Problem Solving

The Science of Resilience

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Table of Contents

Definition

Problem solving is the ability to identify issues or obstacles for something without a given or immediately apparent solution and to employ general or specific strategies to overcome obstacles and solve the issue (Psycharis & Kallia, 2017). This may involve patience, logic, deliberation, collaboration, confidence, and the consideration of multiple possible solutions as well as the monitoring their implementation. The ability to solve problems is a key factor in all levels of life, from the individual and interpersonal to the political (D'Zurilla, 2004). Problem solving involves cognitive and behavioural skills to identify and manage problems and is a necessary component of conflict resolution, workplace relations, and family life (Anderson, Goddard, & Powell, 2007; D'Zurilla et al. 2004). The PISA (Program for International Student Assessment), an international study by the OECD (Organization for Economic Co-Operation and Development) defines problem solving competency as:

> an individual's capacity to engage in cognitive processing to understand and resolve problem situations where a method of solution is not immediately obvious. It includes the willingness to engage with such situations in order to achieve one's potential as a constructive and reflective citizen. (OECD, 2017, p. 6)

Early work in the psychology of problem solving came from *Gestalt* psychologists, who related an individual's ability to problem solve to their ability to learn and perceive (Wang & Chiew, 2010). As in the human brain, computers operate on the ability to assess and decide which path to take in finding the correct solution towards a given goal (Wang & Chiew, 2010). Problem-solving is generally thought of as the ability to approach a situation and consider multiple options before making a spontaneous decision. While a quick, 'gut' response can be useful for simple issues, it is less useful for complex problems where there is no ideal outcome (e.g., moral dilemmas). Common barriers to problem-solving include: a failure to recognize the existence of a problem, thinking a problem is not as bad as it is, making a hasty decision to fix a problem without considering all or multiple options, failing to consider the feasibility of the solution, unnecessary constraints, and emotional dysregulation (Hussein et al., 2017; Nezu et al., 2013; Walinga et al., 2011).

D'Zurilla and colleagues (2004) define a problem as any task or life situation requiring an adaptive response from an individual with no immediately available solutions due to one or more obstacles. Such obstacles might include a lack of insight or competence for something novel, a lack of resources, lack of skills, ambiguity, or conflicting stimulus demands. Problems can occur as single time-limited events (e.g., missing the bus to school), as repeated similar or related events (e.g., multiple missed curfews), or as chronic ongoing issues (e.g., constantly feeling bored or sad). These authors describe the ability to problem solve as a "self-directed cognitive-behavioral process" that considers the potential efficacy of a variety of solutions

before making a decision, thereby increasing the probability of selecting the most effective one (D'Zurilla et al., 2004, p. 12).

Problem solving requires cognitive and metacognitive processes (Lazonder and Rouet, 2008). Cognitive processes are skill-based qualities of intelligence, reasoning, learning, and memorizing that relate to thinking and knowing, which are necessary factors in problem-solving (Psycharis & Kallia, 2017). Reasoning can be divided into inductive or deductive reasoning, with both involving the development of conjectures and conclusions from given information. Reasoning is also considered to be a crucial component of analytical thinking and problem solving (Jitendra et al., 2017; Ormerod et al., 2013; Robbins, 2011).

Cognitive skills learned in one area, such as general reading comprehension (e.g., word identification, analysing syntax, and inference generation), can assist in problem solving elsewhere, such as in navigating various search engine formats (e.g., starting from the title, reading left to right, etc.; Lazonder and Rouet, 2008). While cognition has to do with the awareness of one's own skills, metacognition has to do with 'thinking about thinking', and the capacity to regulate one's own cognition, including the ability to plan, monitor and evaluate one's own actions (Lazonder & Rouet, 2008). In keeping with the search engine example, metacognitive skills would include the ability to plan a search, select search strategies, monitor its progress, and evaluate outcomes in terms of relevance, reliability, and authority. Distinguishing between these two concepts can allow for improved approaches to supporting each (Lazonder & Rouet, 2008).

Metacognition before and during problem-solving has been examined by Metcalfe and Wiebe (1987) for its ability to motivate and guide problem-solving behaviour, including the ability to distinguish between different classes of problems, and to predict the difficulty of future problems, which may be influenced by different cognitive processes. The authors also describe experiences of insight vs noninsight in relation to problem solving, with insight being related to a lack of certainty in knowing and a willingness to engage in thinking about unsolved problems. In contrast, noninsight is associated with a subjective feeling of knowing, which the authors found to predict performance on algebra problems. After struggling with a problem for a while, including with the experience of a 'feeling of knowing' (Metcalfe, 1986), insight can occur as a moment of intense clarity (i.e., a '*eureka!*' moment). While the 'feeling of knowing' is associated to insight moments, it was found to be more connected to memory, and not to the connection between predictions and solutions in the problem-solving process (Metcalfe, 1986; Metcalfe & Wiebe, 1987). Although they did not increase insight problem-solving ability, Walinga et al.'s study (2011) showed that insight problem solving may be facilitated through brief training sessions on conceptualizing barriers as opportunities to identify and remove constraining assumptions. More recently, Walinga has emphasized the importance of

companies and environmental programs adopting creative problem solving and creative insight problem solving procedures to tackle the issue of sustainability (Mitchell & Walinga, 2017).

D'Zurilla and colleagues (2004) focus on the topic of 'social problem-solving', or the process of problem solving through purposeful and effortful adaptive functioning that occurs in 'real world' social settings. These adaptive functions are intentionally enacted to improve a situation, reduce the emotional distress that it causes, or both. The study of social problem-solving deals with all types of issues that might affect a person's functioning, including impersonal problems (e.g., stolen property), personal or intrapersonal problems (e.g., personal emotional or behavioural reactivity issues, physical health problems, or cognitive issues), interpersonal problems (e.g., spousal disputes, problems with friends or family members), and wider societal issues (e.g., problems with crime, racism, or discrimination). Social problem-solving ability consists of two components: problem orientation and problem-solving skills (D'Zurilla et al., 2004). Problem orientation refers to the operation of an individual's cognitive-emotional beliefs, judgments, and feelings about various life problems, as well as their own ability to problem-solve. These can be positive or negative, with negative problem orientation presenting as a dysfunctional cognitive-emotional schema. Individuals with negative problem orientations are more likely to view problems as threats to their psychological, social, or economic well-being; doubt their own ability to successfully problem-solve (i.e., they have low problem-solving self-efficacy); and become easily frustrated and upset when encountering problems. Individuals with positive problem orientations are more likely to be optimistic in believing problems to be solvable, tend to view problems as challenges and learning opportunities, have greater problem-solving self-efficacy, and understand that problem-solving takes time, effort, and the likelihood of failed attempts (D'Zurilla et al., 2004). Problem-solving skills refer to four main cognitive and behavioural activities or tactics used in attempting to understand and/or solve problems: (a) problem definition and formulation, (b) generation of alternative solutions, (c) decision making, and (d) solution implementation and verification.

According to D'Zurilla et al. (2004), problem-solving styles can be rational, impulsive, or avoidant. The rational problem-solving style includes a functional, deliberative, systematic, constructive, and effective application of the above-mentioned problem-solving skills. An individual in this category gathers as many specific and concrete facts about a problem as possible in attempting to (a) define, clarify, and understand it by identifying specific demands and obstacles. They also set realistic problem-solving goals, such as aiming to better accept the situation, minimize emotional distress, or change the situation for the better. With these goals in mind, the individual then attempts to (b) generate as many alternative solutions as possible and anticipate the consequences of each by judging and comparing them, before (c) making a decision as to what route to take. In the decision step, the individual attempts to implement the most appropriate or ostensibly most effective solution to the real-life problem in its given

context, and then (d) carefully monitors and evaluates the consequences in relation to the original problem-solving goal.

In contrast, the impulsive problem-solving style is a dysfunctional approach to problem-solving. Individuals in this category are more concerned with finding any solution, including the first one that comes to mind, rather than the best solution after considering all options. As such, they do actively attempt to apply problem-solving skills and strategies, but these tend to be more hurried, careless, and incomplete. If and when they do consider alternative solutions and various possible outcomes to implementing the solution, they are more likely to briefly scan through rather than use an in-depth systematic approach, and are less likely to carefully monitor and evaluate the consequences of the solution they have implemented (D'Zurilla et al., 2004). The avoidant style is another dysfunctional problem-solving approach, characterized by passivity or inaction, dependency, and procrastination. Rather than confronting problems in a calculated or head-on manner, the avoidant problem-solver will put off the problem-solving process for as long as possible, hoping the problem will resolve itself, or that someone else will come along with a solution (D'Zurilla et al., 2004). These dysfunctional problem-solving styles can be corrected and improved on through addressing the above-mentioned problem-solving orientation and style through a social problem-solving process. Social problem-solving therapy can be an effective approach in this regard and has also been shown to be an effective cognitive-behavioural treatment for personal and social problems like depression (Nezu., 1986).

Another approach to problem-solving occurs through collaborative problem solving (CPS; Fiore et al., 2017; OECD, 2017). While social problem solving can be an individual pursuit, CPS involves group work to develop solutions to non-routine problems and has been shown to improve critical thinking, self-esteem, and social skills. Two main areas of CPS are "teamwork" collaboration, which includes communication and socialization, and the cognitive "taskwork" aspects of problem-solving, such as domain-specific strategies (Fiore et al., 2017). Compared to individual problem-solving approaches or models, CPS requires open communication, idea and knowledge exchange, shared identification of the elements of the problem, consideration of different perspectives, and agreement on approaches to take. An emphasis therefore is not so much on the ability to solve the problem as it is on working with others along the problem-solving process [see our write-up on Cooperation for more information on resilience and team work].

Other approaches to problem-solving include such step-based programs as the IDEAL model to improve critical thinking and problem-solving skills (Bransford & Stein, 1993) [See our write-up on Critical Thinking]. The IDEAL model is an acronym for: Identifying the problem, Defining it by what is already known about it, Exploring the details, Acting on a decision to address the problem, and Looking over the outcomes. Bransford and Stein provide general steps to navigating the problem-solving process, and there are many similarities between this

model and the four problem-solving skills of D'Zurilla and colleagues (2004) mentioned above in the social problem-solving model. Other approaches to problem solving include interpersonal cognitive problem solving (ICPS; Platt & Spivack, 1975; Shure & Spivack, 1982; Spivack et al., 1976), practical problem solving, (Denny & Pearce, 1989), and practical intelligence (Sternberg & Wagner, 1986). Nezu (2004) states that the social problem solving (SPS) model of problem-solving therapy appears most aligned with a behavioural orientation, and Merrill et al. (2017) write that SPS is effective in addressing the poor outcome trajectories of students with maladaptive behaviours by improving their social competence and problem-solving behaviours.

Relationship to Resilience

> "Life is a series of problems… Yet it is in this whole process of meeting and solving problems that life has its meaning… Problems call forth our courage and our wisdom; indeed, they create our courage and wisdom. It is only because of problems that we grow mentally and spiritually." (Peck, 2012)

The ability to "bounce back" from adversity is most commonly an effortful process, and therefore one that individuals engage in to recover, adapt, or transform from, following exposure to atypical stress. This process of resilience is therefore in itself the encountering of a problem and the employment of methods to resolve it. However, the adversity faced by an individual may present several specific problems, and therefore the skill of problem-solving becomes the identification of these issues and determination of appropriate solutions to manage them. For instance, the loss of mobility following illness or physical injury could be considered to be the significant adversity challenging an individual, but it is the issue of continuing one's employment, maintaining social engagements, and potentially other activities of daily life functioning, that are the specific problems an individual is challenged to identify and come up with solutions for.

Positive problem orientation and rational problem solving styles are two constructive dimensions of social problem-solving that tend to be associated with improved adaptive functioning and positive psychological well-being, while negative problem orientation, impulsivity-carelessness style, and avoidance style are understood to be three dysfunctional constructive dimensions associated with maladaptive functioning and negative psychological well-being (D'Zurilla et al., 2004). Constructive or effective problem solving is a process of strengthening an individual's positive problem orientation (i.e., how one views one's ability and competence in confronting and solving problems) to promote their rational problem solving skills, thereby producing more positive future outcomes. Sometimes confronting and managing, but not solving the problem, is enough, as a successful social problem-solving process allows for "the effective management of problems and their resulting emotional effects" (Anderson et al,

2011, p. 48). In contrast, poor problem-solving may lead an individual to experience emotional difficulties and set them up for a cycle of future difficulties, as their inability to approach and process problems leads to poor outcomes, which result in further negative emotional reactions, and so on (Anderson et al., 2011).

An individual's problem orientation, or how they view their ability to orient themselves in relation to problems, has been shown to be associated with levels of psychological stress and adjustment, or the ability to balance conflicting needs (D'Zurilla & Goldfried, 1971; Nezu et al., 2012). When individuals lack positive and effective social problem-solving skills, they tend to be more at risk for depression, anxiety, suicidality, and self-injurious behaviour (Becker-Weidman et al., 2010; Belzer et al., 2002; Nock et al., 2008; Sadowski & Kelly, 1993). Additionally, individuals with personality disorders commonly display more negative problem-solving orientations, and impulsive or careless problem-solving styles (McMurran et al., 2007).

While a positive problem orientation sounds similar to the protective factor of self-efficacy, D'Zurilla et al. (2004) write that the latter is but a component of the former [see our write-up on Self-Efficacy]. In their correlation analysis Zumberg et al. (2008) state that general self-efficacy and problem orientation are related but not redundant, with the former being significantly involved in the latter, both representing important psychological constructs, but generalized self-efficacy having more robust associations with psychological and physical functioning. Further, in their hierarchical regression analysis, using a sample of 192 American college students (142 female; mean age of 19.71), Zumberg and colleagues found supportive evidence for the ability of negative problem orientation to act as a predictor of adjustment (i.e., the ability to adapt or become used to a new situation) in healthy populations, and for positive problem orientation to act as a predictor of adjustment for individuals for which negative thinking is more common, such as in clinical populations, or more accessible, such as in Asian and Asian American populations (Zumberg et al., 2008) Their study also showed that negative problem orientation, as a part of the social problem-solving model, is associated with functioning independent of generalized self-efficacy, as well as with both psychological and physical functioning, and acts as an important predictor of positive psychological and physical functioning, namely positive affect, life satisfaction, and vitality.

Regarding Asian populations, a study on cultural differences in optimism and pessimism by Chang (1996) found that although Asian Americans reported greater pessimism than European Americans, their greater pessimism scores were also correlated with greater problem-solving abilities. Chang & Asakawa (2003) posit that a heightened propensity to quickly imagine negative scenarios may provide this cultural group with 'defensive pessimism', the ability to consider a wider spectrum of consequences in problem-solving, and take constructive steps to circumvent the actual occurrence of such outcomes. The authors further posit that this form of defensive pessimism may contribute to the promotion of interpersonal harmony in this

population in understanding the importance of working with others to overcome problems, while Westerners may be instead more likely to experience negative, isolating, mentally dysfunctional thoughts, like depression and anxiety, when considering possible negative outcomes. Further, the authors point out that these findings tend to be in line with common cultural conceptualizations of individualism in the West, and collectivism in the East (Chang & Asakawa, 2003).

Another study by Chang (2003) found significant differences between men and women regarding pathways thinking (i.e., one aspect of 'hope'; the other being agency), depressive symptoms, and problem solving, with the association between pathways thinking and psychological adjustment being fully mediated by problem solving in women but not in men. Pathways thinking is a consideration of the number and variety of possible pathways through which individuals may reach their goals [See our write-up on Goal Setting]. More recently, in a study of 216 American women (ages 18-53, mean age 21.42; 89.8% White), Chang et al. (2020) found that loneliness was negatively associated with both functional social problem-solving processes of positive problem orientation and rational problem-solving style, and positively associated with negative problem orientation and avoidance style. In line with past studies, the research also found that loneliness was positively associated with depressive symptoms and suicidality, and negatively associated with positive affect and life satisfaction. As such, a lack of social interaction is related to poor social-problem-solving processes (Chang et al., 2020; D'Zurilla & Goldfried, 1971).

Other research has shown the association between different problem-solving orientations and styles with self-esteem, which is another protective factor of resilience [See our write-up on Self-Esteem]. Hamarta's (2009) study of 405 Turkish university students (233 women; mean age 20.45) found that positive problem orientation and rational problem solving styles were positively correlated with self-esteem and life satisfaction, and that negative problem orientation and impulsive and avoidant problem solving styles were negatively correlated with self-esteem and life satisfaction. Further, self-esteem was found to be predicted by negative problem orientation, positive problem orientation, and avoidance style, while life satisfaction was predicted by rational problem solving, positive problem orientation, and avoidance problem-solving style. According to the findings of this study, higher positive problem orientation scores may represent higher self-esteem, or vice versa, and higher scores for avoidance styles or negative problem orientation may represent lower self-esteem, or vice versa. Individuals with more effective (rational) problem solving skills are more likely to have higher levels of self-esteem, as they are also more likely to display greater self-confidence and ambition compared to individuals with low self-esteem who are less confident and more anxious about social acceptance (Hamarta, 2009). Self-esteem levels, problem orientation and problem-solving styles are important considerations in examining the variables involved in

difficult, multifaceted problems, such as anorexia and other eating disorders (Paterson et al., 2006).

In terms of avoidance, the stressors it brings can increase and compound stress and anxiety, so it is important to find alternative solutions to these problems (Hofmann & Hay, 2018). For example, by avoiding studying for a test to avoid the stress and discomfort that can accompany it, a student will feel additional stress from not only failing the test, but potentially also from teachers and parents or guardians voicing their dissatisfaction. In their study of cancer patients' experiences, Shroevers et al. (2011) found that the strongest correlate of negative change was avoidant coping through self-distraction. Among the patients, such avoidance was consistently related to less psychological well-being, lowered self-confidence, deteriorated relationships, and decreased meaning in life. An alternative to avoidance behaviour is "active" or "approach coping" (Schroevers et al., 2011), which involves addressing the problem head on to alleviate the initial stress. Active coping can involve talking through problems, such as with the person one is having trouble with or with a counsellor, reframing a situation to recognize the positives, or making a plan or checklist. This active approach involves a cognitive approach to coping with a problem that involves changing how one thinks (e.g., committing to sit with the problem rather than turning away and doing something else) and a behavioural approach which addresses the problem more directly.

In terms of cultural context and educational goal setting, Flores et al. (2006) found that within a sample of 105 Mexican American high school students (51% girls; ages 15-18, mean age 16.25%) living in a rural community near the Mexican-Texas border, effective problem-solving abilities, career decision-making self-efficacy, and Anglo-oriented acculturation were significant contributors to higher education goals according to standardized regression coefficients. Conversely, career decision-making self-efficacy combined with Mexican-oriented acculturation did not contribute significantly to the students' educational goals. In other words, Mexican American students more accultured to Anglo culture were more likely to set higher level educational goals than their peers. Likely this is due to their desire to attend university and find a career in the United States. Key takeaways were that positive perceptions of problem-solving appraisal significantly contributed to the students' educational goals, and regardless of the specific culture, students with strong connections to the dominant culture in the given context were more likely to set higher educational goals (Flores et al., 2006).

A variety of research has been conducted in the field of education on problem-solving skills. Recent work has examined the positive role video games can play, such as Adachi and Willoughby's (2013) examination of the connection between problem-solving and video game type. Their four-year, longitudinal, Canadian study of 1,492 students in grades 9 to 12 (50.8% girls, mean age at start of study = 13 years, 10 months) showed that students who played more strategic video games (e.g., role playing, strategy, or stealth games) had higher self-reported

problem-solving skills overtime than those who played fast-paced, non-strategic games (e.g., action, racing, first-person-shooter games). Strategy games were more likely to encourage players to stop, explore different possibilities, and consider new strategies before making a decision toward achieving their goals. A further indirect association between video game type and academic grades was found, as higher self-reported problem-solving skills was shown to predict higher academic grades. Notably, no significant difference in problem-solving was found between genders, although boys reported taking part in more strategic *and* fast-paced video game, and girls reported higher academic grades. Further, having higher problem-solving skills predicted less frequent strategic video game play overtime, which may be due to those with greater problem solving skills also being more interested in learning, or not having the time to play video games as they get older, become more engaged in extracurricular activities, and take on more responsibilities. The authors note the important implications of possessing problem-solving skills and extracurriculars in relation to academic and workplace achievement, which are also important contributors to strengthening resilience.

A number of authors point out that the ability to problem-solve on one's own in real-time in a variety of situations is important in a world where computerization and automation of tasks are redefining what skills are necessary to participate and compete in the labour market (Borgonovi & Greiff, 2020). Using international data from the 2012 PISA (n = 237,115 students; age = 15; 42 countries), Borgonovi and Greiff found that boys held more positive attitudes towards problem solving than girls, and outperformed girls on cognitive dimensions of problem-solving. The study also found that the gender gap in problem-solving performance increased in favour of men in countries with greater gender inequality, but decreased in terms of men's problem-solving attitudes in those same countries. Another interesting finding was that after controlling for problem-solving performance, the gender gap in academic subjects like mathematics tends to narrow in more gender unequal countries. The authors state that these findings likely point to the context-dependent role that schools, curriculum, teachers, and other societal-level social actors play in contributing to gender inequality by socializing students to engage in sex-specific stereotypical activities (Borgonovi & Greiff, 2020).

In the field of education, fostering problem solving skills in students has become a central point of curriculum planning in many countries (Psycharis & Kallia, 2017). The ability to efficiently and effectively interpret new information is becoming increasingly more important than possessing specific knowledge and more necessary for successfully navigating both within the academic system and the wider society. Curriculum designers and policy makers at the macro level and teachers and faculty at the micro level, therefore, play an important role in strengthening student's problem-solving skills and their ability to adapt to new conditions. Psycharis and Kallia (2017) write how improving computational thinking may help in strengthening problem solving skills, especially with the growing prevalence of using

computational devices to problem solve, although their study did not find statistically significant evidence for this. The idea behind computational thinking is not to emulate the strict rules of a computer, but to adopt similar reasoning skills found in computational sciences, such as programming techniques, algorithms, and computer science concepts.

Improving

Finally, a variety of problem-solving strategies and techniques have been proposed in various fields of study, such as psychology and computational intelligence. These include the following proposed by Wang & Chiew (2010), who argue that these strategies tend to take place as people figure out which paths to take to find the solution to their problems:

- Heuristic: adopting the most possible solution (i.e., “rule of thumb”).
- Analogy: relating a problem to an existing similar issue which already has a solution.
- Hill climbing: a step by step movement toward solving the problem.
- Algorithmic deduction: employing an already known solution for a problem.
- Exhaustive search: systematically searching for all possible solutions.
- Divide and conquer: breaking the issue into a set of subproblems to eventually solve the whole problem.
- Analysis and synthesis: reducing a problem categorically, searching similarities in other categories, and then finding particular solutions.

Interventions

Problem-Solving Therapy

One approach to improving problem-solving abilities is through targeting dysfunctional problem-solving approaches using social problem-solving therapy (PST), which falls under the umbrella of cognitive-behavioural therapy (CBT; D’Zurilla et al., 2004; Nezu, 1986; Nezu et al., 2012). This style of therapy has been shown to be useful for clients with “depression, anxiety, emotional distress, suicidal ideation, cancer, heart disease, diabetes, stroke, traumatic brain injury, back pain, hypertension, and posttraumatic stress disorder” (Nezu et al., 2012, p. 3). The major treatment goals of PST are to have participants (a) adopt a more adaptive and optimistic orientation toward problem and the problem-solving process, with greater self-efficacy and acceptance of problems being a common occurrence; and (b) implement more effective problem-solving behaviours (e.g., planful problem-solving, and emotional regulation). After assessing the participant’s problem-solving orientation and style (described in the Definition section), PST treatment objective include 5 steps:

1. Enhancing positive problem orientation
2. Decreasing negative problem orientation
3. Fostering planful problem solving
4. Minimizing avoidant problem solving
5. Minimizing impulsive/careless problem solving (Nezu et al., 2013)

PST treatment has been shown to be effective in overcoming the following obstacles to social problem-solving: (a) ineffective or maladaptive problem-solving styles; (b) cognitive overload, often associated with stress; (b) emotional regulation issues (c) difficulties with negative automatic cognitive-emotional processing (e.g., rumination; belief in low self-efficacy; and difficulties disengaging from negative mood-related memories); and (d) limited motivation caused by feelings of hopelessness (Nezu et al., 2013). PST typically occurs over eight weekly group-sessions, approximately 1.5 to 2 hours each, and trains participants in four major problem-solving toolkits: (1) Problem-Solving Multitasking; (2) The Stop, Slow Down, Think, and Act (SSTA) method of approaching problems (formerly, "STOP and THINK"); (3) Healthy Thinking and Imagery; and (4) Planful Problem Solving.

Problem solving therapy (PST) can also be used to foster adherence and compliance with other treatment approaches, as shown in a behavioural weight loss intervention for women with obesity (Perri et al., 2001). After completing 20 weekly group therapy sessions of standard behavioural treatment (BT) for obesity, 80 women were randomly assigned to one of three groups: (a) BT only (i.e., no further intervention); (b) relapse prevention training; and (c) PST. After 17 months, although no differences in overall weight loss were observed between the relapse prevention and PST groups, the PST participants displayed significantly greater long-term weight reductions than BT-only participants. Approximately 35% of PST participants also displayed losses of 10% or more in body weight compared to 6% in BT only members (Perri et al., 2001; Nezu, 2004).

Social Problem-Solving Therapies

D'Zurilla et al. (2004) state that social problem solving (SPS) does best when used in tandem with other therapeutic approaches. SPS has been used in school-based anger management programs, as seen in Lochman's (1992) study of 11-year-old boys (n = 145) identified as aggressive by their teachers. The 26-sessions program was based on four components (SPS, positive play training, group-entry skill training, and dealing effectively with negative feelings), and included eight small group sessions to practice SPS skills to help cope with anger, as well as role playing, goal setting, videotaped behaviour modelling to improve self-statements, and group-developed video recordings illustrating alternative approaches to coping with anger-inducing situations. Compared to a control group, the boys in the anger management and problem-solving intervention group showed higher levels of self-esteem and

SPS skills in a range similar to non-aggressive boys, and lower rates of drug and alcohol use three years after the intervention (Lochman, 1992; Merrill et al., 2017).

Schema-based Intervention

Within academia, math and logic tend to be praised for their focus on solving problems and improving problem-solving skills. Jitendra et al. (2017) developed and replicated a "schema-based intervention" (SBI) for 373 middle school students from racially diverse schools in the USA, with (n = 253) and without difficulties in mathematics, to develop and improve their proportional reasoning skills. The authors state that proportional reasoning is challenging and requires not only the understanding of the concept of ratios, but also the ability to obtain the right information to develop a representation of the problem. The students completed a general mathematical problem-solving measure at pre- and post-test, and a proportional problem-solving (PPS) measure at pre-and post-test, and 11 weeks later. Results showed that SBI was effective at improving proportional reasoning overall and improved long-term retention of proportional problem-solving skills.

Problem-solving Framework for Socioecological System Projects

Regarding problem solving within socioecological system projects, Kells (2019) proposes a practical problem-solving framework to encompass the expectations of multiple stakeholders. Whether for projects addressing challenges with climate change, healthcare, resilience, poverty, crime or education, Kells states that the first step involves goal-setting by obtaining a brief one- to three-sentence description of the desired 'superordinate goal' from each stakeholder for goal congruence and trust-building. After this phase can begin problem structuring using a 'problem-solving model' with four phases: goals, obstacles, solutions, resources. Kells emphasises the importance of 'phase coherence', i.e., keeping the focus on one phase at a time, which can be maintained through designing the model as a visual tool to represent and convey the various stakeholders' work, and to keep track of the progress for later solution implementation. Avoiding 'inter-step entanglement' can also help to avoid the commonly occurring 'phase incoherence' in these multi-stakeholder problem-solving projects. This proposed model is not only visual but also technology-assisted to be accessible to stakeholders through a web portal and mobile apps, thereby maintaining the focus of all throughout the four stages of the problem-solving implementation process. Kells (2019) argues this process can improve trust, focus on a common vision, and positivity by "reframing the problem-oriented narratives into a *future-pull* narrative" (p. 10).

Cognitive Remediation

An important note worth mentioning is that problem-solving abilities can also be negatively affected by physiological conditions, such as neurological disabilities or head trauma

(Nezu et al., 2013). In a review of the literature on evidence-based cognitive rehabilitation from 2003 to 2008, Cicerone et al. (2011) describe several studies using various methods, including problem-solving strategies, to improve symptoms of traumatic brain injuries. Cognitive remediation (CR) is one method that can include problem-solving strategies to help overcome difficulties with attention and concentration or work with other strategies like direct attention training, or memory training using a notebook. The review also found that emotional self-regulation training, using role-play for the internalization of self-questioning, was useful in fostering effective problem-orientation in participants, and was necessary for improving clear thinking for supporting underlying problem-solving skills [see our write-up on Self-Regulation]. In said intervention for individuals with TBIs, only the problem-solving treatment group showed significant improvements in measures of executive functioning, self-appraisal of clear thinking, self-appraisal of emotional self-regulation, and objective observer-ratings of interpersonal problem-solving behaviours scenarios, all of which were maintained at a six-month follow-up (Cicerone et al., 2011; Rath 2003).

CR is also often used in interventions for individuals with schizophrenia, a population that tends to have difficulties with problem-solving abilities (Nezu et al., 2013; Rodewald et al., 2014). One study looking at two types of CR, basic cognition training and specific problem-solving training, found that compared to a control group performing basic cognitive training, individuals in a planning and problem-solving group showed greater improvement in their problem-solving abilities (Rodewald et al., 2014). Both the planning and problem-solving ability group (PLAN; n = 38; 84% men; average age = 28) and basic cognitive training group (n = 37; 77% men; average age = 29.5) took part in training interventions and a 3-week course involving ten, 45-minute computer-based cognitive training exercises in small groups targeting either planning and problem-solving, or basic cognition. The experimental group used a training program called PLAN, which focuses on training participants in using simple but effective planning and decision-making processes for dealing with everyday goal-conflict situations, e.g., “most important tasks first”. An instrument called “Plan-a-Day” was used to assess complex planning and problem-solving abilities. Both groups improved on measures of functional capacity and cognitive functioning, while the PLAN group increased their Plan-a-Day solution time (i.e., problem-solving speed). Interestingly, individuals who initially reported impairments to the planning domain showed the strongest benefit from a domain specific training. This research shows the importance of intervention program selection, and the consideration of conducting a generalized or an individualized approach (Rodewald et al., 2014).

Assessment

Social Problem-Solving Inventory-Revised (SPSI-R; D’Zurilla et al., 2002)

- 52-item long form
- 5-point Likert-type scale (0 = not at all true of me; 4 = extremely true of me).
- Five major scales to measure the five different dimensions of the social problem-solving model:
    - Positive Problem Orientation (PPO; 5 items)
    - Negative Problem Orientation (NPO; 10 items)
    - Rational Problem-Solving Style (RPS; 20 items)
    - Impulsivity/Carelessness Style (ICS; 10 items)
    - Avoidance Style (AS; 7 items)
- "Good" social problem-solving ability is indicated by high scores on PPO and RPS, and low scores on NPO, ICS, and AS. "Poor" social problem-solving ability is indicated by low scores on PPO and RPS and high scores on NPO, ICS, and AS.
- In addition to the five major scales, the RPS scale is broken down into four subscales (each with five items) to measure the four major problem-solving skills in the D'Zurilla et al. (2004) social problem-solving model:
    - Problem Definition and Formulation (PDF)
    - Generation of Alternative Solutions (GAS)
    - Decision Making (DM) subscale
    - Solution Implementation and Verification (SIVS)
- Cronbach's alpha (.95 for total score; .67 – .92 for subscales)
- A 25-item short form of the SPSI-R is also available that measures the five major problem-solving dimensions but removes the four subscales.
    - 25-item Cronbach alpha = .85 avg (or .67 to .92; Li et al., 2016)
- Manual (and measures) costs to obtain: (approx. AU$150: https://shop.acer.edu.au/spsi-r-technical-manual)

Problem-Solving Inventory (PSI; Heppner & Petersen, 1982)

- 35-item
- 6-point Likert-scale (1 = "very dissatisfied", 6 = "very satisfied")
- Based on the notion that an individual's appraisal of a situation will affect the problem-solving performance and process, the PSI was developed as a measure of an individual's "problem-solving appraisal", or their perceived problem-solving competence based on their problem-solving behaviour and attitudes. Note, it does not measure problem-solving skills.
- PSI has three dimensions: Problem-Solving Confidence (PSC; 11 items), Approach-Avoidance Style (AAS; 16 items), and Personal Control (PC; 5 items)

    - Huang & Flores (2011) stated their findings "support the cultural validity of PSI scores with Mexican Americans and enhance the generalizability with culturally diverse samples."
- Cronbach alpha = 0.79 to 0.91 for all PSI scales (Kourmousi et al., 2016)
    - Huang & Flores (2011) found the following alpha scores: .86 for PSI, .77 for PSC, .76 for AAS, and .66 for PC.
- ***See Heppner & Petersen, 1982, p. 69-70 for item statements*

The Means-Ends Problem-Solving Procedure (MEPS; Platt & Spivack, 1975)

- The purpose of MEPS is to measure one's ability to conceptualize the steps necessary in goal achievement (i.e., "finding a means to an end"). It is an outcome rather than process measure.
- Assesses three major components: (a) the ability to conceptualize the sequential steps or "means" necessary to achieve a goal; (b) the ability to anticipate obstacles to goal attainment, and (c) the ability to appreciate that problem-solving often takes time, or that appropriate timing is important for solution implementation.
- Participants are presented with a series of ten hypothetical interpersonal problems consisting of incomplete stories that have a beginning with a stated goal, and an ending where the protagonist has achieved the goal. Participants must make up the middle part of the story that connects the beginning with the ending.
- MEPS uses a quantitative scoring system that computes separate frequency scores for relevant means, obstacles, and time.
    - Schotte and Clum (1987) developed a modified MEPS with two process variables in addition to outcome: (a) the ability to generate alternative solutions and (b) the ability to anticipate solution consequences. The participants, who were suicidal, were asked to list and respond to real problems from their personal lives that contributed to their hospitalization. These suicidal patients presented significantly fewer potential solutions (fewer than half as many as the control group) and reported a greater number of potential negative consequences than non-suicidal patients.
- Schotte & Clum (1987) state the original MEPS had high levels of internal consistency: (KR-20 = .80 to .82, odd-even = .82 to .84).
- Marx et al. (1992, p. 80) state that MEPS' construct validity "has been demonstrated in a number of studies in which significant differences in social problem solving were found between groups varying in social adjustment (Platt & Spivack, 1972)."

Child Health & Illness Profile - Child Edition (CHIP-CE), Child Report Form & Parent Report Form (Riley et al., 2004)

- This measure is included in this write-up, as the social problem-solving subscale falls under the Resilience domain, which measures a parent's assessment of family support, child's coping abilities, and the child's physical activity levels (19 items). The three subscales of Resilience are:
    - Family involvement: level of activities with family and perceived family support
    - Social problem-solving: active approaches to solving an interpersonal problem
    - Physical activity: level of involvement in activities related to fitness
- The five social problem-solving items and their alpha scores are as follows:
    - Cronbach's alpha total = 0.81
    - Child would talk to others for advice. 0.70*
    - Child tries different ways to solve problem. 0.67*
    - Child talks to friend about how feeling. 0.65*
    - Child turns to family to help feel better. 0.56*
    - Child gets help before problems get too big. 0.61*

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