importance of ‘problem finding’ as it impacts convergent thinking and problem resolution suggest that the key to unlocking creative insight lies in the combination of both divergence and convergence (Basadur et al, 1982, 1992, 2000a; Kershaw & Ohlsson, 2004; Rickards & Puccio, 1991; Runco & Chand, 1994). While it is important to ‘shake loose’ from in-the-box thinking, it is also important to ‘choose wisely’ among a variety of alternative solutions. Determining what constitutes a wise solution demands insight into the true nature of the problem and the goals and values in solving the problem.

The concept of creative insight as it relates to problem solving offers a framework for exploring and understanding how best to enhance problem solving skills and consequently performance. Though it is possible to identify insight when it happens, what happens during the insight process remains a mystery. The purpose of this research was to extend the theory of creative problem solving and develop a model of how individuals unlock creative insight. Creative problem solving (CPS) is inherent to effective decision making, innovation, and development tasks but the insight, innovation and creativity

involved in the creative problem solving process remain intangible concepts. The study describes the what, how, and why of creative insight. The model, built from in-depth interviews with 325 participants tackling a variety of problems demanding insight, proposes that creative insight involves an eight stage cyclical process:

- a) Identification
- b) Analysis
- c) Representation
- d) Appraisal
- e) Focus
- f) Solution Generation
- g) Evaluation
- h) Restructuring or ‘Stuckedness’

The current research proposes that the cognitive mechanisms of interpretation and readiness link these eight stages and result in insight or impasse. Impasse then leads to either the construction of a new problem representation and begins at the first stage again, or leads to ‘stuckedness’ in which no other solutions or problem representations present themselves and the solver gives up. The model enlarges the theory of problem solving by proposing that prior knowledge and assumptions constrain thinking. Constrained thinking leads to the construction of barriers which are then represented as the problem. This shift in attentional focus from problem to barrier limits problem representation thereby impeding insight into the nature of the problem and the creative generation of solutions to solve that problem. The research builds upon the ‘reframing’ and ‘constraint relaxation’ literature and has implications for individual, team and organizational settings suggesting that performance on a wide variety of problems may be improved by utilizing an ‘integrated’ focus.

Insight and Problem Solving: Review of the Literature

What is Insight?

The concept of insight seems to capture the total mechanism we seek in aiming to determine how a person creatively solves a problem; creative problem solving requires a certain shift in thinking or letting go of assumptions about the problem and its potential solutions at the same time as it requires a sudden clarity of problem representation

characterized as insight or the ‘aha’ moment. Many cognitive psychologists agree that insight plays a necessary role in the development of creative solutions (Dominowski, 1995; Ohlsson, 1992; Knoblich, Ohlsson, Haider, & Rhenius, 1999; Schooler & Melcher, 1995; Sternberg & Davidson, 1995; Sternberg & Lubart, 1996). Wertheimer (1959) articulated well the challenge we face in attempting to train creative problem solving: insight results from the sudden realization of a new, more penetrating view of a problem situation. While many have suggested ways to achieve a new view of the problem (Clement, 1982, 1991; Newell and Simon, 1972; Schoenfeld, 1982; Schoenfeld and Hermann, 1982) it is not clear how to facilitate a more ‘penetrating’ view of the problem, a view of the problem that then prepares the mind to both seek and see the insightful breakthrough, ‘aha’ or ‘outside of the box’ solution.

Insight problem solving has been characterized in various ways: For Schooler, Ohlsson, and Brooks (1993), insight involves:

- a) a solution well within the competence of the average subject;
- b) a high probability of an ‘impasse’, that is, a state in which the subject does not know what to do next; and
- c) an ‘Aha!’ experience resulting from sustained effort in which the impasse is suddenly broken and insight into the solution is rapidly attained.

There exist a number of examples of creative insight from which we can gain a more thorough understanding:

Example 1: An example of insight occurred within NASA during the early days of the space program. Scientists tried to solve the problem of heat of re-entry by devising a substance that could withstand heat, and met with repeated failure. Their ultimate solution – the ablative heat shield that burns away as the space vehicle penetrates the atmosphere, taking the heat with it – turned upside down their original problem definition of ‘how to withstand the heat.’

Example 2: A large healthcare facility was operating with success in a large urban centre (Caldwell et al., 2007). The centre employed over 1000 doctors and several thousand nurses and staff. A smaller health center opened within the same area, offering good care at a reduced rate, and soon lured a good portion of the clientele away from the larger centre. One can imagine the implications that attempting cost cutting would have

upon both employee and client satisfaction. A more insightful solution found the larger centre focusing instead upon quality. Their new mandate of offering ‘quality care at a moderate rate’ found commitment from organizational members and was implemented over 2 years with a positive response from clientele.

The insight mechanism is of particular interest due to implications for related areas of creativity, learning, and performance. For instance, the divergence, openness, looseness, or ‘breadth of attentional focus’ typical of the creative thinker is enhanced further with the unlocking of creative insight into the nature of the problem and would be quite useful in the athletic arena, enabling the player to both utilize all relevant cues and see new possibilities for playmaking. Wayne Gretzky was known for his uncanny ability to ‘see 3 plays ahead of the play at hand’ and ‘hold the whole game in his mind’. Or, as Sidney Crosby, 16 year old hockey phenomena, describes: insight is the ability to see “not where everyone is when you look, (but) where everyone will be if you buy some time and hold the puck for another second” (Allen, 2004). Unlocking the mystery of insight may be the key to expanding our understanding of the creative problem solving process and enhancing performance overall.

How and Why Does Insight Work?

The insightful problem-solving process has been proposed to involve three main phases (Schooler, Ohlsson, and Brooks; 1993):

- a) an initial *representation* phase, in which the solver inappropriately represents the problem
- b) an initial search through the faulty problem space that may lead to *impasse*
- d) and a post-*impasse restructuring* phase.

The present study aimed to further unpack the above phases to determine the what, how and why of each phase as well as exploring the general barriers to insight.

Problem Representation

Perception of the problem or ‘how the problem is represented’ is a critical component to effective problem solving, and researchers have illustrated that conciseness of problem representation varies with experience level in the areas of accounting (Choo & Tan, 1995; Choo & Trotman, 1991; Christ, 1993; Chung & Monroe, 2000; Lehman & Norman, 2006), academics (Gagne et al., 1993), foreign policy (Sylvan & Voss, 1998),

and medicine (Bordage, 1994; Boshuizen & Schmidt, 1992; Rickers et al., 2003; Schmidt, Norman & Boshuizen, 1990, 1993; Van de Weil et al., 2000). While randomly restructuring a problem representation does not necessarily lead to better solutions, the restructuring process seems central to effective problem solving. Kershaw and Ohlsson (2004) distinguish three classes of difficulty factors in solving insight problems: perception of the problem, processing of the problem information, and prior knowledge. Kershaw and Ohlsson (2004) and Ormerod, et al, (2002) demonstrate that the elimination of one factor does not allow an individual to solve a problem with multiple sources of difficulty. If a problem solver develops a correct representation of a problem, the relevant operators will be activated.

It is proposed that that all three sources of problem solving difficulty (perception of the problem, processing of the problem information, and prior knowledge) are linked by interpretive mechanisms and as such can be resolved by facilitating a cognitive shift in problem representation. “The majority of mistakes in ordinary thinking (outside technical matters) are mistakes in perception. Our traditional emphasis on logic does little for perception. If the perception is inadequate, no amount of excellence in logic will make up for that deficiency” (DeBono, 2005). Perception is a matter of directing attention or focus. If you are not looking in the right direction it does not matter how clever you are, you will not see what you need to see. By exploring solution constraints, and the underlying problems that exist within these (lack of control, lack of sustainability), the solver may be more willing to let go of his initial representation and approach to solving the problem.

Prior knowledge or the experiences, beliefs, and assumptions that individuals bring to a task, can support or constrain creative insight and the problem solving process. Familiarity with or prior knowledge of the problem components should hypothetically enhance participants’ performance (i.e. knowledge of mechanics would assist a person in fixing a car problem). Alternatively, it could be argued that familiarity may breed ‘fixation’ and lack of creativity (i.e. assuming that a brick can only be used for building). Successful experiments begun as early as the 1920s by Gestalt psychologists Karl Duncker (1941) and, later, Abraham Luchins (1942) demonstrated that habitual use of familiar objects and problem-solving strategies limits the ways individuals employ them.

Psychologist Jennifer Wiley (1998) revived this work with a study investigating the relation between expertise and blindness to alternatives. Wiley found that “experts generally solve problems in their fields more effectively than novices because their well-structured, easily activated knowledge allows for efficient search of a solution space” (p. 716). Subjects with a large amount of domain knowledge may actually be at a disadvantage because their knowledge may confine them to an area of the search space in which the solution does not reside. Hashem, Chi, & Friedman (2003) found that physicians within a given specialty have a bias in diagnosing cases outside their own domain as being within that domain and try to “pull” cases toward their specialty. In this way, domain knowledge may act as a mental set, promoting fixation in creative problem-solving attempts.

Gestalt theory would suggest that interpretation and representation is constructed based on a number of factors that influence an individual’s perception. Max Wertheimer, together with Kurt Koffka and Wolfgang Köhler, was the founder of Gestalt theory. In his (1912) “*Experimentelle Studien über das Sehen von Bewegung*” he examined the phenomenon of apparent motion, where a pair of alternately flashing lights stimulate a percept of a single light moving back and forth. Wertheimer recognized that this phenomenon revealed a constructive or generative aspect of perception. In terms of problem solving, how one interprets and constructs the problem, what one perceives as the heart of the problem, determines how one might go about searching for and seeing potential solutions.

The missing piece in understanding how people solve problems creatively seems to be that of how an individual arrives at his problem representation and whether or not it is possible to facilitate this process more effectively. Some cognitive psychologists have shown that the interpretation of a problem mediates the processing of the problem information by generating a cognitive bias. The cognitive bias then acts to moderate the utilization of information cues or prior knowledge (Eysenck & Calvo, 1992; Easterbrook, 1959; Mendelsohn & Griswold, 1967; Mendelsohn & Lindholm, 1972) as well as the ability to make ‘remote associations’ (Ansburg, 2000; Mednick, 1962). If an individual interprets a problem as ‘beyond his locus of control’ or ‘threatening’ for whatever reason, he becomes hypervigilant to threat cues, and his attention narrows, (Ansburg, 2002;

Eysenck & Calvo, 1992; Hertel, Mathews, Peterson, & Kintner, 2003; Mogg, Mathews, Bird, & Macgregor-Morris, 1990) resulting in a limited capacity to utilize cues as they are presented. The solver focuses on premature solutions or representations of the problem making it difficult to see the problem for what it truly is (Ormerod et al, 2002). If one is too busy looking at the obstacles, it is impossible to see the openings. It is not so much what causes the imposition of cognitive constraints that concerns us, but rather that such an imposition indeed takes place and how it might be possible to resolve imposed constraints or at least navigate past them to a clarified view of the problem.

Many have experienced the phenomenon in which one has a problem and goes about searching for something to fix the problem. Or, in the words of one colleague, “I don’t know what I am looking for but I know it is somewhere on this workbench.” There is a certain level of openness to potential solutions in such an endeavour that comes with clearly representing the problem. For instance, Getzels (1975) provides an excellent illustration of how problem construction sets the problem solver up for ‘choosing wisely’: An automobile is traveling on a deserted country road and blows a tire. The occupants of the automobile go to the trunk and discover that there is no jack. They define their dilemma by posing the problem: “Where can we get a jack?” They look about, see some empty barns but no habitation, and recall that, several miles back they had passed a service station. They decide to walk back to the station to get a jack. While they are gone, an automobile coming from the other direction also blows a tire. The occupants of this automobile go to the truck and discover that there is no jack. They define their dilemma by posing the problem: “How can we raise the automobile?” They look around and see, adjacent to the road, a barn with a pulley for lifting bales of hay to the loft. They move the automobile to the barn, raise it on the pulley, change the tire, and drive off (p. 38). Therefore, how one represents or defines the problem determines attentional focus (I need a jack vs. I need to raise the car), determines the degree of cognitive restraint (only a jack will work vs. there are many ways to raise a car), and influences creativity (where can I find a jack? vs. how else can we raise the car?). Kershaw and Ohlsson (2004) and Ormerod, et al, (2002) demonstrate that the elimination of one factor does not allow an individual to solve a problem with multiple sources of difficulty. If a problem solver develops a correct representation of a problem, the relevant operators will be activated.

Problem Search and Impasse

In previous work, Ohlsson (1992) proposed that past experience or prior knowledge biases the initial representation of a problem or a situation in particular ways. The initial representation activates potentially useful knowledge elements (categories, chunks, concepts, constraints, methods, operators, procedures, rules, schemas, etc.). These knowledge elements implicitly define a space of possible solutions. If past experience is not helpful vis-à-vis the problem, that initial problem space does not contain a workable solution and an impasse will result. Problem solving often unfolds in a way that reflects the need to overcome the imperatives of past experience. The thinker begins by exploring the approaches to the problem suggested by past experience. When success does not follow, he or she enters an impasse, a state of mind that is accompanied by a subjective feeling of not knowing what to do and the cessation of overt problem-solving behavior. Continued attention to the problem sometimes leads to the appearance of a new idea, solution, or approach in consciousness. If the insight turns out to be unhelpful, the impasse continues. However, if the new idea does point the way to a solution, goal attainment is likely to be purposeful and swift, in marked contrast to the hesitation and passivity of the impasse phase (Knoblich, Ohlsson, Haider, & Rhenius, 1999). Problems involving insight all seem to possess an impasse or a point at which the problem solver gets ‘stuck’. For instance, in the NASA example above, the impasse seemed to occur at the realization that ‘there is no material that can withstand the heat.’ Breaking through an impasse requires ‘insight.’ Breaking through the NASA impasse required that the engineers ‘consider moving beyond the concept of ‘heat tolerance’ and toward ‘heat absorption.’

Kershaw and Ohlsson (2004) distinguish three classes of difficulty factors in solving insight problems: perception of the problem, processing of the problem information, and prior knowledge. Various explanations point to different constraints (prior experience, problem display, assumptions), but all share the view that the locus of problem difficulty is centered on the solver’s constrained representation of the problem (MacGregor et al, 2001). If one’s cognitive appraisal of a problem results in an interpretation of the problem as ‘outside of one’s locus of control’ or ‘threatening’ in any way or for any reason, it is likely that the solver will impose an implicit constraint upon

the problem. Let us examine how the two groups constructed Getzel's car problem i.e. we must have a jack to solve this problem vs. we must raise the car somehow to solve this problem.

In explicating the interpretive or appraisal process, it may become clear as to how we might facilitate a problem representation that is free from constraints. If a person appraises the problem free from constraints, he is more likely to represent the problem in a way that invites more creative solutions (i.e. we need something to lift the car). Such a phenomenon has been observed in a variety of challenging or problem solving situations including cognitive (Eysenck, 1992), artistic (Czikszentmihalyi & Getzels, 1970; Rump, 1982; Suwa, 2003), and athletic (Easterbrook, 1959; Jones & Swain, 1992, 1995; Eubank, Collins & Smith, 2000; Mathews & MacLeod, 1994). An unconstrained interpretation of the problem leads to an unconstrained representation of the problem. A lens through which the solver will represent the problem more clearly places him in a position to notice more sustainable, productive, and appropriate solutions. Representing the problem to accurately reflect the situation then supports a 'preparation of mind' or capacity to recognize the insightful solution when it appears.

Ohlsson recommends 'constraint relaxation' as a potential solution to the impasse. Constraint relaxation is based on the idea that an impasse can be broken if certain constraints can be relaxed. The author would argue within this study that relaxing constraint is not automatic. In fact, the process of relaxing constraints may be more complex than is presumed and may represent the crux of problem solving. Thus it was hypothesized for the current study that a more integrated focus and definition of the problem may serve to relax the constraining barrier focus. For example, opening a door is normally subject to the constraint that the door should not become damaged in the process. In an emergency, it might be necessary to relax this constraint and break through a locked door. In this type of situation, problem solving might be less a matter of searching among possibilities than of redefining what to search for. To break through a locked door in time, one should perhaps search for an axe rather than a key. Knoblich et al. (1996) argue that arriving at the need to search for an axe requires that the constraint to avoid damaging the door be relaxed by realizing that it does not matter if the door is damaged; whereas in this study it is argued that shifting one's focus from the barrier itself

(it's locked!) to the problem the locked door poses to one's goal of reaching safety (we can't get through!) would help one to define the problem in a way that promotes more productive solutions (the problem is we need to get through, how can we smash the door!?).

However, the present study proposes that the mechanism whereby one might shift an interpretation of a problem and thus increase divergence may exist within the problem itself. Ormerod et al (2002) point to an unusual approach: that of failure. With failure, individuals are driven to restructure the initial representation of the problem and open up their attentional focus. What are we ultimately anxious about when attempting to solve a problem? Failure. Gary Klein (1996), in his work on non-linear problem solving, also proposes that possibilities for solution reside within failure for "as options are generated and rejected, the reasons for the failures will suggest ways of changing the course of action, while at the same time changing the way the goal is perceived" (p. 199). In an anxious state, we thus seek out what is familiar, our attention is narrowed, we spend our time dodging failure as opposed to taking risks and 'testing unusual moves' thus making us less open to available cues (Easterbrook, 1959; Ormerod et al, 2002). "The music of the violin we get by friction" (Ashcraft, 2001). When we meet failure at once, there is no possibility for constraints. The result is an impulse to seek alternative moves, to broaden and relax our attentional focus, inadvertently increasing our capacity to solve the problem at the same time.

MacGregor et al (2001) and Knoblich, Ohlsson, Haider & Rhenius (1999) suggest that experiencing 'criterion failure' may induce an impulse to 'seek alternatives' while creating 'a state of preparedness that disposes the solver to attend to solution-relevant information'. It seems a state of mental readiness is necessary for capitalizing upon novel, solution-relevant information. While it is suggested that 'repeated failure' can serve to relax constraints, unless the underlying mechanism causing constraints to be imposed is changed, the solver may simply impose new constraints (i.e. we must find something like a jack to fix a flat tire). It is not clear in either of these studies how or whether criterion failure serves to generate a 'state of preparedness that disposes the solver to attend to solution-relevant information'. Intriguing is the concept of solution within failure. Perhaps within failure, the problem presents itself again and demands a

fresh approach or at least forces the solver to reevaluate what the problem is. In the case of the flat tire, having no recollection of a service station would mean criterion failure, offering a prime opportunity to not only reframe but to reevaluate the problem. The group might simply look for other ways to find a jack, or they might think ‘why do we need a jack anyway? What else could we use?’ What would encourage the group to look for the root of the problem?

Criterion failure may not only signal the ‘need to abandon the current operator and to search for an alternative operator’, but may also signal a deeper problem. It may be, at the point of criterion failure, that an individual is not only open to alternative solutions, but also to alternative problem representations. It is at this point that it may be most possible to facilitate a shift in interpretation. As well, it may be this point that offers the pivotal point upon which an individual can make that shift. Is your solution working? No. Why not? Simply asking people to reconstruct the problem without facilitating an actual shift in cognitive bias may result in a construction still grounded in external locus of control: ‘where can we get a jack?’ ‘how can we make a jack?’ Shifting interpretation of the problem can occur by exploring actual constraints and not only serves to restructure the problem, but does so in such a way as to shift the interpretation of the problem so that it is free of constraints: ‘why is the lack of jack a problem for you?’ or ‘what problems does the lack of a jack create?’, the answer being ‘because we need to lift the car in order to change the tire’. The cognitive shift is made to the goal and as such moves to a personal point of power: ‘we need to lift the car’. If there had been no way of getting a jack, the group would have met with criterion failure and would have been forced to think of ‘no jack’ as a new problem, thereby reconstructing the problem in the appropriate way. Once the group constructs the problem appropriately, they are mentally prepared to ‘see’ the barn and all of the ‘lifting’ possibilities held within it.

While divergent training programs like Synectics ask for a suspension of judgment, openness and divergence of thinking (Harriman & Mauzy, 2003; Hicks, 1991; Nolan, 1989), the synectic approach is an imposed open mindedness as opposed to an emergent openness. Not everyone responds to being told to think openly. However, most people have the capacity to think openly and thus could be facilitated to open up their

thinking processes. In line with all great pedagogical theory, a learner must follow their own path, and make their own connections in order to truly understand.

Inquiring deeply into the problem may help the solver to see the causal connections between the problem they experience and the actual source or ‘root’ of the problem. It may be possible to expose the fundamental problem behind the assumed representation of the problem. In clarifying the problem as such, one also clarifies what is most important to solving the problem. It is this cognitive shift from barrier to goal that restructures the perception of the problem which has, in turn, been shown to increase capacity to process problem information and activate prior knowledge (Eubanck, Collins, & Smith, 2000; Eysenck & Calvo, 1992; Mogg, Mathews, Bird, & Macgregor-Morris, 1990). While putting De Bono’s six hats on may shake loose one’s paradigm or perspective, it would seem to be most effective if we could shift one’s thinking more specifically. The key to removing constraints upon problem representation may lie within the constraints themselves.

Problem Restructuring

Some theories propose that the restructuring phase involves controlled search processes (Davidson, 1995; Kaplan & Simon, 1990), whereas other theories propose that restructuring is achieved through the automatic redistribution of activation in long-term memory (Knoblich, Ohlsson, Haider, & Rhenius, 1999; Ohlsson, 1992; Seifert, Meyer, Davidson, Patalano, & Yaniv, 1995). Several researchers in creative and insight problem solving suggest that the formation of a new representation of the problem is the only manner by which activation can be redirected: Getzels (1982) coined ‘problem construction’, Mumford et al (1994) was responsible for introducing ‘problem representations’, and Ohlsson, (1984;1992) explored ‘restructuring’.

Processing of the problem information is mediated by a variety of cognitive and physiological processes that serve to either enhance or constrain insight and the problem solving process. Stress or challenge has been shown to impact focus, causing the individual to focus unproductively and debilitatively on, among other things, the stress itself (Jones & Swain, 1992, 1995; Jones, Swain, & Hardy, 1993a, 1993b), associated negative emotions, thoughts or images (Hayes, Barnes-Holmes, & Roche, 2001), the step-by-step processes of a task (Wulf, McNevin, and Shea, 2001), or distractions such as

the crowd or external expectations (Eysenck, 1992) (Figure 1). According to the theory of cognitive appraisal, an individual first appraises or interprets a potential performance stressor as threatening or not, then appraises his resources for resolving the threat (Lazarus & Folkman, 1984). Myriad personality, temperament, socio-cultural, and genetic factors may be influencing the mechanism of cognitive appraisal (Cloninger, Przybeck, & Svrakic, 1993; Penley & Tomaka, 2002); however, leverage for changing personal or biological factors may be elusive. Svrakic, Svrakic, and Cloninger (1996) found that their factors of temperament were invariant despite socio-cultural influences.

According to the theory of cognitive bias, if an individual perceives a performance barrier to be a threat to self or performance goals, he will attend to the barrier in an effort to resolve it thereby diverting attention away from the goal (Eysenck & Calvo, 1992; Mathews & Mackintosh, 1998). Effective problem solvers appear to benefit from a facilitative interpretation or acceptance of stressors or performance barriers. Accepting or positively interpreting barriers and stressors appears to free up the cognitive resources required to attend to the task at hand supporting a goal focus as opposed to a threat focus (Hayes, Barnes-Holmes, & Roche, 2001; Jones, Swain, & Hardy, 1993b; Macleod & Mathews, 1988). However, the mechanism that enables individuals to accept or positively interpret stressors and thereby sustain a more productive focus still eludes researchers.

Interpretation in turn may not be explained or controlled. How one interprets an event or a problem is the result of a myriad of infinite factors and can change from one day to the next. A friend described how, though he was able to solve a coin problem in his colleague's office, when asked to do so in front of a classroom of students, he was not able to solve it, despite his earlier success that very day. As well, though he faints at the sight of a needle one day, another day or at the sight of another needle, he manages to remain conscious. However, in understanding how interpretation acts upon problem representation, it may be possible to facilitate a positive interpretation of the problem and thus a representation of the problem free from constraints using an intervention that generates a cognitive shift in interpretation.

Divergence and convergence are popular principles within the realm of problem solving. Scott, Leritz, & Mumford (2004) performed a meta-analysis of creativity training

programs and, based upon 70 studies, found that successful programs were likely to focus on both idea generation and cognitive skills training. The emerging challenge in training CPS has been how to facilitate the divergence necessary to cast a wide attentional net, along with the convergence that enables one to choose well among many alternative solutions. But, while a correlation may exist between divergent thinking or remote associations and creativity in solving problems (Feldhusen & Clinkenbeard, 1986; Harrington, Block & Block, 1983; Mednick, 1959), creative insight does not appear to be a function of divergent thinking alone. For instance, Fontenot (2001) found that creative problem solving skill depended upon a combination of fluency in data and problem finding (number of ideas and problem representations), flexibility in problem finding (variety of ideas and problem representations), and quality of problem statement (degree to which the needs and motives were satisfied as established by the owner, goal and constraints of the final problem statement).

The ability to think of many ideas, or to link remote ideas, does not necessarily mean one is creative (Feldhusen & Clinkenbeard, 1986). Likewise, restructuring a problem representation (Ansburg, 2000) alone will not ensure that a solution will be found or even that a person will notice that an impasse has been broken (Ormerod, MacGregor, & Chronicle, 2002). However, the qualities of divergence and remote association may signify a capacity for creative insight because of the underlying principle they represent: The capacity to think divergently may be operationalized by the same interpretive mechanism that enables a person to represent a problem effectively, that is, a facilitative interpretation that is free from cognitive biases, assumptions or constraints.

While restructuring a problem representation does not necessarily lead to better solutions, the restructuring process seems central to effective problem solving. Several researchers in creative and insight problem solving suggest that the formation of a new representation of the problem is the only manner by which activation can be redirected: Getzels (1982) coined 'problem construction', Mumford et al (1994) was responsible for introducing 'problem representations', and Ohlsson, (1984;1992) explored 'restructuring'. Kershaw and Ohlsson (2004) distinguish three classes of difficulty factors in solving insight problems: perception of the problem, processing of the problem information, and prior knowledge. Kershaw and Ohlsson (2004) and Ormerod, et al,

(2002) demonstrate that the elimination of one factor does not allow an individual to solve a problem with multiple sources of difficulty. If a problem solver develops a correct representation of a problem, the relevant operators will be activated.

Knoblich, Ohlsson and Raney (2001), in a study of problem solving found that ‘gaze’ predicted problem solving ability. They concluded that a problem solver’s focus (in the case of matchstick problems upon either the number or the operand) was a critical factor in the problem solving process. Studies in performance and problem solving have demonstrated that focusing on perceived threats or barriers diverts attention from goal achievement thereby detracting from performance (Eysenck, 1992; Hayes, Barnes-Holmes, & Roche, 2001; Jones & Swain, 1992; Wulf, McNevin, and Shea, 2001). Likewise, efforts to focus solely on the goal when a perceived barrier exists have proven ineffective because the act of replacing the negative with the positive diverts energy and focus from the task at hand (Beilock, Afremow, Rabe, & Carr, 2001).

A certain amount of cognitive readiness may also be necessary to ‘choose wisely’ from alternative solutions once they arise. This suggests that the problem must be represented in such a way that the solver is not only generating viable solutions but also ‘ready’ to see the sustainable solution as it emerges (Seifert et al, 1995). Ohlsson (1992) re-conceptualized insight as “situations which are characterized by initial failure followed by eventual success”. Ohlsson qualifies the term impasse as ‘unmerited impasse’ in that the solver is competent to solve the problem, and extends the definition to one of ‘full insight’ which consists of the breaking of the impasse plus the completion of the entire solution in the mind’s eye pointing out that sometimes solvers continue to struggle even after breaking the impasse or cognitive constraint. In this case the impasse is broken accidentally or without the awareness of the solver. Such a concept points to Ormerod et al’s (2002) suggestion that a certain level of preparedness is also necessary for full insight to occur: the solver must be ready to see that an impasse has in fact been broken and that a whole new realm of solution possibilities are available.

Ormerod et al (2002) show how, ‘even when a move capture(d) the conceptual insight necessary to solve the problem’, the solver would often return to the original constrained thinking (p. 798). Pasteur once said “Dans les champs d’observation, le hazard ne favourise que les esprits prepares” (“In the field of observation, chance favours

only the prepared mind”). The American physicist Joseph Henry echoed this axiom with “the seeds of great discoveries are constantly floating around us, but they only take root in minds well- prepared to receive them.” How many others alongside Newton had also witnessed an apple fall from a tree? This leads us to conclude that the cognitive shift, ‘shaking loose’ or ‘choosing wisely’ process need not occur at the solution end, but rather at the problem end. Perhaps the problem finding process may be more accurately described as a route finding process as well as a root finding process, in that we must navigate a pathway to a more precise representation of the problem. Finally, navigating one’s way past imposed constraints and being ‘ready’ to see solutions may demand a certain ‘letting go’ of assumptions about the problem. Ormerod et al (2002) suggest that meeting with failure can inspire the solver to look for alternative solution paths, or ‘let go’, as opposed to fixating on a pathway that is ineffective.

Conceptual Framework

While many theories abound, it is still unclear how and why the process of insight occurs. What is the underlying mechanism that causes insight to occur? What neurological, physiological, cognitive, or emotional processes are involved in promoting the insight experience? And, based on this knowledge, how might one facilitate or enhance insight? The current study proposed that all three sources of problem solving difficulty (prior knowledge and assumptions, perception of the problem, and processing of the problem information) are linked by interpretive mechanisms. As such, insight may be best understood by inquiring further into the interpretation of a problem and tracing the implications that interpretation may have upon insight and the problem solving process.

The theoretical framework emerging to describe creative insight suggests that the sustainable solution is one that shows insight by illustrating a profound understanding of the problem at its core, and sustainability by offering a practical and enduring application. Various explanations point to different constraints (prior experience, problem display, assumptions), but all share the view that the locus of problem difficulty is centered on the solver’s constrained representation of the problem (MacGregor et al, 2001). If generating sustainable solutions depends upon how the problem is defined, it is important to understand the process of problem representation and its consequences for

the problem solving process as a whole. Building upon this theoretical framework, the following inductive study explored the questions:

1. What is insight?
2. How does insight work?
3. Why does insight occur or not occur?

Methodology

Design

The purpose of this research was to extend the theory of creative problem solving and develop a model of how individuals unlock creative insight. The study aimed to describe the what, how, and why of creative insight as determined from in-depth interviews with athletes, teachers, students, and workers ($N = 325$) tackling a variety of problems demanding insight and creativity. Groups of individuals were interviewed including students addressing puzzle type ‘insight’ problems ($n = 120$), workers addressing the problem of workplace injury ($n = 65$), athletes addressing the problem of performance barriers ($n = 70$), and teachers addressing organizational and educational problems ($n = 70$). Memmert’s recent study of creativity and attentional breadth reviews several methodological aspects and recommends the field of sport in particular as a fruitful area in which complex behaviour can be studied in a complex context (Memmert, 2007). As well, the realistic, open, and complex problems faced by organizational members was considered an important avenue of problem solving to explore.

Participants were interviewed and observed as they tackled problems presented to them by the researcher (i.e. how to tighten a clamp that seems impossible to tighten) or problems of the individual’s own identification (i.e. a workplace injury). Research on defined and ill-defined or ambiguous problems suggests that there is a difference between defined and ill-defined problems (Kitchener, 1983; Reiter-Palmon, Mumford, & Threlfall, 1998) and a further distinction between open and closed problems and open and closed solutions (Jausovec, 1997). Because we are concerned mainly with the workings of insight, we chose open problems and a range of open and closed solutions in the design of our problems. We sought to explore both problems with a defined solution (such as a puzzle) and problems with an undefined solution (such as a workplace injury).

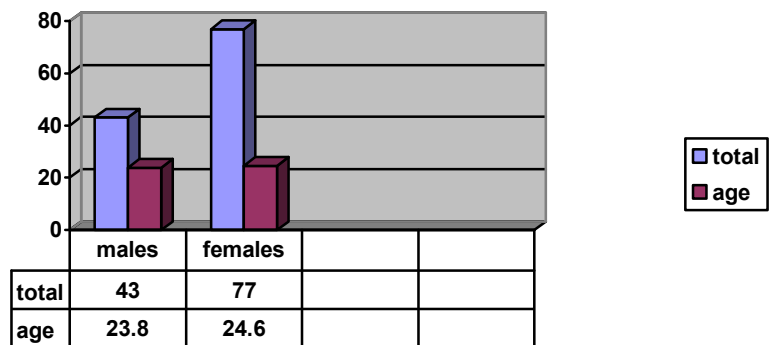
Participants

The sample involved a cross section of individuals facing a variety of performance challenges: students, teachers, injured workers, and athletes ($N = 325$).

Student Sample

The student sample included 120 participants (77 female, 43 male) deriving from a variety of departments within one university who volunteered to take part in the experiment in response to email and poster requests. Participants were given \$20.00 to participate and provided signed informed consent (Appendix A) prior to partaking in the experiment. Participation was restricted to English speakers due to the complexity of the task instructions. Descriptive statistics follow (Figure 1).

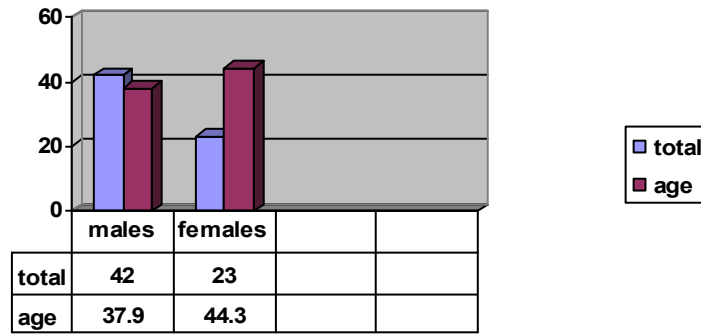
Figure 1
Gender and Age across Student Sample



Worker Sample

A convenience sample of 65 workers suffering from work related injury was involved in the study. The participants ranged in age from 20 - 60 and were enrolled in a short term rehabilitation program at the Canadian Back Institute with an emphasis on activation, education, exercise, and physiotherapy. 100% of people in select locations identified by the research manager of the Canadian Back institute were recruited. Those who granted consent were surveyed and interviewed using the questions described in the procedure section.

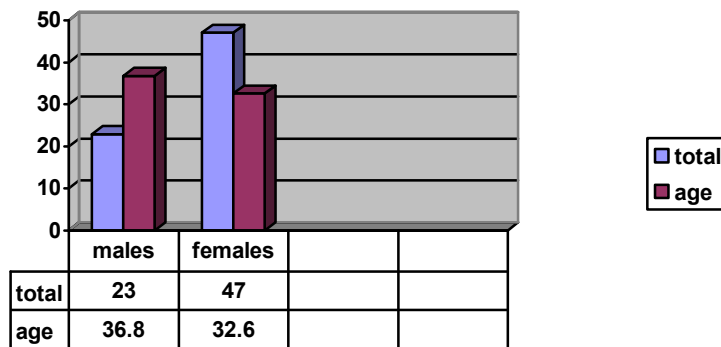
Figure 2
Gender and Age across Worker Sample



Teacher Sample

The study involved a convenience sample of 70 teachers from an independent K-12 school of 120 teachers. The participants ranged in age from 26-58 and teach within a variety of disciplines and age groups. Participants were recruited via email and those who granted consent were then surveyed and interviewed using the questions described in the procedure section. Because interviews were not always possible, some teachers responded instead to an online survey using Question Pro survey tool. Interviews took place in private offices or classrooms.

Figure 3
Gender and Age across Teacher Sample

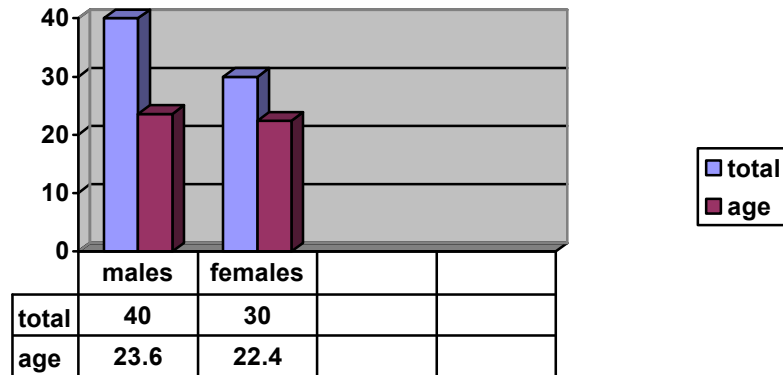


Athlete Sample

The athlete sample was comprised of two complete teams from a university, the women’s soccer team ($n = 30$) and the men’s rowing team ($n = 40$). The athletes ranged in age between 18 and 26 and in experience level from novice/beginner to

varsity/experienced. The interviews were conducted over the course of a full competitive season from September to April and took place in the training facility meeting room. Athletes were asked the questions described in the procedure section.

Figure 4
Gender and Age across Athlete Sample



Apparatus and Procedure

We define insight problems as problems whose solution is likely to produce the experience of insight in the solver. Insight problems involve an initial representation, impasse, and restructuring. A variety of problems were utilized and each type of participant procedure as well as their corresponding problems is described below.

Student Problems and Procedure

Eleven potential insight problems were collected, adapted or invented and appear, along with a description of the underlying restructuring that may be required for solution (the characteristic which potentially makes each one an insight problem) in Appendix A. Also included are references to a problem’s previous use as an insight problem. For the student sample, after informed consent was granted (Appendix B), the researcher explained the research process and participants then attempted to solve 11 insight problems. As they tackled the problems, students were asked the following questions:

1. *What do you find yourself focusing on? What strategies have you been trying?*
2. *Why are you using these/these strategies? What are you trying to do? And why do you want to do that? What is actually important to you?*
3. *Is your strategy working?*
4. *Why not? What is getting in the way?*

5. *And what assumptions are you making? What are you assuming is necessary in order to solve this problem?*
6. *What is posing a barrier for you? And how is that getting in the way? What makes that a problem? What bugs you about it?*
7. *So what are you really trying to do? What is your real challenge? What is the real problem?*

A time limit of 4 minutes was imposed for each problem attempt. If the participant did not solve the problem within the time limit, then the experimenter would move on to the next problem. Participants were informed of the time limit prior to beginning the tasks and assured that the time limit was not designed to exert pressure but rather to move the process along so as not to take any longer than an hour. It was also explained that 4 minutes represented enough time for a thorough attempt.

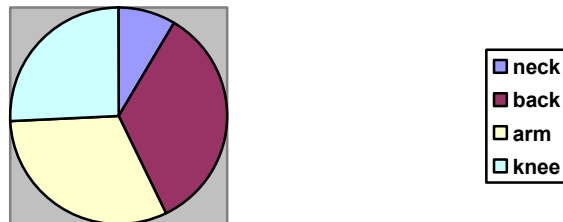
Worker Problems and Procedure

For workers suffering from workplace injury, problems consisted of a variety of injuries (Table 2/Figure 5) as well as the ‘symptomatic’ problems that the injuries created for individuals in terms of their everyday lives (i.e. educational, financial, social; Appendix A).

Table 1
Types of Injuries

<i>Back</i>	<i>Knee</i>	<i>Arm</i>	<i>Neck</i>
44%	30%	36%	10%

Figure 5
Distribution of Injuries across Worker Sample



Workers were interviewed using similar questions in a private office at the clinic where they were participating in a rehabilitative program.

Teacher Problems and Procedure

Teachers were asked to identify a challenge they were currently facing within their work setting. Problems are displayed in Appendix A. Teachers were then asked similar questions via survey or interview.

Athlete Problems and Procedure:

Athletes were asked to identify a problem or challenge that they were currently or recently facing within their training or competition (Appendix A). Athletes were then interviewed.

Data Analysis

Qualitative analysis involved deriving, coding, analyzing and categorizing key themes emerging from each questioning process. Analysis was undertaken manually for initial theming along with two external researchers for inter-rater reliability. After the second level of analysis, the themes were checked with a group of three participants for further corroboration.

Results and Discussion

Student Results and Discussion

Qualitative themes emerging from observations and participant comments were derived, coded and categorized. The key elements of the problem solving process emerged as:

- a) Identification
- b) Analysis
- c) Representation
- d) Appraisal
- e) Focus
- f) Solution Generation
- g) Evaluation
- h) Restructuring or ‘Stuckedness’

It was found that individuals experience the following process when confronting a challenge. The individual:

1. *identifies the problem (i.e. how do I solve this puzzle?)*
2. *draws on prior knowledge and assumptions to analyze the problem (i.e. this means... I believe...)*

3. *and **initially represents** the problem in a constrained or unconstrained manner (i.e. I usually... therefore I must...)*
4. *generates **solutions** and*
 - i. *meets with a barrier due to constrained thinking (i.e. but this solution isn't working!) OR*
 - ii. *attains insight (i.e. aha!)*
 - iii. *if a barrier is met, **re-represents** the problem as the barrier (i.e. how can I make this solution work?)*
5. ***appraises** barrier and resources and **focuses** on*
 - i. *attempting to control the barrier (i.e. I can make this strategy work!)
OR*
 - ii. *resigns to the barrier and gives up (there's nothing I can do!) OR*
 - iii. *accepting the barrier (i.e. I can't control or change this but there are things I can control)*
6. ***evaluates** the solution and*
 - i. *continues to focus on controlling the barrier (i.e. I'll just keep trying to make this strategy work) OR*
 - ii. *gives up (i.e. I suck!) OR*
 - iii. *restructures without insight (i.e. this isn't working so I'll have to try something else or accept, ignore, carry on despite it)*
 - iv. *restructures with insight (i.e. I must focus on the problem this creates for me such as how I can ... despite the fact that...)*

For instance, the initial task or problem in Table 3 was identified as ‘how can I tighten the screw without seeing or going inside of the box?’ Prior knowledge and assumptions were brought to the analysis of the problem leading to constrained or unconstrained thinking and a representation of the problem which is unconstrained or constrained. A constrained representation leads to the construction of a barrier (i.e. the solutions generated do not work because they are not solving the actual problem but rather a constrained interpretation of the problem). At this point, the solver re-represents the problem as the barrier. In this way, the solver moves off track from the initial problem

and its inherent challenges. Once the solver represents the problem as the barrier, she will appraise the barrier as threatening or unthreatening, and she will appraise her resources for addressing the barrier. The combination of problem representation and appraisal will result in a specific focus which is either barrier control, integrated, barrier accept, or barrier resign focus. Focus then influences solutions making them repetitive, creative or non-existent. Based on the solver’s evaluation of the problem (i.e. whether they feel they have struck an insight, impasse, or feeling of ‘stuckedness’) they will decide to restructure their problem representation once again either with insight, without insight, or not at all.

Table 3
Student Problem Solving Process

Analysis	Representation	Appraisal	Focus	Solutions	Evaluation	Restructure
Constrained the hole is too big	Barrier how do I make the hole smaller	Old Resources I’ll do what I always do New Resources I’m sure I will come up with something No Resources I’m no good at this sort of thing	Barrier Control I have to change the size of the hole Barrier Accept It is impossible, so I’ll have to try something else	Repetitive What else could I jam in there?	Impasse	Without Insight there has to be another way (leading to impasse, insight or stuckedness) With Insight given this barrier, what is the real challenge? (leading to insight)
Unconstrained this is an unusual problem	Problem how do I secure the nut without being able to go inside?		Integrated Because the hole is too big, I have to figure out something else for the screw to screw into	Creative There is a nut, but I can’t hold it, so I have to secure it in another way, I guess I could pull on the screw...	Insight	Not at all there is no other way (leading to ‘stuckedness’)
Constrained there is nothing	Barrier I need to figure		Barrier Resign	None I can’t	Stuckedness	

for the screw to screw into	out what else to screw the screw into	It is impossible, so I give up	think of anything at all
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Among the approaches identified above, unsuccessful approaches seemed to be impacted by cognitive constraints in the form of prior knowledge, assumptions, appraisal of the problem, and appraisal of personal resources as shown in Table 4.

Assumptions about the nature of the problem constrained the problem solving process. Many participants working on the plates problem would create one plate, thus breaking through the impasse, and then attempt to fit the other pieces around or onto that single plate rather than creating another plate. The solver seemed locked into a certain problem representation that involved incorporating all of the pieces into one shape, thereby preventing them from seeing the solution when it presented itself. The way in which the participant represented the problem then appeared to determine readiness to see both the nature of the problem and insightful solutions.

At times, participants were able to move past the impasse but not see the impasse, and therefore did not see the solution. For instance, the solver may form a small plate or circle with the plates problem, but then mess the pieces up again and start over, or seek ways to add the other pieces to the smaller circle, not satisfied with a distinct shape and not considering that there may be two shapes. As well, with the cross problem, often a solver would create the square end (breaking the impasse and achieving the insightful solution), but would not see it and would continue trying new pieces to fill the end of the long piece.

Table 4
Barriers to Insight - Students

Prior knowledge	Assumptions	Appraisal of the Problem	Appraisal of Resources
persist, don't give up, that usually works	I need to fill this space, no part of a plus has a right angle	It can't be done, this is really hard	I can't do this, I suck

Further unpacking the concept of focus elucidated additional themes. While participants sustained either a barrier or integrated focus as a result of their problem representation combined with their appraisal of the problem and their personal resources, there appeared to be different types of barrier and integrated foci. Some participants with

an integrated focus achieved the solution by apparent instinct while others processed the problem and arrived at an integrated focus after some deconstruction and analysis as portrayed in Table 5.

Table 5
Impact of Focus on the Problem Solving Process - Students

Focus	Process	Solutions	Evaluation	Restructure
Integrated I have to figure out something else for the screw to screw into, I've done this before	intuitive	pulled on screw right away, instinct	insight	none
Barrier Accept / Integrated There are too many cards. I need a 4x4 not a 3x4...	sees failure, problem, and solution	3x4, impossible! Matrices, 3D, okay, what I need is a 4x4 with spaces	insight	none
Barrier Accept / Impasse There are too many cards, I need a different kind of grid...	Sees failure, problem, but no solution	Ugh, I don't know what else to try!	impasse	restructure/new representation OR stuckedness
Integrated I have to make enclosures	sees problem and solution	Overlapping squares because each piggy needs own space...	insight	none
Barrier Control I have to change the size of the clamp	sees problem but cannot see solution	too much wire in clamp, I want to cut some out, bend it...	impasse	restructure/new representation
Barrier Resign There are too many cards, it seems impossible	Sees failure, does not see problem or solution	Does this even have a solution?	impasse	stuckedness

The intuitive problem solver seemed to rely upon prior knowledge, but in this case, the assumptions were correct i.e. one participant working on the 8 sticks problem stated: 'I want to flip it. I want to make this box but I have to make it somewhere else.' Insightful problem solvers seemed to either possess direct insight into the nature of the problem i.e. 'how can I double the leftover coins?' or spent time problem 'finding' and eventually were able to articulate the problem i.e. one participant working on the clamp problem cinched, took his time, tested the size, stared and studied, eventually stating 'I need to somehow make this clamp smaller... aha, I need to overlap the ends!' Others

seemed inspired by failure. For example, one participant stated: '3 x 4 is impossible' while working on the cards problem. He then said, 'I need a 4 x 4 grid with spaces, can I have spaces?' thereby achieving the insight and completing the problem.

The most interesting problem solving approach was the one in which the impasse was broken through but the solution was never achieved. For instance, a participant would arrange the cards perfectly needing to move only one Jack to achieve the insightful arrangement of a 4 x 4 grid with spaces. However, the participant clearly did not understand the real nature of the problem or see that she had broken through the impasse as demonstrated when she quickly reverted back to the 3 x 4 grid and then messed all the cards up to start over.

In another case, the participant seemed constrained by a lack of confidence i.e. one participant working on the cards problem stated the insightful representation of the problem 'there are too many cards, not enough rows' but her feelings of inadequacy seemed to prevent her from generating solutions, 'I can't do this, I suck.' Alternatively, some participants seemed constrained by too much confidence. Those who insisted on attempting to overcome a barrier repeatedly because they believed that 'to persist, and don't give up, usually works' reached impasse and did not restructure the problem other than 'how else can I make my strategy work?' For instance, many participants working on the cross problem would continue to 'fill the space' in the large piece, confident that 'something would eventually work.' Others working on the 8 sticks problem would continue to try to build the box in the top right corner, convinced that 'there had to be a way.' Such an over-confidence in strategies prevented the solver from considering alternative representations of the problem.

Worker Results and Discussion

Participants suffering from workplace injury emulated a similar problem solving process to that of the student sample (Table 6). For instance, a worker might identify the problem as the injury itself and constrained thinking would lead to the assumption that 'I may not be able to do a physically demanding job now' or prior knowledge may lead the individual to believe that 'I have an additional stress' because 'I have language challenges to worry about already, now I must add the physical consideration.' These constraints are coupled with a threat appraisal of the injury expressed by his belief that he

will ‘have to put many of (his) goals on hold and, with some of them, start over’ and his threat appraisal of his resources to address it: ‘I am vulnerable. I am not sure if I can go back to do whatever job I want. I am limited.’ Constrained thinking constructs a barrier focus and causes the individual to attempt to control the barrier: ‘I have been coming here, getting therapy and physio, being careful. There are delays in my decisions now in terms of my mobility. I don’t move instinctively’, accept the barrier: ‘I have to realize that I have to care for my body and know my limits’, or integrate the barrier:

‘These concerns impinge upon my abilities to fulfill my roles. If I am a failure, people may not think I am capable any more. I have lost power. If I am not seen as capable, then I need to find jobs I can do. I need to talk to my boss about what I can do. I need to evolve. What is in my power? I need to set new goals and ambitions. I want to work at a bank. I want to figure out ways to work that are not going to cause injury to me. I need to also be a leader in the workplace and that means taking the lead on safety. I will find new ways to do the work.’

A barrier focus that aims to control the barrier leads to fixation, more unsustainable solutions and impasse. Accepting the barrier or integrating the barrier can lead to insight into the nature of the problem and consequently the generation of more creative solutions. Acceptance should not be confused with resignation. An individual who accepts the barrier but then resigns himself to it, is closed to any possibility of insight or creativity and is left in a state of ‘stuckedness’: ‘I felt useless. I felt like a failure’, ‘I feel isolated, alone at home. That makes your mind work overtime.’

Table 6
Worker Problem Solving Process

Analysis	Representation	Appraisal	Focus	Solutions	Evaluation	Restructure
Constrained I feel like I can’t do it all alone.	Barrier I need that emotional support.	Old Resources I’ll do what I	Barrier Control and keep fighting for	Repetitive keep fighting	Impasse	Without Insight there has to be another way

		always do	funding.			(leading to impasse, insight or stuckedness)
		New Resources I'm sure I will come up with something	Barrier Accept It isn't working, so I'll have to try something else			With Insight given this barrier, what is the real challenge? (leading to insight)
Unconstrained Well, I know it is a process. I know it takes patience.	Problem I know I have to fully recover before I go back, so that I'm confident and I do a good job. It's really about being there for the kids.	No Resources I'm no good at this sort of thing	Integrated I have to be patient and know that it will take time, but I have to take that time in order to be there 100%.	Creative It's hard to stay positive but this place is good for that, reassuring, supportive, confidence building. And you need to be positive through this.	Insight	Not at all there is no other way (leading to 'stuckedness')
Constrained my financial status could be up in the air	Barrier I worry about my ability to continue fully as a production line worker		Barrier Resign Just coping with pain	None	Stuckedness	

Among the approaches identified above, unsuccessful approaches seemed to be impacted by cognitive constraints in the form of prior knowledge, assumptions, appraisal of the problem, and appraisal of personal resources as shown in Table 7.

Table 7
Barriers to Insight - Workers

Prior knowledge	Assumptions	Threat Appraisal of the Problem	Appraisal of Resources
There's that stress and anxiety of 'what are my options.' I feel guilty asking. People don't tell you.	A lack of support does not allow me to pursue the goals I have	I'm not a whole person because of my injury, because of my inability to work.	I can't do it alone

I've had lots of injuries, I can get through it. I know what to do, I can handle it.	That's my only choice...	'I can't 'not do it' when I am working without wreaking havoc throughout the district program	You just have to accept it, you can't do a thing. We just work through it, we always have.
you think that they know what they are doing	I guess I just assumed they were doing their best	I hate not working, sitting around	I don't have much experience in this so... (I didn't say anything)

Individuals approach identified problems bringing assumptions and prior knowledge to their analysis: 'What bothers me most is how unfair it is. The accident wasn't even my fault. It is so unfair. I am innocent yet I have to suffer this pain and injury.' These assumptions constrain thinking and can lead to the construction of barriers: 'My neck and back are injured and I have terrible pain.' Individuals then represent the problem in terms of this barrier:

'I am a mechanic so my job relies heavily on my neck and my ability to look up underneath cars. I am doing rehab here and it works to a degree but not for the pain. I have 8 hours of pain a day. It pisses me off. How can I get through 5 more weeks?'

Representing the problem in terms of the barrier then leads to an attempt to control the barrier. Often a barrier, such as pain, is more likely a reality than a problem, and is uncontrollable: 'It just aches and aches. I can't get relief from it.' Fixation on the barrier leads to repetitive solutions and eventually impasse: 'It is totally consuming. It's all I can focus on sometimes.'

Likewise, participants demonstrating a threat appraisal of their injury constrain their thinking leading to the construction of barriers: 'The injury has led to a great deal of pain, and I feel like I move 1 step forward and 2 steps back.' The barrier then replaces the problem representation as the participant comes to focus on the barrier as the problem: 'I have tried relaxation and meditation exercises as well as coming here now to this program.' Further threat appraisal of resources leads to a barrier representation: 'It seems impossible for me to continue in my present job.' The tendency is to then focus on controlling the barrier: 'I just push through, I have reinjured my back and neck several

times now,’ or resigning to the barrier: ‘I feel like there is no way out.’ A barrier control or barrier resign focus lead to impasse or a state of complete ‘stuckedness’ or stagnation.

Focus also appears to play a large role in the insight and problem solving process (Table 8). Some workers were able to generated insightful representations of the problem and creative solutions intuitively. For instance, several participants immediately understood the true nature of the challenge the injury posed for them:

‘But if I couldn’t quite cut the mustard...I would have to try to play a different position so that it wouldn’t be damaging to myself and my team. I could give more to the kids. It is just about as much a workout, more of a mental workout too. I have to think about it, and break things down for them...I can play other sports like golf, but I love baseball. I can just get more involved in the league. I get self satisfaction from playing, but if I can’t get self satisfaction out of playing I can get satisfaction out of helping others play. Our league is excellent. It makes you feel good to know that people are having fun out there, that they don’t want to leave.’

Others were able to see that impasse or failure and were able to accept and look at the problems this impasse created for them:

‘I will focus on sustaining strong relationships at work with my long time coworker in particular and in taking pride in the fact that I ‘do the right thing’ (like catching a keg before it creates a bigger problem). When I am home, I am home and I will focus on being the best I can be there rather than trying to change what I can’t at work.’

Table 8
Impact of Focus on the Problem Solving Process - Workers

Focus	Process	Solutions	Evaluation	Restructure
Integrated It doesn’t even enter my mind that I wouldn’t be able to play. Now, an injury is different. But if I couldn’t quite cut the	intuitive	I would have to try to play a different position so that it wouldn’t be damaging to myself and my team.	insight	none

mustard...				
Barrier Accept / Integrated I know I can't continue with what I was doing physically, so I will have to find something else.	sees failure, problem, and solution	I can start planning. This injury has given me some time to work on redoing my resume and gaining clarity.	insight	none
Barrier Accept / Impasse You just have to accept it, you can't do a thing. I can't 'not do it'	sees failure, problem, but no solution	I've had lots of injuries, I can get through it. That's my only choice.	impasse	restructure/new representation OR stuckedness
Integrated I'll do whatever it takes to go. I don't have to stand, I can figure ways around it.	sees problem and solution	If I can't lift and move, I'll figure out solutions. I can still sail.	insight	none
Barrier Control Without some support it is hard for me to pursue any other kind of job. Without emotional support, I'm all alone.	sees problem but cannot see solution	I'll seek that emotional support and keep fighting for funding.	impasse	restructure/new representation
Barrier Resign I've been doing physio for 8 months but I don't see it really working.	Sees failure, does not see problem or solution	I don't do anything. I don't see anyone.	impasse	stuckedness

Most interesting perhaps were those participants who could articulate the problem but did not seem to hear it and reverted back to a barrier control focus. For instance, the woman seeking emotional support seemed constrained by her over confidence in her strategy: 'Without some support it is hard for me to pursue any other kind of job. Without emotional support, I'm all alone. I'll seek that emotional support and keep fighting for funding.' Though she accepts the barrier: 'I have two children to support and I need emotional support, and there is none' and she is able to articulate the real challenge: 'A lack of support does not allow me to pursue the goals I have or to help my kids be strong. It makes me feel all alone,' she is not able to penetrate the barrier to see the challenge of figuring out ways to pursue her goals and help her kids be strong despite a lack of support.

Perhaps it is her threat appraisal of her own personal resources that constrains her thinking even further and makes it difficult to relinquish a barrier control focus: 'I'm so stressed and depressed that I don't know where to start. I need that emotional support.' Or perhaps the barrier is her lack of personal resources and thus she fixates on increasing these preventing her from seeing the challenge her lack of personal resources poses: i.e. I

can't do it alone, and there is nobody to help me, therefore I need to find other resources to equip my kids and to guide me in pursuing my goals (such as organizations or service providers). It appears that her assumptions about her ability to get emotional support may be constraining her ability to move beyond a barrier control focus. If she does not ever achieve emotional support, she may eventually feel at a loss and simply give up.

Teacher Results and Discussion

For teacher participants, similar stages and themes within the problem solving process were observed (see Appendix C: Problem Solving Processes). For instance, a teacher described the problem as 'never feeling like she had achieved the learning outcomes she was obliged to teach to her students.' Assumptions about what 'she was supposed to accomplish' constrained her thinking causing her represent the problem initially as 'feeling pressured to know very clearly what she must teach so as to avoid 'wasting time' focusing on something she wasn't supposed to include.' Representing the problem in this way constructed the barrier of 'feeling unclear and thus incompetent and worried that time allocated to her subject was continuously being eroded by administrative timetabling decisions, thereby cutting into the time she had to deliver the curriculum.' Because she appraised her problem and her resources as threatening i.e. she felt 'incompetent' and feared 'delivering material that was irrelevant because it would let the kids down.' Her threat appraisal coupled with her barrier representation created a barrier focus and solutions that met with impasse and lack of sustainability: Her solutions had been to focus on what she was 'supposed to teach' and ensure that 'all the details were taken care of'. However, 'focusing on the details' was not really working because 'she would always end up missing deadlines for herself' further eroding her confidence and sense of clarity. 'If she wasn't confident then she would not be effective.' When she explored the barriers more fully, she was able to penetrate these and reveal her goal:

She described a feeling of 'letting the kids down', of 'not honouring them' or her 'responsibility to ensure that each perfect child was attended to and taught the skills they need'. Then she told me a story of a child who she had seen as a grade 12 student and who had 'discovered the poet in himself'. He was 'following the beat poetry' and 'seemed to have really found his voice', he 'was a poet'. She recalled him in grade 8 as someone who 'had trouble expressing himself with clarity' and that she had focused on this with him. She 'now saw that she had

missed his need to simply find a medium that worked for him'. She was 'sad that she had been so focused on clarity that she had missed a potential avenue for him to express himself'.

A more integrated focus then seemed to bring forth more creative solutions:

Three days later, she articulated that 'honouring the child' was her goal, and she decided to begin her planning not with the curriculum, but with constructing an image of her beliefs as a teacher 'starting from the foundation up' as a guide to her decision making in the classroom. She recognized her ability to 'begin her lessons with broad concepts as opposed to tertiary details' and that the 'details would spring from these grander concepts'.

Among the approaches identified above, unsuccessful approaches seemed to be impacted by cognitive constraints in the form of prior knowledge, assumptions, appraisal of the problem, and appraisal of personal resources. A man spoke of 'wanting to apply for a job' but being concerned about 'the politics of the department in which the position resides'. He explained that he had applied for a position before and that the group had 'been quite black in their response, they had worn black and had treated his proposal for the position quite seriously.' He had been very turned off by their response. In this way, prior knowledge and assumptions can constrain thinking and create barriers that become represented as the problem. His solutions then become barrier focused 'trying to avoid the politics' or 'hoping that they did not continue' but neither of these options were sitting well with him and he was feeling reluctant to apply. Likewise, appraising his resources negatively (how else am I supposed to get where they are going?) and the problem as threatening (they weren't willing to work with him on his proposal) caused his solutions to continue to be barrier focused: how do I overcome the politics?

Focus also appeared to play a large role in the outcome and process of problem solving for the teacher sample. A barrier focus as described earlier, usually leads to impasse. 'running laps to release energy', 'peer evaluation and marking', 'sending behaviourally challenged children to the computer lab', and 'increased classroom structures and routines' may help in the management of the classroom but they do little to 'improve conditions for student learning' and create even more 'extra' work for teachers reducing time for one-on-one or collaborative team planning.

While accepting the barrier can lead to a more insightful representation of the problem it can also lead to impasse due to an apparent lack of creativity once the problem has been represented clearly or due to an over-confidence in one's strategies for controlling the barrier. For instance, a teacher described how frustrated he was that he had not been given the 'head of physical education position.' He 'tried to take on more leadership and assert his ideas when possible,' but he often felt 'shut down' by the person in charge. He was focused upon 'gaining leadership' and controlling the barrier, when really his goal was to 'share ideas' and 'help.'

Accepting the barrier at times led to a more insightful representation of the problem, such as the teacher struggling for position who accepted that his principal 'shut him down in order to assert his own leadership and establish his credibility with the team.' He was then able to see that what bothered him most was the 'lack of opportunity' and that 'he wouldn't be able to implement any of the ideas that he had or any of the skills that he possessed' which helped him generate more productive and creative solutions. In describing how he might go about 'helping and sharing his ideas' effectively he suggested that he 'work with the head of P.E., explain that he wanted to help, explain his ideas, and develop strategies for implementing them in a way that was supportive of the department as a whole.'

At times, acceptance of the barrier was not enough to lead to insight. Teachers argued that lack of specialist educators in the schools and increasing class sizes were compromising the education of children but the focus remained on the barrier of 'reducing class size, and changing the legislation that removed the class size limit from contracts.' When asked whether attempts to have their demands met had worked, the teacher explained that though the 'work to rule' action taken by teachers in the past was effective at making a statement about the amount of 'extra' work demanded of teachers, it did little to resolve the problems or change the situation. Perhaps an over confidence in their efforts to 'have their demands met' limits them from noticing the insightful representation of the problem ('compromised learning conditions'). At times, an acceptance of the barrier leads to resignation: 'class sizes are here to stay and all we can do is endure it.'

Athlete Results and Discussion

Similar themes emerged for the athletes' problem solving process (Appendix C). A university rower complained of 'not being able to make a technical change that the coach was asking him to make.' He was struggling to 'not lunge or reach too far at the catch (top of the stroke).' I asked him what he had tried so far to make the change and he explained that he was 'really concentrating on all that the coach was asking him to do, sit up, not reach out so far, use his legs more' but his assumption that this change would cause him to 'row too short' was making it impossible to commit to the coach's requests. He believed that 'he was committing 100% to the guys in my crew and putting out extra only when he was reaching out long.' His barrier representation then caused him to focus on 'doing what the coach asked without rowing too short' which he believed was impossible. He appraised the problem as threatening to his position on the team and worried that he couldn't possibly make the change. Accepting the barrier allowed him to sustain a more integrated focus: He explained how in the boat what bothered him about rowing 'too short' was that 'if he saw his stroke was shorter, then he felt like he wasn't giving it his full effort, wasn't putting in a full stroke. It's important to be putting in a full stroke, to be feeling like I am committing 100% to the guys in my crew and putting out extra, he only felt this when he was reaching out long.' The insightful representation of the challenge became how to 'commit wholly to the team' and produced more creative solutions: He described how he felt when he was in a four man boat recently and all of them had responded to the coach's request to sit up taller and drive more with the legs. He felt the unity and commitment of all four guys. He also noticed how one of the tallest guys was sitting up, not reaching out so far, and still maintaining a long and fluid stroke. He was then able to express his new goal as 'committing to the crew' rather than 'rowing long.' He saw that 'committing' could also happen with the legs and with a power application that was unified with the other crew members.

Among the approaches identified, unsuccessful approaches seemed to be impacted by cognitive constraints in the form of prior knowledge, assumptions, appraisal of the problem, and appraisal of personal resources. A rower struggled with making a technical change. Appraisal of resources as threatening led to a barrier focus when he complained that he 'couldn't stop lifting with his shoulders at the catch' and 'didn't feel that he was able to do it all the time and he would fall back into the habit often.' His

assumptions about what made a boat go fast further constrained his thinking: he ‘worried about being too slow off the start, too soft, for if he didn’t go hard at the beginning, then his whole stroke or drive would be slower and he wouldn’t have as much power at the end of it.’ This led him to a barrier focus of ‘lifting his shoulders’ to ‘get on it faster’ at the beginning of the stroke. Such a technique only deprived his stroke of power overall because he would expend too much of his strength too early.

Prior knowledge also proved to constrain thinking with athletes. A rower complained that he couldn’t make the technical change from ‘lifting his shoulders at the catch (top of the stroke)’ to ‘driving more with his legs and lower back.’ He could understand how the coach’s description of an effective stroke would be better than his own, but he couldn’t make the change easily. He ‘felt that it was too easy’ when he rowed the way the coach was asking him to row. He ‘wanted to get on it right away’ and believed, according to prior knowledge, in ‘doing that in all aspects of his life.’ He found ‘it generally worked.’ However, technically, lifting his shoulders would expend energy too early and reduce his overall power. He also assumed that responding to the coach meant ‘trying to relax and be more calm.’ The resulting barrier focus causes the athlete to focus on forcing a change rather than achieving a goal within a certain technical parameter.

Focus plays a large role in the problem solving processes of athletes. As with the other samples, an ability to see the problem and solutions intuitively helped many athletes to generate creative solutions. For instance, some soccer players were able to quickly and intuitively represent the problem insightfully, resulting in creative solutions: ‘my opponent was tackling me so I focused on where I put the ball when I crossed it’, and ‘a player was on a breakaway towards our keeper, I ran towards the goal to cut off the player’s angle so that I could get there quickest or get behind the goalie in case she got by her.’ Others were able to see the impasse or failure in a situation, which allowed them to restructure the problem in an insightful way and generate creative solutions. One soccer player, when faced with a particularly challenging opponent, was able to acknowledge how difficult it would be to ‘stay with her opponent’ and represent the problem insightfully as one of ‘communicating with my partner to make sure someone follows back, and when we get the ball paying attention to get forward.’ However, accepting the

barrier was not always productive and often led to a renewed vigour in attempting to overcome the barrier by ‘just trying harder’ without understanding the nature of the challenge. At times, acceptance leads to resignation. Even though the participant was able to recognize failure, accept the barrier as impossible, or be at impasse, he lacked the tools to restructure the problem, perhaps due to a threat appraisal of personal resources, and resigned himself to failure: ‘we hit rock bottom’, ‘I just walked away.’

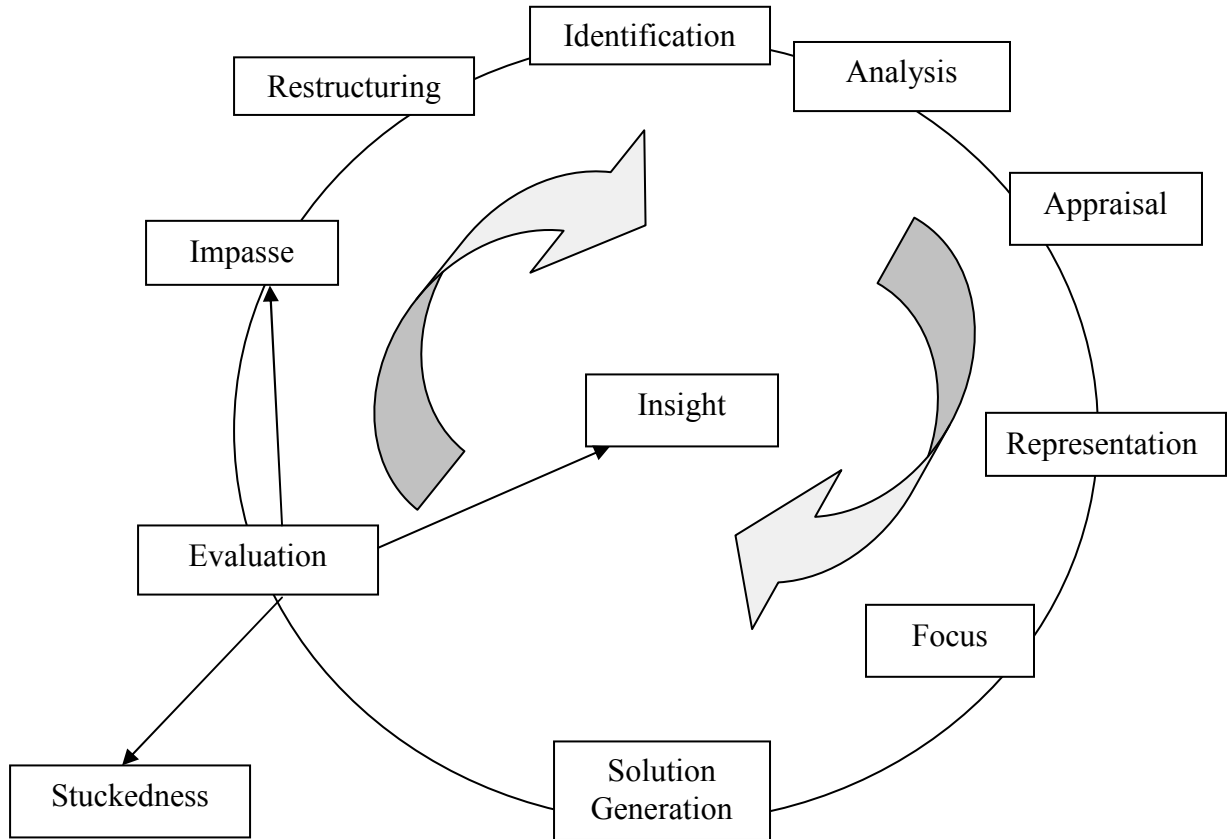
General Discussion

What is Insight?

It is believed that creative insight follows the integrated focus model, built from in-depth interviews with 325 participants tackling a variety of problems. The model proposes that creative insight involves eight stages and can be cyclical (Figure 6):

- a) Identification
- b) Analysis
- c) Representation
- d) Appraisal
- e) Focus
- f) Solution Generation
- g) Evaluation
- h) Restructuring or ‘Stuckedness’

Figure 6
Pathways of Problem Solving



How and Why Does Insight Work?

In general, the data demonstrate the roles that prior knowledge, assumptions, appraisal, and focus play in the insight problem solving process (Table 9).

Table 9
Cognitive Mediators and Moderators of Problem Solving and Performance

Problem Rep	Appraisal	Focus	Solutions	Evaluation
Constrained	Old Resources	Barrier control	Repetitive	Impasse
Constrained	No Resources	Barrier accept impasse	None	Impasse
Constrained	Old resources	Barrier accept integrated	Creative	Insight
Constrained	No resources	Barrier resign	None	Stuckedness
Unconstrained	New	Integrated	Creative	Insight

Resources				
Intuitive	Old Resources	Integrated	Creative	Insight

The cognitive mechanisms of appraisal and focus determine readiness to both seek and see insightful solutions, resulting in either a state of insight, impasse, or ‘stuckedness’. At the point of impasse, the individual cycles through the phases having either a) restructured the problem representation or b) retained the same problem representation but with renewed vigour or c) reach a point of complete failure or ‘stuckedness’. Stuckedness describes the state an individual reaches in which they ‘give up’ or throw up their hands in defeat because they see no alternative. At times, impasse seems to facilitate further restructuring and insight by causing individuals to let go of their barrier representation of the problem; at other times impasse leads to renewed efforts to overcome the barrier. Because overcoming the barrier is usually unsustainable or impossible, this avenue eventually leads to restructuring or a state of stuckedness. For instance, after ‘pushing through several injuries’ an individual may become exhausted and have a complete physical breakdown. The breakdown may lead to a restructuring, insightful representation of the problem, and more integrated focus: i.e. what problems does my inability to work create for me and how can I solve these given my injured status? The breakdown may also lead to stuckedness: i.e. I am useless.

At times participants would represent the problem correctly but would be unable to generate creative solutions. At this point, a brainstorming intervention may help. Presently, creative problem solving strategies focus on generating creative solutions to a problem at the outset. While it is possible to intuitively arrive at a problem representation or an insightful solution, such a strategy is unreliable and at times the problem solver seems ‘surprised’ when arriving at the answer. While it is possible to ‘stumble upon a solution’ it is just as easy to stumble past it. Divergence and openness can be helpful to the problem solving process, but alone creativity exercises and strategies are not enough to ensure an insightful solution. The data supports the study’s reasoning that creativity may not be productive or purposeful until after the problem has been represented correctly and focus has been recomposed to include both the barrier and the goal. For instance, a student working on the screw problem could articulate that she needed to

‘secure the nut on the inside somehow in order to provide something to screw the screw into’ but was unable to generate solutions. Participant responses throughout the problem solving process suggest that it is not enough to simply see the solution or see the problem, one has to be ready to see solutions due to a clear representation of the problem, or ready to see and pursue the problem due to confidence in personal resources. At this point of insightful representation of the problem, it is believed that creativity exercises such as divergent thinking and brainstorming would be most effective.

In contrast, some individuals would get the solution but not the problem. They would break through the impasse but remain focused on overcoming the barrier. This inability to see an impasse suggests that if the solver is not ‘ready’ to see the impasse they will not recognize it when they do come across it. For instance, an injured athlete who has represented the problem as ‘getting better fast’ will not see the opportunity to ‘support her team and demonstrate leadership from the sideline’ because she is too focused on ‘getting better in order to resume her leadership position on the team.’ The lack of recognition of the impasse supports the idea that a solver must have represented the problem in such a way that the impasse is recognized when broken. If the solver has represented the problem as the barrier, they are focused on overcoming the barrier and they will not see the solution to an insightful representation of the problem. Readiness may involve a more precise understanding and representation of the problem.

Checking assumptions can be helpful, but it is also important to see the constraint one has set up because of the assumption. “Perspective transformation is the process of becoming critically aware of how and why our assumptions have come to constrain the way we perceive, understand, and feel about our world; changing these structures of habitual expectation to make possible a more inclusive, discriminating, and integrating perspective; and, finally, making choices or otherwise acting upon these new understandings” (Cranton, 1994, p. 22). While assumptions may well impact and constrain cognitive processing on ill defined problems (Bowe et al, 2003; Schommer, 1990), checking assumptions, though important, may not always be realistic. As several participants queried: ‘how can I check my assumptions when I don’t realize I am making them?’

One further theme emerging is the idea that each individual must follow their own path to the solution. A certain level of failure seemed to be necessary before participants were willing to move on or release a strategy that was not productive. Participants perhaps needed to recognize the failure of their solutions before they were willing to attempt other solutions or recognize the barrier as a barrier rather than as the actual problem. For instance, two injured workers seemed to cling to their strategies of ‘fighting for emotional support’ and ‘just accepting the fact that they don’t want to hear (my ideas for preventing injuries)’ despite the unsustainability of both strategies. Perhaps in time, they will come to recognize the immovability of these barriers, reach an impasse, accept the barrier, and reconstruct the problem more insightfully: i.e. given that there is no emotional support available, how else can I ensure that my kids are equipped and supported? Or, given that the organization does not want to hear my ideas, how else can I implement my ideas? Perhaps a certain level of self efficacy (belief in one’s ability to and resources for addressing a challenge, Bandura, 1980; Lazarus & Folkman, 1984) is required in order for individuals to let go of uncontrollable threats. Such individuals may be better able to tolerate a level of uncontrollability because, though they do not necessarily know what alternative solutions exist, they are confident in their ability to generate ‘some kind of alternative solution somehow.’ Opportunities for leverage are limited, however, for it is difficult to change or enhance self efficacy especially when under time constraint as posed by an athletic, professional or academic challenge. The present research suggests that manipulating focus may be a more productive avenue for facilitating problem solving outcome.

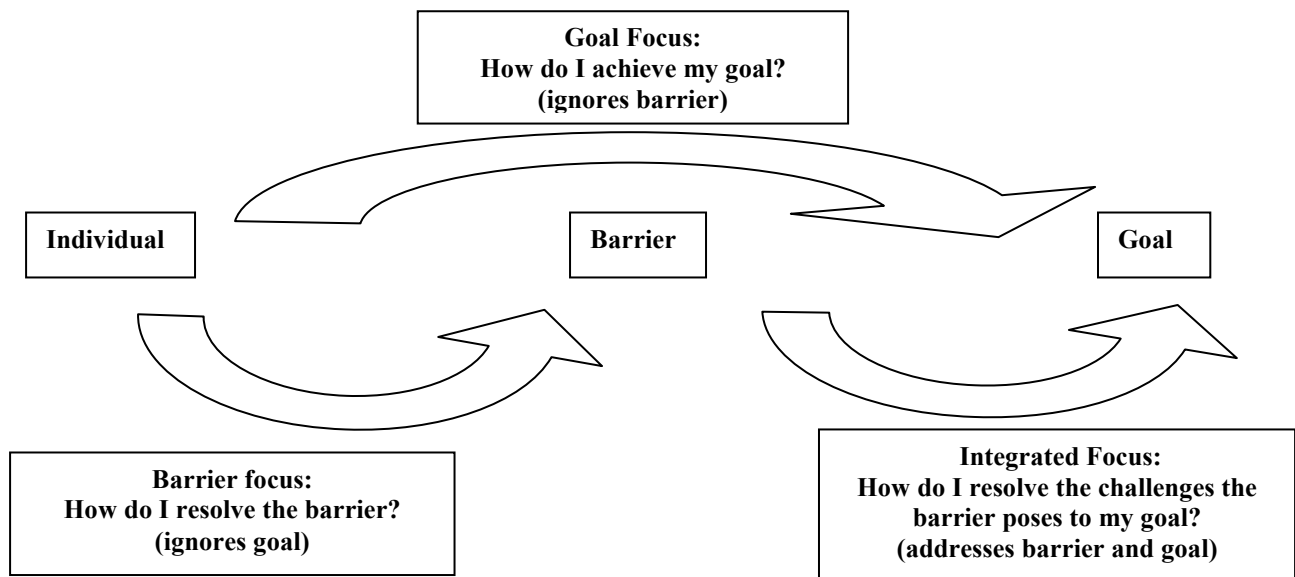
It appears that threat appraisal plays a large role in how strongly an individual clings to their barrier representation and barrier control focus. If the barrier is perceived as very threatening as it appeared to be for the woman seeking emotional support then the tendency would be to focus on the barrier with great intensity. Asking a person to let go of the barrier would be unproductive. Attempting to override the individual’s need to address perceived threats will likely result in resistance (Baumeister, 1984; Baumeister et al, 2001). In order to facilitate a more integrated focus, it may be necessary to ‘drill down’ through the barrier or ‘unpack’ the barrier to better understand what makes it threatening to the individual (i.e. what bothers me most about the lack of emotional

support is that I'm not sure if I can equip my children all by myself, or, what bothers me most about the fact that the organization is not listening to my ideas is that my ideas for injury prevention are not being implemented). Unpacking the barrier exposes, clarifies and elucidates the individual's actual challenge or goal (i.e. I need to support and equip my children, or I need to implement my ideas for injury prevention in the workplace). Utilizing the barrier as a pathway to a more goal oriented representation of the challenge still enables the individual to address the threatening nature of the barrier while moving toward a new, more productive representation of the challenge (i.e. how can I equip my children despite a lack of emotional support? Or, how can I prevent injuries in the workplace despite a lack of support from my administration?). Understanding what goals the barrier is threatening will serve to identify more clearly the individual's actual goals.

Promoting Insight

In order to 'drill down' or 'unpack' perceived barriers and the threats associated with these, the question: "what bothers, concerns, or worries you most about the injury?" would appear to offer leverage for clarifying the actual goals and values that the threat is threatening, thereby clarifying the actual problem. Unpacking the threat both addresses perceived threats and generates a pathway to the goals that the threat threatens, bypassing constrained thinking and the barriers that constrained thinking constructs as illustrated in Figure 7.

Figure 7
The Integrated Focus Model



In the example of the Mann Gulch fire introduced at the beginning of the paper, only Dodge was able to acknowledge that they could not outrun the fire and look to the challenges that this reality created for him: the prospect of being consumed by the fire. His younger crewmembers remained focused on the threat and the subsequent barrier they constructed: how do we escape the fire. Accepting the threat as part of his reality perhaps allowed Dodge to focus upon the goal of survival and the need to remove fuel so as to reduce the chance of being burned by the fire.

Knoblich et al. (2001) prefer the hypothesis that “initial representations are inappropriate or misleading rather than incomplete, and thus have to be deactivated or inhibited rather than extended or elaborated” (p. 10), but the present study would argue that rather than turning one’s gaze from the barrier and ‘deactivating or inhibiting’ a representation, it would be more productive to follow one’s gaze through the barrier, to the goal. By inquiring more deeply into the initial barrier focused problem representation it is possible to penetrate the barrier and arrive at the actual goal of a challenging task. Klein and Weitzenfeld (1978) proposed the importance of identifying the properties of the goal, and simultaneously attempting to find procedures for accomplishing the goal in their work on ill defined problem solving. The current study proposes that by penetrating the barrier, one arrives at the goal while keeping the barrier in view generating a more integrated representation of the problem, and subsequently unlocks more creative and relevant solutions. It is hypothesized that an integrated focus would enhance both problem solving ability and outcome on a variety of problem solving tasks.

The purpose of the study was to explore the nature of the insight problem solving process. On the basis of the study, it is important to question whether it was possible to increase problem solving performance outcome by shifting an individual’s focus from a barrier or goal focus. A more integrated focus may serve to enhance performance by attending to the challenges a barrier poses to a goal while sustaining a goal focus overall.

Further Research

The results, though preliminary, indicate that it is important for future researcher to explore the roles that appraisal, perceived control, and focus play in problem solving process and outcome. The impact of appraisal and focus upon solution readiness and problem representation requires explicit attention. It is difficult to generalize from such

specific samples suggesting that future researchers expand the inquiry into a wide array of problem scenarios in both lab and field settings. Further research is also necessary to identify the mediating variables accounting for the tendency of human beings to fixate on barriers or barrier focused strategies. Studies to explore the roles of perceived control, appraisal and attentional focus, including a broader sample derived from a variety of problem solving and performance scenarios, would further elucidate the topic. More specifically, research to explore the negative effects of internal locus of control under objective uncontrollability would serve to expand understanding of the role that stress appraisal and perceived control plays in the problem solving process. Finally, the results of this study are encouraging and suggest that a quasi experimental study testing a focusing intervention designed to help individuals penetrate barriers and identify goals in a problem situation may be useful for equipping individuals with the tools to better problem solve their work and life processes. Further questions worth exploring include:

1. What role does focus play in the insight problem solving process?
2. What are further barriers to insight?
3. In what ways does problem representation impact the occurrence of insight?
4. What impact does problem representation have upon the problem solving process and outcome?

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Appendix A: Problems

Problem 1 involves arranging 12 cards, 4 each of 3 types, into a grid so that each row and each column of the grid contains one and only one card of each type. The problem cannot be solved in 3x3 or 4x3 arrangements, and requires expanding the boundaries of the table to a 4x4 grid by leaving gaps. The problem was created as an analog of Mendeleev's insight in arranging the Periodic Table, to leave gaps for potentially missing elements (Kedrov, 1969). This is a new problem.

1. Problem 2 can be solved by placing one disc at each intersection and stacking a second disc on top. The solution therefore involves two forms of "double counting", where a disc stacked on another disc is counted as being "on" an intersection, and an intersection is counted as being part of two edges. This is a new problem, although the stacking aspect of the solution requires using the third dimension, which is characteristic of a number of problems thought to involve insight (Metcalf & Weibe, 1987; Ormerod et al, 2002; Weisberg, 1992).
2. Problem 3 is a modification of the T puzzle (Suzuki, 2003). People persist in orienting the longest piece vertically or horizontally, while the solution requires that it be placed diagonally (Suzuki, 2003). Another potential barrier to solution is a tendency to want to fill the right-angled "notch" in the largest piece (Suzuki, 2003).
3. Problem 4 is a modification of the "fish" problem, where the source of difficulty is the unwarranted assumption that the original and solution states have to be vertically aligned (Kokinov et al, 1997).
4. Problem 5 is the "pigpen" problem described by Isaak and Just (1996) as an insight problem. The restructuring required for solution is that a square oriented as a diamond is still a square (Isaak and Just, 1996).
5. Problem 6 was inspired by the thought that, if bone fragments came from more than one animal, a paleontologist starting with the mind-set of a single animal would have a much more difficult task of reconstruction. In the version we used, the eight pieces of wood fit perfectly to make two separate circles, but cannot make a coherent single shape. As far as we know, this is a new problem.
6. Problem 7 is new. It used a commercially-available hardware product (a wire clamp). To tighten the clamp a screw mechanism is attached and adjusted so that it *pushes* the

two free ends of the clamp *apart*, whereas the natural tendency seems to be to try to tighten the clamp by *pulling* the free ends *together*.

7. Problem 8 is also new and similar to Problem 7 but operates in reverse. It uses a toggle bolt, where to tighten requires *pulling* the bolt *out* instead of pushing it in. The challenge is usually framed as ‘the hole is too big’ but the actual challenge is how to stabilize the nut and provide something for the bolt to screw into.
8. Problems 9, 10 and 11 are all ‘matchstick arithmetic problems’. These problems are mathematical and involve moving one stick to another position within the equation to make the equation true. Each of the three problems demands a different representation of the problem i.e. ‘too many sticks’, ‘make the numbers balance’, ‘not enough sticks’.

Student Problems

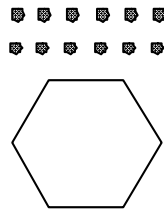
1. Cards:

Materials: Twelve cards from a standard deck, 4 Kings, Queens, Jacks

Script: Here are 12 cards from a standard deck—the 4 Jacks, 4 Queens and 4 Kings. The task is to arrange them in a grid—a table—so that each row and each column contains only one Jack, one Queen and one King.

2. Hexagon

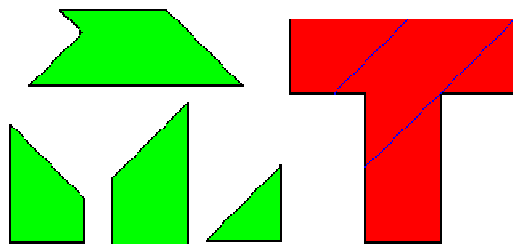
Diagram:



Script: Can you arrange the 12 discs so that each side of the hexagon has 4 discs?

3. Cross

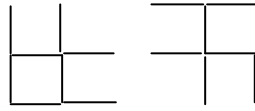
Materials: Five pieces of wood that fit together to form a cross (as above T puzzle but middle section is broken into square and triangle with square on top of T to form cross):



Script: The task here is to arrange these 5 pieces of wood to form a cross (like a plus sign).

4. 8 Sticks

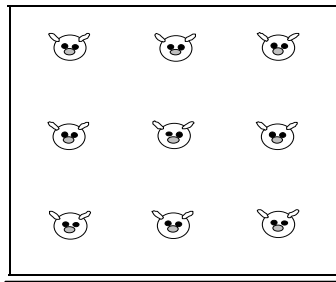
Diagram:



Script: By moving three sticks only can you change the pattern on the left to look like the pattern on the right?

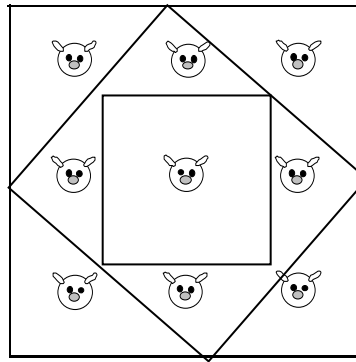
5. Pigs

Diagram:

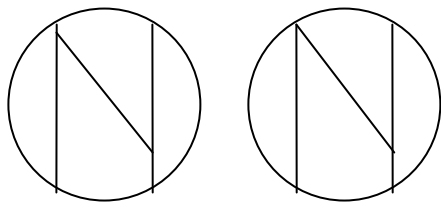


Script: Can you add two squares so that each of the 9 pigs/points ends up in a separate enclosure?

Solution:



6. Plates



Materials:

8 pieces of wood that fit to form two circles

Script: Can you arrange these puzzle pieces of wood so that they fit together into what they once were?

7. Clamp

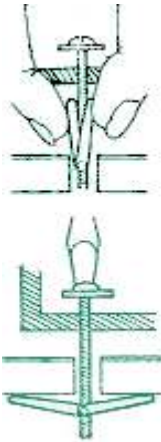
Materials: a round wire clamp that tightens by overlapping two ends and pushing the two ends apart with a screw configuration as opposed to ‘cinching’ or pulling the ends together, and a piece of black plastic 4 inch tubing



Script: The task you have before you asks that you attach the clamp firmly around the plastic pipe.

8. Screw

Materials: toggle bolt, 18 x 4 x 4 wooden box, piece of metal to attach to the front of the box



Script: The task you have before you asks that you tighten the screw with a screwdriver so that the metal piece is firmly attached to the outside of the hollow wooden box. You cannot reach or look inside the wooden box.

9. Matchstick problem #1

Answer: $II + I = III$

$$||| + | = ||$$

Script: in this problem, you can move one of the sticks to another position within the equation in order to make the equation true.

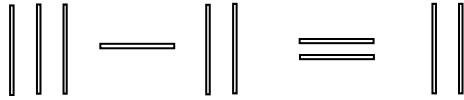
10. Matchstick problem #2

Answer $III - II = I$

$$|| + || = |$$

11. Matchstick problem #3

Answer II = II = II



Workers' 'Symptomatic' Problems

Physical	Financial	Social	Psychological	Systemic
<ul style="list-style-type: none"> lifting weights, walking up stairs, vibration walking any distance, getting back to normal Not able to do things the way I usually do Getting back to work, returning to full strength to sit for a long time sitting, sleeping, driving, bending pain, will not go away, gnawing at my knee limited mobility 	<ul style="list-style-type: none"> uncertainty about future, work, income, losing seniority, hours, pay, benefits... Loss of income Loss of opportunities 	<ul style="list-style-type: none"> unable to socialize unable to play sports, travel Increasing relationship tension not being able to perform my regular ADL household chores driving not able to care for my 8 month old niece unable to perform manual, social, regular activities 	<ul style="list-style-type: none"> uncertainty about whether the pain will go away and stay away feeling like a failure Loss of control over my life and decisions will the knee hold up doing my job? health problems such as headaches and sleeping 	<ul style="list-style-type: none"> Lack of safety policies at work The time and energy it has taken to get support The time I spend defending my claim Navigating the system

Teacher Problems

Time	Work Tasks	Financial	Communication	Interpersonal	Intrapersonal
<ul style="list-style-type: none"> • Schedule is awkward • Limited time available • Time to complete the little things • Lack of time with students • Crises overtake time • Little time for professional development • Not enough time to write • Stalling and delays 	<ul style="list-style-type: none"> • One assignment is confusing • Class size is too large • Stress and burnout • Not enough staff • Need to be in two places at once • Administrative workload • Out of timetable scheduling (outside of work day) • Performance assessment • Pressure to diminish quality in order to conform to administration's demands • Students not re-reading for errors • Student absenteeism • Lacking web knowledge • Creating a test that matches curriculum outcomes 	<ul style="list-style-type: none"> • Budget restraints • Control of own budget • Sufficient funding • Funding for professional development • Not enough pay • Staff replacement • The more pervasive business model being applied to school life 	<ul style="list-style-type: none"> • Lack of information • Conflicting priorities with administration • Email abuse • Lack of assimilation process • Getting others to see the way things are • Having to go through too many chains of power to get things accomplished • Lack of communication • Circumvention of authority/position • Lack of collaboration • Guardedness • Lack of communication from teachers to 'keep me in the loop' as a conduit for parents • Difficult to coordinate project with a coworker • Unclear responsibilities 	<ul style="list-style-type: none"> • Colleagues resistant to change • Colleagues taking over my projects • Conflict with supervisor • Coworkers' lack of change and ability to join the team • Rumour-mongering and backstabbing • Lack of department synergy • Friction • Leader resistant to change • Gender restrictions related to career opportunities • Goals not shared by others • Teamwork • Feeling caught between two groups • Different teaching style and approaches from colleagues • Inexperienced leadership • Difficult to find common ground • Lack of understanding of the importance of a task • Mistrust • Personality conflict • Lack of cooperation amongst team • Colleague does not value input 	<ul style="list-style-type: none"> • Not moving forward • Trying to find my niche in a new community • Lack of confidence • Lack of opportunity for professional development i.e. French training • Lack of autonomy • Lack of recognition • Lack of security • Lack of qualification • Not well connected politically • Lack of respect for my ideas • Uncertainty about future

Athlete Problems

a) Rowers

Technical	Physical	External	Psychological
<ul style="list-style-type: none"> • Can't reach a certain 'time' on physical test • Can't make a technical change • Can't change my style • Limited training volume • Limited time in a boat • Not living in right location to train • Lack of experience 	<ul style="list-style-type: none"> • Strength • Overuse injuries • Pain • Decreased fitness • Illness • Lack of endurance • Increased fatigue • Undersized (height and weight) • Unpredictability of injury 	<ul style="list-style-type: none"> • Not enough time • Constraints within structure of program • Conflict between scheduling of practices/school • Heavy workload • Insufficient finances • Tough competition • "Nay Sayers" • Difficult choices between activities (training or fun) • Lack of coaching • Few training/competitive buddies 	<ul style="list-style-type: none"> • Lack of mental strength/toughness during physical tests and races • Lack of confidence • Lack of motivation • Imbalance in work/life/sport • Stress

b) Soccer Players

External	Technical	Psychological	Physical
<ul style="list-style-type: none"> • Setbacks or losses • When things don't go the way you hope • My check was lightning fast and I had a hard time keeping up • they were on the counter attack, going fast to goal • There was a point in the game when they were sending through an extra 	<ul style="list-style-type: none"> • Crossed a ball into our box • Got 'nutmegged' (ball through the legs) • A player on our team dribbled up her own butt and then got stripped on what was a good chance • If I make a mistake • Letting in a very bad goal • We were playing SFU last Sunday and it felt as if nothing was working • I went forward when I probably shouldn't have and I left my other defenders outnumbered in the back 	<ul style="list-style-type: none"> • Feeling mentally and physically exhausted because of panicking! • Not having the desire to play an exhibition game • Not trusting my abilities at the time and instead of just hitting the shot, I hesitated • Playing in a somewhat unfamiliar position 	<ul style="list-style-type: none"> • Is my rib injury (over 1 year long) going to flare up? • Fitness – I have not played a full game in 2 months • I am sick and I believe that my inability to breathe properly will affect my performance • I got a Charlie horse ½ way through the first half • Getting my ankle

<p>midfielder so there was an extra man to mark. It was intense because they were outnumbering us in the back</p>	<ul style="list-style-type: none"> • I tried to save the ball from going out to prevent a corner kick but crossed it right into our own box giving the other team a slight chance to score • Miscommunication between myself and a teammate and neither of us went for the ball • A player was on a breakaway towards our keeper one on one with our goal keeper, we could have been scored on! 	<ul style="list-style-type: none"> • Not knowing what to expect going into a competition, for example the skill of the other team, how I will perform, how my body will feel in the game (tired/weak/strong) <p>Fearing that we might lose to a team that isn't as good</p>	<p>twisted!</p> <ul style="list-style-type: none"> • Getting tired because I ran forward then had to get all the way back • Beginning of second half I was tired and had to really buckle down to make my legs move • My vision got blurry
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Appendix B – Consent Form

You are being invited to participate in a study that is being conducted by Mrs. Jennifer Walinga (PhD candidate), in the School of Public Administration at the University of Victoria. If you have further questions you can contact them at 721-6435 or 721-8059. The research is funded by the Social Science Research Council.

The purpose of this research project is to further understand the processes of solving problems. Research of this type is important because, by understanding, we may be able to find means to promote more creative and effective problem-solving. Potential participants have been recruited by advertisements placed on campus and by word-of-mouth to contact us if interested in taking part in the research project.

If you agree to voluntarily participate you will be asked to describe and/or solve a number problems. Also, you will be asked a few questions about your experience. The first session should take around 60 minutes. There are no known or anticipated risks to you by participating in this research.

The potential benefits of your participation in this research include the enjoyment of tackling problems. At the same time, you will be helping us further our understanding of problem solving.

Your participation in this research must be completely voluntary. If you do decide to participate, you may withdraw at any time without any consequences or any explanation. If you do withdraw from the study any data collected up to that point will be excluded from any analysis.

Your confidentiality and the confidentiality of the data will be protected by storing the data collected in a locked filing cabinet or in password-protected electronic form.

It is anticipated that the results of this study will be shared with others in the form of journal articles and presentations at scholarly meetings.

In addition to being able to contact the researcher [and, if applicable, the supervisor] at the above phone numbers, you may verify the ethical approval of this study, or raise any concerns you might have, by contacting the Associate Vice President Research at the University of Victoria (250-721-7968).

Your signature below indicates that you understand the above conditions of participation in this study and that you have had the opportunity to have your questions answered by the researchers.

PARTICIPANT SIGNATURE _____ DATE _____

Appendix C: Problem Solving Processes
Teacher Problem Solving Process

Analysis	Representation	Appraisal	Focus	Solutions	Evaluation	Restructure
<p>Constrained I have to service too many kids, part time and with little support</p>	<p>Barrier need to be here full time</p>	<p>Old Resources I'll do what I always do</p> <p>New Resources I'm sure I will come up with something</p> <p>No Resources I'm no good at this sort of thing</p>	<p>Barrier Control I'll ask to go full time</p> <p>Barrier Accept I know I can't get full time so I'll have to think of something else</p> <p>Integrated Letting a kid down or making a mistake would betray the responsibility she felt for the kids in her care</p> <p>Barrier Resign kids getting lost and forgotten</p>	<p>Repetitive arranging her schedule so that she could 'take care of' all of the kids who were struggling, taking on all of their extra learning needs herself</p> <p>Creative I'll need to work with others in 'teams' so students will be prepared for highschool where they will not get any extra support</p> <p>None</p>	<p>Impasse</p> <p>Insight</p> <p>Stuckedness</p>	<p>Without Insight there has to be another way (leading to impasse, insight or stuckedness)</p> <p>With Insight given this barrier, what is the real challenge? (leading to insight)</p> <p>Not at all there is no other way (leading to 'stuckedness')</p>
<p>Unconstrained 'doing a good job' 'making a difference'</p>	<p>Problem To ensure that the kids would have strong skills and self esteem which would provide them with the foundation for success in coming years</p>					
<p>Constrained feeling too stretched and too isolated</p>	<p>Barrier afraid to drop the ball</p>					

Barriers to Insight – Teachers

Prior knowledge	Assumptions	Threat Appraisal of the Problem	Appraisal of Resources
she did not have the support she had anticipated.	not meeting her expectations or the expectations of others	having too much on her plate	not doing a good job
tried speeches, emphasizing the need to be consistent with teachers, focusing attention on problem	an inconsistent response from teachers, teachers resent mandated behaviours, teachers also didn't want to police all the time	a total disregard for rules from students	All to no effect. It seemed to be getting worse
lengthening classes to slow pace	trying to add a period to add flexibility	The schedule still feels fragmented and frantic	it didn't seem to help because 'we are all doing more teaching in the process.'

The Impact of Focus on Problem Solving Process – Teachers

Focus	Process	Solutions	Evaluation	Restructure
Integrated High numbers mean that marking and one-on-one support is less available or possible on a day to day basis	intuitive	ensuring more opportunities for one on one by teaming and collaborating	insight	none
Barrier Accept / Integrated We are stuck with large class sizes therefore we have to come up with another way to improve learning conditions	sees failure, problem, and solution	how to improve conditions for student learning by ensuring more opportunities for one on one, shared resources, accessing teacher expertise through teaming	insight	none
Barrier Accept / Impasse large class sizes, though possible to manage, were more about 'management' and 'discipline'	Sees failure, problem, but no solution	'running laps to release energy', 'peer evaluation and marking', 'sending behaviourally challenged children to the computer lab', and 'increased classroom structures and routines.'	impasse	restructure/new representation OR stuckness
Integrated 'Having thirty-six voices occurring in a room built for twenty-five was prohibitive to real learning.'	sees problem and solution	how to improve conditions for student learning	insight	none
Barrier Control 'increasing the number of	sees problem but cannot see	'work to rule'	impasse	restructure/new representation

specialists in the schools’, ‘reducing class size, and changing the legislation that removed the class size limit from contracts.’ Barrier Resign Large class sizes are here to stay	solution Sees failure, does not see problem or solution	Early retirement? Reduced ‘passion and compassion’	impasse	stuckedness
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Problem Solving Process - Athletes

Analysis	Representation	Appraisal	Focus	Solutions	Evaluation	Restructure
Constrained I have to be used to the same things, the way I warm up for a game, I kinda do it the same	Barrier I just don’t feel comfortable in the cold	Old Resources I’ll do what I always do New Resources I’m sure I will come up with something No Resources I just fade away	Barrier Control I stayed positive, loud and confident Barrier Accept If we couldn’t go over the rock, we just went around it	Repetitive <ul style="list-style-type: none"> • I just kept telling myself “We are going to Nationals” • I just push through it • I just keep working hard 	Impasse	Without Insight there has to be another way (leading to impasse, insight or stuckedness) With Insight given this barrier, what is the real challenge? (leading to insight)
Unconstrained I made an error	Problem so I made sure I won the ball so that we would not be faced with a 3 on 2		Integrated We used to play (the player they lost to injury) all the way down the field, but now we had to play the feet more	Creative I let in a goal so I adjusted to the spin on the ball	Insight	Not at all there is no other way (leading to ‘stuckedness’)
Constrained Nobody could step into her shoes, she was the fastest player on the team	Barrier It (the injury) shouldn’t have happened		Barrier Resign <ul style="list-style-type: none"> • I just sat back, I got kinda passive • I just fade away • I just walked away 	None	Stuckedness	

Barriers to Insight – Athletes

Prior knowledge	Assumptions	Threat Appraisal of the Problem	Appraisal of Resources
she was the fastest player on the team	Nobody could step into her shoes	It was a downward spiral, it kept getting worse	There was no connection between us and we couldn't communicate
the team was already unfamiliar and did not know her	This was the only way she could truly demonstrate her abilities and her commitment to the team.	her injury left her no opportunity to demonstrate her skill	Fear of not being able to work on and develop her game
every time she tried to conduct a fitness test, her breathing would betray her	she felt that she had to stop or risk a poor score	breathing problems when under high stress made it difficult for him to do his best	unpredictable and beyond his control

Impact of Focus on Problem Solving Process – Athletes

Focus	Process	Solutions	Evaluation	Restructure
Integrated My check was skillful so I made sure I did not dive into the tackle	intuitive	I held my check up so we could get numbers back and avoid a counter attack	insight	none
Barrier Accept / Integrated I was tired so I decided to make better decisions about when to commit myself	sees failure, problem, and solution	I made sure I communicated when I needed help so that my opponent wouldn't get a breakaway	insight	none
Barrier Accept / Impasse I just don't feel comfortable in the cold, but I know I have to work with it	Sees failure, problem, but no solution	I just push through it and try not to think about it	impasse	restructure/new representation OR stuckedness
Integrated The lights were in my eyes so I focused on the ball and my positioning.'	sees problem and solution	It was hot so I focused on using smart direct routes	insight	none
Barrier Control One of our players dribbled up her butt (lost the ball), I yelled	sees problem but cannot see solution	I got angry We made silly mistakes, we just started blaming	impasse	restructure/new representation
Barrier Resign There was no connection between us and we couldn't communicate	Sees failure, does not see problem or solution	<ul style="list-style-type: none"> You couldn't stop the flow of negativity No matter what we tried we didn't get the outcome we wanted 	impasse	stuckedness

Appendix D: Problem Solving Samples

Student Problem Solving Samples

Insight

obviously I'll have to leave blank spaces, always comes down to this one card,
cbc emblem, I'll just start, (part circle) wait that's too small, could it be 2?
what's the same, obviously want to move 4, that's the barrier, why can't I make it down here? Why not here?
saw it immediately
trial and error, this wouldn't work, that wouldn't work, the barrier is this space here (right angle), had it and didn't see, used grain of wood but didn't like the angles, why don't I stop thinking about the right angle and start focusing on the real problem which is how to make square ends...
 $4 \times 6 = 24$, that is convenient, obviously need to share, 3 a side, why can't I stack?
I want to go inside and grab that nut, maybe I'm not meant to use the screwdriver at all?
I need to hold the nut inside so that the screw/nut system works, I guess I could pull on it to create friction, is that working? Yes, but how will I completely tighten? This piece is in the way, I guess I could hold this and use the screwdriver
cinched 1st, saw failure, not tight enough, has to go between, just put these bad boys in the holes like it was designed, hope I'm on the right track!

Readiness

doesn't really look, just goes for it, had big piece on angle but didn't see
no gaps, couldn't see possibility
abandoned circles repeatedly
fold paper?' shared one but no more
counted them, stacked them in middle in order to 'make them fit' into the side
looked carefully at screw
how do I check my assumptions?

Constrained

ah! I didn't realize you could go out of the box!
stuck in box
all in one?
stuck in same position/plane
joining the squares diagonally
kept big piece in perp position
shared once
I'm not very 'hands on'
used the screw but actually needed to tighten clamp

Unconstrained

took notes, repeated how 'it's okay if I don't get them'
I've seen it before, can I remember?' 'this is where I wasn't sure' (second corner outside of box)
wrote it out, used goal language herself looked at it different ways, upside down etc.
put 2 of some, then removed, removed a row, diag, 'maybe space between...' then did it all at once
right away got two middle pieces, circle, then '2 shapes' redrew 'what is different' (middle 4 sticks), 'that's impossible', well I'll have to share...
seems solvable', counted lines, took notes
plays, seems happy, filled corner

2 per side, then 4 per corner
need a washer' used paper folded up, 'in real life...duct tape'
focused on hose, had screw in position but did not see solution

Intuitive

remembered, out of the box
moved one row over
I'll go with this
I want to do this, but this is what I'll do
2 squares, diamond in the middle, lines on the right
filled right angle, used negative space to create cross
folded, left 6 in middle,
gravity to put pressure on toggle nut
hooked, checked tightness, explored screw, backwards, then cinching, saw that the screw was operable as tightener
visual, can erase it
my favourite ones, using hands, relevance to life, more sense of accomplishment
challenge, possibilities, no real use but I like problem solving in general

Impasse and Insight

need to look at it in a new way, on angle, not in box...
made one side smaller, keep going back to old strategies, need to think outside...
got it, needed to make space, then needed to shift them slightly to make it work, couldn't see how my last card fit in...
3/4 circle, wanted 1 shape, then saw wouldn't work
keep middle sticks, saw opportunity to build outside frame elsewhere
overlapped squares then saw need to make many lines,
had it, lost it, didn't see, has seen T before, got it
shared, spread out, 2 per corner?
stops and thinks, put box on side, started to pull, then felt catch
cinched, took time, tested size, stared and studied
good feedback, can tell when something is working, feel when you are overcoming it

Barrier Accept

took notes, repeated how 'it's okay if I don't get them'
I've seen it before, can I remember?' 'this is where I wasn't sure' (second corner outside of box)
wrote it out, used goal language herself looked at it different ways, upside down etc.
put 2 of some, then removed, removed a row, diag, 'maybe space between...' then did it all at once
right away got two middle pieces, circle, then '2 shapes' redrew 'what is different' (middle 4 sticks), 'that's impossible', well I'll have to share...
seems solvable', counted lines, took notes
plays, seems happy, filled corner
2 per side, then 4 per corner
need a washer' used paper folded up, 'in real life...duct tape'
focused on hose, had screw in position but did not see solution,

Barrier Control

want to get all the dots in one row, want to catch the dots
sideways screw, then length, kept putting screw too far into hoop
cinching, focus on screw, not tight enough, kept trying one approach,
in box, need to keep trying poss's not exhausted all alternatives yet, I need a change of pattern somehow
kept trying to make the one side equal 2,
cinched repeatedly
you can't keep track, persist, don't give up, usually works
cinched for a long time, couldn't get washer on other side of hoop, then saw the real problem, 'I hate this.'
keep doing same thing, can't seem to let go
diag, missed it, messed it up again, 3x3,
not enough, folded at 300, want to make a smaller hexagon, want to use 50cents to make a phone call,
sideways, kept trying to make sideways work.
long piece, cut off this angle, still filing ends, on right track, this end is giving me trouble, I need to get rid of it!
stuck in box
hole is too big
hooked, looked, sideways, how it fits? Backwards?
we always approach things one way, it is important to look for new approaches, consider that maybe another way is better, we usually don't think this is
even possible until we see it in something like these problems, we just need to TRY
everything but the answer, complicated it
drew it, touching, filled up? (cards)
filled angle, convinced something worked
2 overlapping repeatedly, 4 a side, 12 coins, 6 sides, what is a side? 3 a side
hooked, jammed something, sideways screw tight
cinched, hooked, sideways screws, seemed to have little knowledge or experience with tools.
4x3, solid? Zig zag...

'Stuckedness'
5th line? More line? Assumed stay in box
complicated it
more creative ideas, but never adds up
very negative, too many cards, not enough rows, I can't do this, I suck
too many possibilities, can't reframe, "I hate you! :)"
need to make more lines but couldn't solve
need to utilize pieces more, build ends...couldn't solve
folded at 180, stacked in middle, need to get 6 left over to touch more than one line...couldn't solve
need to hold nut somehow, couldn't solve
saw holes, careful, afraid to break it...unsure of self, couldn't solve

Worker Problem Solving Samples

Appraisal of Resources	Attentional Focus	Solution Generation	Solution Evaluation
<ul style="list-style-type: none"> • I worry this will not get much better • There is uncertainty about the future, work, income, pain • I can handle it, I've had injuries before • I have support • I can see progress already • It's stressful... • I'm concerned... • I'm worried... • It's frustrating... • There's nothing I can do, they don't want to hear it • I've had lots of injuries, I can handle it • I've had injuries, I know that it takes patience and it is a process • I can't imagine being stuck • I can't control that, so I focus on... • It takes time but I have to be 100% if I'm going to do my job well and be there for my family • This is an opportunity. This injury has given me some time to work on redoing my resume and gaining clarity 	<ul style="list-style-type: none"> • There is no emotional support • It has taken much longer than it has to • They don't respect the time I have put in • They aren't listening • I felt abandoned and neglected by the health system • The accident wasn't even my fault. It is so unfair • The hardest thing is facing my boss when I tell him I want to quit, I don't know if he will lose it on me. • I didn't have an opportunity to say what I was feeling, my gut instinct on this injury • I can't make contributions, I can't be a leader • I don't want them to make the decision for me • I can play other sports like golf, but I love baseball • I don't feel as productive when I'm not involved socially and actively • The problem with that is I then lost that joy. When I don't have that, I lose my sense of self, my purpose. I lose them and they lose me • I spend my time arguing for myself rather than simply getting better • If I'm not there, I'm not sure they will get the love they need 	<ul style="list-style-type: none"> • I just keep fighting for support • I spend a lot of time defending myself • I just try to cope with the pain • I take pills • I just don't say anything • I can commit in other ways. I can commit to doing the elliptical whenever it works out, commit to helping out, commit to not going to the gym because it takes time away, commit by eating healthy rather than trying to change the amount of food I eat. • I can seek retraining to help me get my ideas off the ground • I need to focus on the relationships I'm good at building • I get self satisfaction from playing, but if I can't get self satisfaction out of playing I can get satisfaction out of helping others play • I need to also be a leader in the workplace and that means taking the lead on safety • I focus on strengthening my body • I'm applying for other jobs. I'm making sure that I will be doing what I really want. I'm just going to work on this right now • I have to surround myself with good people, remind myself of who I am and what I do 	<p>Insight:</p> <ul style="list-style-type: none"> • I need to focus on... • I can commit to... • I can seek training in... <p>Impasse:</p> <ul style="list-style-type: none"> • I just keep trying... <p>Stuckedness:</p> <ul style="list-style-type: none"> • I just accept it, there's nothing I can do • I take pills • I just cope with the pain

Teacher Problem Solving Samples

Insight

The real problem is how it compromises learning

It impacts pride in our school

The order of the school is impacted

it means I need to focus on the broader concepts and let the details emerge

I need an opportunity to discuss the proposal, perhaps I can just explain my need for this process...

I could just share my ideas with the head and demonstrate my leadership that way

We should focus on learning conditions rather than teaching conditions even though the two are connected.

Constrained

The schedule is awkward

There is limited time available

They won't support professional development

Colleagues resistant to change

Colleagues are taking over my projects

Our leader is totally resistant to change

career opportunities are totally based on gender

My goals are not shared by others

Teamwork is everything!

Feeling caught between two groups

People don't understand the importance of a task

Colleague does not value input

Unconstrained

I'm sure it doesn't have to be this way

I know there are other models out there

I'll just ask, maybe not everyone wants to team but someone will

We could get together and talk and we'd come up with something

We don't know for sure what they are thinking

Intuitive

I need to take care of myself if I'm to take care of others

It's noisy and busy so I just make sure we get one on one time and co-teach so there are two of us at once

Need to be in two places at once so I carry a cell phone and hold meetings with several people at once to save time

There is a great deal to do administratively but sometimes I can get the kids to do tasks while still making it meaningful

We were lacking web knowledge so we got the kids to run a workshop, killed two birds with one stone that way!

Impasse and Insight

If this is the way it is, then I can't support the students

There isn't the funding, but there are other ways to get these resources

It makes it difficult to get my point across to parents

How can I support the teachers if they don't talk to me? Ah! I can visit classrooms...

we don't have enough so we need to share resources

Barrier Accept

I came out of the experience better than when I went in.

I now know what is important in life.

The schedule isn't going to change

I know why it has to be this way

I know it won't change

We are stuck with the situation, the size of classes isn't going to change

I understand why he needs to shut me down, he is trying to establish his own credibility

Barrier Control

I need to get more information somehow

The administration needs to change their priorities

We have to stop the email abuse, make more rules

We need to develop an assimilation process

I need to get others to see the way things are

We make our demands clear, we strike!

I let my feelings out

I have to go through too many chains of power to get things accomplished

How do we get people to stop circumventing authority/position

We need more collaboration

I need to coordinate with a coworker better

responsibilities need to be made more clear

I need to avoid the politics

I knew what had to be done, so I just try harder.

Try to get the person to change his or her mind.

I got angry

I just put my head down and work hard, at least I was doing something

I refused to get too serious about it.

Didn't let it get to me; refused to think too much about it.

Try to forget the whole thing.

Try to stay positive, upbeat

'Stuckedness'

I just wish that the situation would go away or be over with.

Just cope. It'll never change.

I just hope for a miracle

Early retirement?

I give up

I just avoid him

I tried, but it doesn't work.

Athlete Problem Solving Samples

Barriers

- weather
- injury
- mistake
- field conditions
- loss
- reffing
- competition
- nerves
- uncertainty
- lack of clarity
- coaching
- imbalance
- technical change
- size

Assumptions

- **Nobody could step into her shoes, she was the fastest player on the team**
 - **I just can't feel comfortable, that was just me**
 - **I have to be used to the same things, the way I warm up for a game, I kinda do it the same**
 - **This was the only way she could truly demonstrate her abilities and her commitment to the team.**
 - **she wouldn't respond well to unpredictable factors and let the team down or not do her job as well as she would like to.**
 - **knew that any situation that arose could be dealt with through her skills, confidence, and preparation.**
 - **He worried about 'being smaller' so he wanted to be 'explosive right away.'**
 - **if he had too slow of a start to each stroke, he wouldn't build momentum and would be less powerful overall**
 - **Rowing long is the only way to show he is committed to his team**
 - **She believed that her coach was not supportive of her because she was 'old guard' and he was trying to 'get rid of the older members of the team'.**
 - **the only way she would 'avoid being cut' was to achieve a strong score.**
 - **He worried that 'if he didn't go hard at the beginning, then his whole stroke or drive would be slower and he wouldn't have as much power at the end of it.'**
 - **his 'winning strategy was to get on it right away and throw himself right into challenges.'**
 - **He worried about being 'smaller' and he felt he 'needed to do more than the average guy each stroke.'**
 - **he couldn't stop his reaction, it was instinctive and immediate.**
 - **'even an inch off course can cost you an inch at the finish'**
 - **she felt 'shut down' because she was 'so much smaller.'**
 - **'because I am small, I can't be a powerful, I can't power down the course like the big guys.'**
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Appraisal of resources	Focus	Strategy
Old Resources	Barrier Control	<ul style="list-style-type: none"> ▪ I just push through it ▪ tried to deek them out, to be faster than they were’ but that ‘they were fast as well, and that she couldn’t get around them or they would push her right off the ball if she had it.’ ▪ ‘stop overreacting when the boat would get off course because of conditions or because of a bad stroke by the crew.’ ▪ I stay positive and don’t worry about it ▪ I focus on my own playing ▪ I just kept telling myself “We are going to Nationals” ▪ Realizing that we can do it! ▪ One of our players dribbled up her butt (lost the ball), I yelled ▪ I got angry ▪ I talked with the other players on the team. I told them how I was feeling and what I needed in order to pull myself together ▪ I stayed positive, loud and confident ▪ he had tried ‘pushing back, but got the foul and then the guy tripped me. ▪ he ‘tried to block out how he was feeling and just concentrate on the workout, his coach, his technical challenges.’
No Resources	Barrier Resign	<ul style="list-style-type: none"> ▪ We made silly mistakes, we just started blaming ▪ I just fade away ▪ I just walked away ▪ I just sat back, I got kinda passive ▪ There would be a problem and it would just sort of not be dealt with ▪ We couldn’t even put together a two yard pass ▪ You couldn’t stop the flow of negativity ▪ It just couldn’t get any worse ▪ We kind of hit rock bottom ▪ No matter what we tried we didn’t get the outcome we wanted ▪ There was no connection between us and we couldn’t communicate ▪ It was a downward spiral, it kept getting worse ▪ I felt disconnected
Old Resources	Barrier Accept Impasse	<ul style="list-style-type: none"> ▪ We were out of control and we didn’t even know why we were out of control ▪ I just don’t feel comfortable in the cold, but I know I have to work with it ▪ If she couldn’t get a good stroke and everyone would be ‘off time’ then she felt

New Resources
Barrier
Accept
Integrated

frustrated by not making a contribution and the boat was frustrated because everyone was going in at different times.

- he ‘would do weights and just work on his power’ but ‘overall, is just undersized and didn’t tend to put weight on easily’ but ‘because I am small, I can’t be a powerful, if I can’t be powerful, I can’t lift the boat like they do, or drive the boat through the water.’
- ‘if the boat isn’t gliding with balance, then we aren’t going as fast as we can and we also can’t get our oars in the water effectively. And if we can’t catch quickly and in sync, the whole stroke is messy and that messes up the next stroke. It’s a vicious cycle.’
- they were bigger and making it impossible for her to have an impact because they were able to just take her out
- I let in a goal so I adjusted to the spin on the ball
- she ‘couldn’t play her game’, she was ‘put in the game to be the bulldog, to bring up the energy and to spark the other players’ with her speed and agility, her real goal was not to ‘avoid or deek out the other players’ but to spark the energy and movement between her own players.
- his goal was ‘efficiency’ and accepted that there would be ‘bad strokes’ or that the ‘wind would blow him off course at times’, the best reaction was to ‘nudge or encourage the boat back onto the course gently rather than shoving it.’
- My check was skillful so I made sure I did not dive into the tackle, I held my check up so we could get numbers back and avoid a counter attack
- I made an error so I made sure I won the ball so that we would not be faced with a 3 on 2
- There was a missed ball so I just worked hard to get back so I could help out my teammate
- I was tired so I decided to make better decisions about when to commit myself and made sure I communicated when I needed help so that my opponent wouldn’t get a breakaway
- It was hot so I focused on using smart direct routes
- My opponent was tackling me so I focused on where I put the ball when I crossed it
- The lights were in my eyes so I focused on the ball and my positioning.
- Negative thought patterns concerned her then because they interrupted focus and confidence which could interfere with performance
- Accepting that she would feel nervous before and during a competition allowed her to move past her fear of the unexpected

Integrated

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- She explained that ‘if everyone were to focus on putting their oars in the water at the same time’ then the balance problem would be solved.
 - If I can’t row long, there are other ways of committing to the crew
 - If I can’t lift with my shoulders, there are other ways to ‘smash it’, and ‘get on it right away in the stroke.’ He could achieve the same aggression with his legs rather than his shoulders.
 - I decided to pass instead of turn because she had a better chance than me (at scoring).
 - A player was on a breakaway towards our keeper, I ran towards the goal to cut off the player’s angle so that I could get there quickest or get behind the goalie in case she got by her
 - ‘being quick at either end’ meant he needed to use his hands at the top to ‘drop his oar in quickly’ and use his hips at the end of the stroke to ‘finish off the stroke quickly.’
 - I focused on getting closest to the player and taking away her chance of scoring
 - being specific about the time allotted to soccer and personal life served to generate ‘extra’ time in her schedule
 - She could pass more quickly and use the speed of the ball to beat the larger opponents rather than trying to beat them in a foot race or sneak around them.’ She explained how she ‘needed to focus on her own abilities and less on the opponent’s size.’
 - what she needed to focus on was ‘building on other areas of her game that her injury allowed’ in terms of mental focus, imagery, observation, and certain fitness components.
 - ‘could focus on his lightness; his quickness and speed as well as his fitness would allow him to be quicker for a more sustained period of time. He could row at a higher rate and concentrate on being sharper, on making the boat skim across the water, on flying.’
 - his goal was ‘smooth strokes from the team’ as opposed to ‘less rudder (steering)’
 - rather than trying to change the error, prevent the errors, or threaten people who make errors, a more productive problem solving stance would
 - focus on designing a clear game plan, and develop strategies for remembering this game plan throughout the game despite the stresses of competition.
 - include striving to ‘retain focus’ and ‘regain confidence’. Strategies for refocusing included reminding themselves of the specific goals and technical foci the team had decided upon for that specific game.
 - focusing on gaining that clarity as opposed to focusing on ‘trying to stay confident’ was key to resolving the problem. She had decided to ‘ask the coach exactly what she
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was looking for.'

- He 'wanted to play his own game' so 'he learned to just talk to the ref and suggest that s/he keep an eye on a particular player.' That seemed to help and he was able to refocus on his own play
 - His goal was actually to 'be explosive and have a fast, powerful drive' rather than to 'stop lifting his shoulders' or even 'avoid being too slow at the catch.'
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