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CHAPTER 30

Facilitating Curiosity: A Social and Self-Regulatory Perspective for Scientifically Based Interventions

TODD B. KASHDAN and FRANK D. FINCHAM

Curiosity is an understudied human strength with relevance to domains ranging from creativity, leisure, and social relationships to applications in educational, sport, organizational, and clinical psychology. Although curiosity may be a universal trait, individuals have idiosyncratic interests and differ in their receptivity to novel and challenging activities and the intensity, frequency, and sustainability of curiosity states. Existing research shows that curiosity explains approximately 10% of the variance in achievement and performance outcomes (Schiefele, Krapp, & Winteler, 1992) and 36% in career choices (Lent, Brown, & Hackett, 1994). In the workplace, curiosity-related cognitions and behaviors predict greater adjustment to new occupations (Wanberg & Kammeyer-Mueller, 2000), job-related changes (Wanberg & Banas, 2000), and job-related learning, satisfaction, and performance (e.g., Reio & Wiswell, 2000; Wall & Clegg, 1981). In the clinical realm, individuals with greater curiosity in self-reflection and behavior modification goals show greater clinical gains (e.g., Williams, Gagne, Ryan, & Deci, 2002; Williams, Rodin, Ryan, Grolnick, & Deci, 1998). None of these studies, however, used the term *curiosity*. The construct of curiosity has gone under various labels leading to redundant and isolated research, impeding scientific progress.

Systematic examination of the theories, structure, development, and correlates of curiosity are beyond the scope of this chapter (see Kashdan, in press-a; Silvia, in press, for reviews), which instead focuses on social and self-regulatory factors that enable curiosity to flourish. This analysis serves as a springboard for suggestions to develop empirically informed curiosity interventions. The limitations of existing curiosity research are noted in highlighting new research directions.

THE CONCEPT OF CURIOSITY

Understanding curiosity necessarily requires consideration of its potential overlap with interest, flow, and intrinsic motivation, each of which tends to be used interchangeably within a trait-state individual difference framework (Kashdan, in press-a). In fact, researcher preference often determines which label is used for the construct under study.

We define curiosity as the volitional recognition, pursuit, and self-regulation of novel and challenging opportunities (reflecting intrinsic values and interests). Enduring or *trait curiosity* refers to dispositional differences in curiosity behaviors. A person high in trait curiosity prefers novelty, complexity, uncertainty, and conflict; is more likely to be involved in or actively search for activities with these qualities; is more mindful of discrepancies between what is known and not known in a situation; and has these experiences more readily or chronically. Task or *state curiosity* is a temporary state evoked by an ongoing internal or external activity, implying a transaction between the person and environment. When curious, individuals are actively involved in the pursuit of personal enjoyment. Internal pressures (e.g., guilt and fear) and external pressures (e.g., the demands of other people) cannot induce an individual to appreciate and savor the beauty of a Renee Magritte painting or feel a sense of control and effortlessness while being mindful to the body positioning of an opponent and location of the ball in a tennis match. These examples capture the essence of experiencing curiosity. Reinforcements from momentary curiosity serve as likely precursors to enduring curiosity. Fortunately, curiosity is a malleable psychological state (and perhaps, trait) that is strongly influenced by social contexts and other individual difference variables.

We use the term curiosity because multidimensional curiosity models predate and are implicit in models of intrinsic motivation (e.g., Deci, 1975; Ryan & Deci, 2000) and interest (e.g., Fredrickson, 1998; Krapp, 1999). Berlyne's (1960, 1971, 1978) discussion of contextual properties that induce curiosity—namely, novelty, complexity, uncertainty, and conflict—suggests that research needs to account for person-level curiosity, the interestingness of the specific context, and interactions between person and context. We use this transactional approach to synthesize and expand on relevant curiosity research. The phenomenology of curiosity, interest, and intrinsically motivated states is virtually synonymous and includes positive affect (e.g., vitality, enjoyment), receptivity to new experiences, broadened cognitive processing, task absorption, and active exploration of sources of interestingness. The use of standard curiosity terminology serves to integrate overlapping bodies of work. As evidence of the distinctiveness of curiosity, factor-analytic studies indicate that indexes of positive psychological constructs such as hope, optimism, positive affect, well-being, and life satisfaction all load onto a single global factor whereas curiosity scales load onto an independent factor (Kashdan, 2002, in press-b).

A FRAMEWORK FOR FACTORS THAT SUPPORT CURIOSITY

The propensity and intensity of an individual's curiosity at any given time depend on an individual's personal sensitivities to ongoing activity and the properties of the activity. To specify factors that facilitate and stabilize enhanced levels of

curiosity in an activity or domain, we integrate different theoretical traditions. Although several theories offer an account of the social contexts and self-regulatory processes that support the expression of curiosity, we believe self-determination theory (SDT; Deci & Ryan, 1985, 2000) is the most fertile for intervention work. However, to further illuminate methods for intervention, we integrate this with the curiosity-inducing stimulus properties specified by Berlyne (1960), the skills-challenge balance specified by Csikszentmihalyi (1990), and the dynamic interplay among trait curiosity, task curiosity, and situational contexts.

The crux of SDT is that individuals primarily strive to achieve self-determination in their daily activities. Motivation is derived from subjective feelings of self-determination. Self-determination theory covers extensive territory on the social conditions and self-regulatory mechanisms that foster or hinder feelings of self-determination, goal pursuit, and goal attainment, which are integral to well-being and optimal functioning (Deci & Ryan, 2000). We limit our discussion to the mechanisms relevant to curiosity-based activities. Curiosity is given a privileged status in this model:

> Perhaps no single phenomenon reflects the positive potential of human nature as much as intrinsic motivation, the inherent tendency to seek out novelty and challenges, to extend and exercise one's capacities, to explore, and to learn. (Ryan & Deci, 2000, p. 70)

Self-determination theory suggests that the likelihood and strength of curiosity depends on the subjective experience of autonomy and, to a slightly lesser extent, competence. Although SDT affords less attention to feelings of relatedness, we believe social contexts that satisfy this need strongly influence the expression of curiosity. The independent and interactive influence of these psychological needs on task and enduring curiosity is not known.

AUTONOMY

Autonomy hinges on the belief that personal behaviors are self-initiated. In general, people exhibit greater task curiosity (self-report and behavioral measures of persistence during free-choice periods), enjoyment, and deeper cognitive processing when provided greater choice (e.g., Cordova & Lepper, 1996) and when provided greater information and encouragement for personal choices (e.g., Black & Deci, 2000).

Threats, punishment, negative feedback, and surveillance have clear negative effects on task curiosity and performance. These pressures are experienced as internally controlling and tend to result in extrinsic motivation or task disengagement, both of which have adverse effects on performance-related outcomes. There is considerable debate as to the effects of external rewards on curiosity. A meta-analysis found that external rewards have an overall detrimental effect on task-related curiosity (Deci, Koestner, & Ryan, 1999). The undermining effect of external rewards was more robust for interesting, compared to boring, tasks. Extrinsic rewards appear to be useful for motivating individuals to participate in unpleasant or undesirable activities. This is fortunate because monotonous activities, rules, deadlines, evaluations, and social proprieties are vital and integral to schools, organizations, sports, and families. The same rewards that

increase motivation in uninteresting tasks undermine motivation in initially interesting tasks because feelings of personal causation shift from internal to external. This underscores a complex relationship:

> That is, a person could feel able to obtain a desired outcome (i.e., have an *internal* locus of *control*) and also feel pressured and controlled by that desired outcome to behave in a certain way (i.e., have an *external* locus of *causality*). (Deci et al., 1999, p. 693)

To sustain or enhance initial task curiosity and enjoyment, the provision of rewards should contribute to an internal locus of causality. The strategies in which rewards (or punishments) are administered affect task-related curiosity (see Ryan, 1982). Informational rewards are used to acknowledge a recipient's mastery and skill development and tend to be unexpected (e.g., a coach encouraging athletes about improvements in their techniques). These rewards let recipients feel that they are the origin of their behavior. Controlling rewards are used to motivate recipients and strengthen their interest (e.g., a coach telling the team that the best performer gets to skip the next practice). These rewards cause recipients to feel like pawns that exchange effort and work for potential rewards.

Feelings of autonomy and the autonomy-supportive behavior of significant others have clear, positive effects on curiosity. As for controlling behaviors such as giving rewards or being critical, the administration tactics are crucial to fostering or hindering curiosity. Controlling tactics may increase immediate task curiosity but are likely to undermine autonomous curiosity and the development of enduring interests. Virtually no empirical attention has been given to the specific mechanisms by which internal pressures are activated and influence curiosity and goal-related outcomes. Overall, curiosity is more likely to be enhanced when control is minimized and feelings of personal choice, meaningfulness, and competence-related processes are emphasized.

Competence

Events that cause individuals to believe they can interact effectively with the environment (perceived competence) or desire to interact effectively (competence valuation) tend to enhance curiosity and predict achievement gains (e.g., Cury, Elliot, Sarrazin, Da Fonseca, & Rufo, 2002; Elliot et al., 2000). Students with high academic ability but low perceived academic competence report lower academic curiosity, enjoyment, persistence, and grades across a school year than those students with both high academic ability and perceived competence (Miserandino, 1996). Strong abilities are not sufficient, as competency beliefs appear to be the primary mechanism for experiencing high task curiosity and persistence, increasing the likelihood of achievement success.

Appropriate and sincere praise (informational positive feedback) kindles feelings of competence and competence valuation (Deci et al., 1999). The salutary effects of positive task feedback on curiosity in challenging word games were independently mediated by perceived competence and competence valuation (Elliot et al., 2000). However, when using a basketball dribbling task, mediational effects were found only for competence valuation (Cury et al., 2002). These findings highlight the importance of both the administration of positive feedback (informational versus controlling) and the domain specificity of tasks (e.g., academic,

challenging cognitive games, sports) in synthesizing curiosity-related research and developing interventions.

Competence valuation is proposed to be more malleable and less stable than perceived competence. Positive feedback following a single task has to contend with substantial personal data (e.g., prior performance) informing beliefs in the certainty of abilities in the task (e.g., math, football). Most of the research on the effects of positive feedback and social contexts on competence-related beliefs and subsequent curiosity have used experimental tasks. More work is needed on the longevity of positive feedback effects and whether changes in competence valuation and task curiosity translate into further participation, engagement, and success in the same domain. The longevity of positive feedback effects is likely to be contingent on the degree to which it is internalized.

Competence-related beliefs are proposed to cause individuals to perceive activities as challenges as opposed to threats. Strong competence-related beliefs can be expected to minimize the disruptive influences of self-consciousness and fears of negative evaluation, and increase feelings of control and task absorption. There is evidence of a sequential relationship from competence valuation to task absorption to task curiosity (Cury et al., 2002). Yet, there are two issues in interpreting these findings: (1) The assessment of competence valuation and task absorption were conducted simultaneously, and (2) task absorption is a structural component of curiosity (Csikszentmihalyi, 1990; Kashdan, in press-a). Refinements in the timing of assessment and greater attention to the differential operationalization of predictors, mechanisms, and outcomes can provide greater understanding of the sequelae of curiosity. Despite these caveats, there is evidence that both autonomy and competence-related beliefs are important antecedents to curiosity. To date, however, there are no data on the potential interplay between these different belief systems.

RELATEDNESS

According to Deci and Ryan (2000), unlike autonomy and competence, satisfying relatedness is not necessary for the expression of task curiosity. However, a sense of connectedness and believing that inner emotional experiences are acknowledged and validated do appear to increase curiosity (Mikulincer & Shaver, 2003, for review of attachment literature). Feelings of relatedness enhance curiosity and performance in athletic, academic, and work contexts (e.g., Grolnick & Ryan, 1989; Hazan & Shaver, 1990; Smoll, Smith, Barnett, & Everett, 1993), producing consequences such as personal growth and less susceptibility to closed-minded cognitions (e.g., ethnic stereotypes, Mikulincer, 1997). Preliminary support exists for reciprocal relationships between curiosity and feelings of relatedness. Feelings of comfort and safety encourage curiosity and exploratory behavior, and curiosity predicts greater feelings of closeness among strangers (Kashdan, Rose, & Fincham, in press; Kashdan & Roberts, in press) and students and teachers (Skinner & Belmont, 1993). Each pathway leads to a broadening of personal resources.

When significant others (e.g., parents, teachers, supervisors, coaches, therapists) are perceived to be sensitive and responsive, concerns about impressing others and being accepted are minimized. Satisfying this fundamental need to belong frees resources to embrace risks and pursue and persist in novel and challenging activities. Infants, children, and adults who feel close to significant others are more likely to explore their environment because the inherent anxiety of

novel and ambiguous activity is modulated by beliefs that they can return to a safe comfort zone. Excessive anxieties undermine exploration and increase withdrawal and avoidance behaviors.

We suggest that satisfying feelings of relatedness becomes increasingly important for the initiation, maintenance, and self-regulation of curiosity when activities are conducted in interpersonal contexts. Students, workers, athletes, and clients under the supervision of individuals who satisfy relatedness needs may be inspired to pursue appetitive goals at the potential expense of failure, embarrassment, and rejection.

The Self-Regulatory Strategy of Internalization

Rules, deadlines, assignments, and social mores are necessary for parents to raise young children to be virtuous and productive members of society and for each workplace, school classroom, and athletic team to keep account of what is being learned and to ensure a safe and pleasant environment. Although individuals may initially feel controlled by pressures and obligations to do things that are not self-endorsed, goal-related behaviors can be internalized, thereby producing self-determination and the strongest form of personal investment.

Take the example of a client seeking treatment for impairing social anxiety on the insistence of his or her spouse and work manager (external pressures) as opposed to the desire to be healthier and happier (autonomous reasons). Clients pressured into seeking treatment are likely to be less invested in the treatment process. They may complete treatment-related assignments because of the rationale offered by their therapist: The anxiety experienced during social exposure tasks can be viewed as an investment for a calmer and more pleasurable future. Sometimes clients experience a shift toward greater treatment-related curiosity and personal effort when they recognize positive changes (i.e., competence-related beliefs). Other clients drop out prematurely, which can be a result of discordance between intrinsic values and interests and the treatment process. When treatment-related goals are internalized such that clients begin to understand and value what they are doing, why they are doing it, and begin to invest time and effort of their own accord, their motivation changes. This process leads to increased curiosity in the self-discovery and behavior modification process, subsequently enhancing clinical gains (e.g., Williams et al., 2002).

Considerable data show that autonomy, competence, and relatedness enhance curiosity, initiate internalization, and inform the development of curiosity interventions. But exploration of the salutary effects of treatment-related curiosity and, more importantly, the structure, value, and assessment of internalization has only just begun. There is clinical value in capitalizing on the internalization process to transform lack of motivation and boredom to psychological states closer to curiosity.

ELABORATING THE FRAMEWORK FOR CURIOSITY SUPPORTIVE FACTORS

Domain Specificity of Curiosity

Individuals have idiosyncratic interests and can be expected to react differently to the specific activity (e.g., video game, reading task, documentary on Egyptian pyramids), global domain (e.g., school, sports), or specific content area (e.g., math,

philosophy, basketball) under study or target of intervention. Failure to address domain-specific matches between individual interests and specific activities evokes nonrandom error into investigations. On average, girls become less interested in science and math as they get older compared to boys, and individuals in collectivist countries (e.g., China) express less curiosity for solo sports such as mountain biking and rock climbing than individuals in individualistic countries (e.g., United States). Autonomy, competence-related beliefs, and curiosity have shown differential patterns in specific academic subjects and sporting activities (Duda & Nicholls, 1992; Reeve & Hakel, 2000). Most curiosity studies have focused on single content areas or experimental tasks such as pinball games, basketball dribbling drills, and problem-solving tasks (e.g., crossword and jigsaw puzzles). Findings on factors and processes that facilitate curiosity need to be replicated in multiple domains to examine the extent of cross-domain generalizability versus domain-specific patterns and pathways.

A TRANSACTIONAL APPROACH

The transactional work from flow theory (e.g., Csikszentmihalyi, 1990) and Berlyne's (1960, 1971) research on responses to stimuli with varying challenging properties suggest that curiosity behaviors are a function of the person and environment. To augment SDT, these theories share supplemental perspectives on enablers of curiosity. There is substantial support for a quadratic or inverted U-shaped relationship between curiosity and the challenge of ongoing activities. Curiosity will be undermined if activities are too difficult and complex, evoking anxiety and withdrawal, or are too easy, leading to boredom and apathy. Curiosity appears to be inextricably linked to anxiety in predicting the most desirable states and subsequent approach/avoidance behaviors in a given situation (Spielberger & Starr, 1994). To increase the likelihood of heightened curiosity, the challenge of activities should match or slightly exceed the individual's abilities.

Support for this model stems from a considerable number of perceptual tasks in which participants were exposed to stimuli with varying degrees of novelty, complexity, and ambiguity (e.g., bizarre shapes, planes with the wings of a bird). Participants preferred shapes, colors, and pictures with moderate novel, ambiguous, conflicting, and complex properties (inducing greater state anxiety and curiosity) as opposed to neutral or extremely ambiguous stimuli (see Berlyne, 1971; Voss & Keller, 1983, for reviews). These findings are plagued by a narrow operationalization of curiosity and questionable generalizability. However, validation for the quadratic relationship between curiosity and challenge has been replicated in diverse ecological settings such as river kayaking, leisure, and work- and school-related activities (e.g., Csikszentmihalyi & LeFevre, 1989; Jones, Hollenhorst, Perna, & Selin, 2000; Peters, 1978). Using jigsaw puzzle and epistemic tasks, Loewenstein, Adler, Behrens, and Gillis (1992) found that curiosity increased as individuals obtained more information and success toward task completion; however, across each task there was a point of diminishing returns in curiosity and task persistence. Once participants could make well-educated guesses about the final design of jigsaw puzzles, their curiosity dissipated dramatically.

Silvia (in press) has carefully examined much of the research on curiosity and learning and found that a disproportionate number of researchers report only

linear analyses or conduct experiments without addressing the quadratic relationship between curiosity and stimulus or task properties. We believe it should become standard practice in the field of curiosity to report the results of quadratic analyses.

CURIOSITY INTERVENTIONS

Curiosity is based on appraisals and emotional reactions to ongoing internal or external activity. Only in rare circumstances would it make sense to directly cultivate curiosity in an intervention. As the prior section makes clear, the best avenue for cultivating curiosity is to create social and contextual conditions that facilitate the perceptions and emotions that lead to greater curiosity. These conditions include satisfying the three psychological needs we have identified, highlighting the personal meaningfulness of activity, producing optimal transactions between person-level characteristics and ongoing activity, and directly manipulating the collative properties of activity.

Table 30.1 presents a list of general strategies for enhancing curiosity based on theory and research on SDT and curiosity-related constructs. The primary targets of intervention include the activities used during sessions, homework assignments, and the interpersonal style and behaviors enacted by leaders or authority figures. For parsimony, we did not include reciprocal feedback loops among activities, psychological needs, and curiosity. Pending the need for supportive data, we would hypothesize that the more needs that are targeted in an intervention, the greater propensity for high levels of task curiosity and the search and attainment of subsequent and enduring curiosity experiences. The task or social environment can be the target of intervention but especially with students, workers, clients, and athletes who have sustained relationships with teachers, managers, therapists, and coaches, respectively. Thus, training authority figures to support self-determination (autonomy, competence, and relatedness) should increase the likelihood of upward spirals among activities, needs, and curiosity, leading to enduring interests. These sorts of multifaceted pathways and relationships should be considered in the design of interventions and analyses of efficacy. Using the targets and strategies in Table 30.1 as a guide, the few existing curiosity interventions are examined along with suggestions for new techniques and modules in the domains of education, work, sports, and health. We begin with an exemplar of interventions targeting both activities and the social environment.

Curiosity Interventions in the Health Domain

Motivational Interviewing (MI) Originally developed for treating alcohol abuse, for the past 20 years MI has been applied to health-related domains such as smoking cessation, drug use, gambling, domestic abuse, HIV risk reduction, diet and physical activity, and adherence to medical and psychiatric treatment (e.g., Dunn, Deroo, & Rivara, 2001; Miller & Rollnick, 2002). In contrast to authoritarian and confrontational treatments, in MI, therapists gently guide clients in self-directed changes. Expressed motivation to change, articulation of how current behaviors interfere with desired outcomes, and agenda setting during treatment are elicited from clients. Therapists operate at the client's pace and do not use persuasive tactics, refute irrational or maladaptive beliefs, or challenge

Table 30.1
Empirically Informed Targets and Strategies of Curiosity Interventions

Target of Intervention	General Strategies and Techniques	Directly Activated Psychological Needs	Curiosity Outcome
Activity or task	Create tasks that capitalize on novelty, complexity, ambiguity, variety, and surprise.	Direct influence on curiosity	
	Purposely place individuals in contexts that are discrepant with their experience, skills, and personality.	Autonomy	
	Create tasks that can be conducted independently.	Competence	
	Allow opportunities for play.		
	Create tasks that are personally meaningful.	Relatedness	
	Create challenges that match or slightly exceed current skills.		
	Create enjoyable group-based activities.		
Social environment (leadership)	Provide choices and participation in decision-making process.	Autonomy	
	Foster personal responsibility and ownership of actions and successes.		Affect curiosity as a function of activated psychological needs.
	Give clear information about task structure and expectations.		
	Provide encouragement and supportive feedback for efforts.	Competence	
	Focus on improvement and the process of learning and mastery.		
	Elicit and reinforce positive self-talk.		
	Emphasize the meaningfulness of activity and efforts.		
	Aid in goal setting, planning, and monitoring.		
	Avoid threat, judgment, and harsh evaluation and criticism.		
	Foster open dialogue.	Relatedness	
	Express empathy for individuals' emotions, values, and needs.		
	Be warm, accepting, and supportive.		
	Provide clear information about the social structure and other people.		
	Express and model interest in individuals and activities.		

resistance. Motivational interviewing sessions are a forum for clients to openly express thoughts and feelings concerning their desirable and undesirable behaviors and for therapists to help clients explore and resolve conflicts between ongoing behaviors and their interference with intrinsic desires and goals. If clients voice interest, other intervention techniques are also evoked. Motivational interviewing is a brief intervention that has been examined alone or as an adjunct to existing clinical and health interventions.

It is assumed that clients differ in their motivational orientations to change long-standing behaviors and each client's motivation fluctuates as a result of transactions between them and the environment. Despite the use of motivational terminology, we could not find any published work that explicitly tied MI to curiosity or the components of SDT. Motivational interviewing provides a therapeutic environment that supports the psychological needs of autonomy, relatedness, and competence, which facilitate curiosity-related behaviors that lead to positive treatment outcomes. The goal of MI is to foster clients' self-exploration of the meaning, implications, benefits, and costs of their behavioral tendencies. It is believed that a failure to engage in this deep cognitive processing prevents clients from recognizing how their health behaviors disrupt their ability to meet desired outcomes and experience well-being. Motivational interviewing fosters clients' personal accountability and responsibility for their behaviors.

Therapists are trained to enact a specific style compatible with the goals of MI (see Miller & Rollnick, 2002). In support of autonomy, they consistently provide clients with options and the freedom to choose the discussions and agendas of sessions. Therapists help clients perceive conflicts between their ongoing behaviors and their personal short- and long-term goals. For example, engaging in unprotected sex with multiple partners for immediate gratification would conflict with the striving to live a long, healthy life. Upon accentuating clients' mindfulness of these discrepancies, therapists let clients argue both sides of their ambivalent feelings and values in the hopes of resolution. In support of competence, therapists provide continual feedback about the results of formal assessment (e.g., self-report forms, interviews) and their ongoing behavior and its consequences. Treatment goals are elicited from the client and, when necessary, are modified and negotiated with the therapist to ensure they fit the skills and motivation of the client. To cultivate self-efficacy and treatment-related curiosity behaviors, a primary strategy of therapists is to elicit and reinforce self-motivational statements (e.g., recognizing small gains over the course of a week) and behaviors (e.g., rewarding themselves for making progress) made by clients. In support of relatedness, therapists are nonjudgmental, nonconfrontational, and express empathy, validation, understanding, and genuine interest in clients' feelings, values, and concerns. Therapists engage in more listening than talking during sessions, which supports both autonomous behavior and feelings of relatedness. However, when therapists do communicate, it is in a reflective manner to further clients' self-exploration of the aforementioned discrepancies and ambivalence. The training to reach this self-determination supportive interpersonal style taps nearly all of the social environment strategies in Table 30.1.

There is mixed empirical support for the effectiveness of MI (see Dunn et al., 2001), but it is defined as a "probably efficacious" treatment. It appears to be most effective for addictive behaviors, younger clients, and individuals with lower initial motivation for change. Motivational interviewing has been shown to increase

curiosity-related behaviors and cognitions in treatment such as active engagement and participation, receptivity to new ideas, and thoughtful processing of different experiences and perspectives. There is evidence that client engagement during treatment mediates the relationship between in-patient treatment (MI versus no-MI) and reduced alcohol use at a three-month follow-up after discharge (Brown & Miller, 1993).

Therapist Training and Treatment Dosage There is a great deal of variability in how MI is administered, including training of therapists and mode and the length or dosage of treatment. The therapeutic style of MI is distinct from the modal cognitive-behavioral therapy training of psychologists and the non-collaborative decision making in doctor-patient (e.g., directive advice to clients) and teacher-student relationships (e.g., continuous testing and evaluation on preplanned material). Motivational interviewing appears to be used as a stand-alone intervention or as an adjunct to other programs, administered in individual and group formats, with varying numbers of contact hours (e.g., Dunn et al., 2001). At present, there is no clear standard because results between these modes of delivery differ by the age of client, behavior being treated, and client characteristics. In terms of cost-effectiveness, MI shows great promise as a brief adjunct treatment to initiate client engagement with other programs. Tests of therapist fidelity to the principles of MI should be conducted systematically with independent ratings of audiotaped or videotaped sessions, which should include early and later sessions to assess for behavioral drifts back to initial therapeutic interpersonal styles. The development and evaluation of standardized (e.g., manualized) training and interventions should prevent variability in therapist fidelity and treatment dosage across studies. Learning from the applications of SDT to education (e.g., Williams & Deci, 1996), therapists should be trained in the same self-determination supportive style that they are expected to exhibit to clients. The criterion of therapist training is the effects on trainees' interests in MI, their therapeutic style, and the outcomes of their clients.

Assessment Issues and Suggestions As for the mechanisms of action in MI, we suggest that future studies examine SDT-related variables such as client autonomy, competence, and relatedness beliefs during treatment sessions and their influence on curiosity and positive health-related outcomes. We emphasize the strong empirical support for the satisfaction of each of these beliefs in predicting curiosity-related outcomes. Additional support stems from a smoking cessation intervention with adults counseled by physicians (Williams et al., 2002). Physicians were trained to provide an intervention similar to MI except that it did not help clients recognize, explore, and resolve discrepancies between what they do and what they would like to be doing and feeling. Results found that the autonomy supportive compared to the control intervention was perceived as more autonomy supportive (as evaluated by independent raters of session audiotapes) and led to greater client efforts and success in smoking cessation. Independent ratings of autonomy support are commendable because they don't contaminate client-rated outcome measures. However, the goal of intervention is to enhance client perceptions of autonomy in the therapeutic setting. We suggest that clinical studies also focus on the satisfaction of needs as rated by clients.

The failure to examine theoretical models and constructs related to curiosity has interfered with examinations of efficacy and process-related mechanisms. A

large majority of MI studies have used self-report measures or clinical observations of the broad construct of readiness to change. This complex theoretical construct has less meaning to nonprofessionals than the constructs of curiosity and the psychological needs of SDT. The premise of working with clients with less than ideal motivation for treatment goals begs for instruments that are sensitive to the degree to which treatment goals are pursued because of their own curiosity or internalized extrinsic goals. The single SDT dimension ranging from amotivation to intrinsic motivation is a useful framework for creating specific self-report and interview questions about client curiosity in the current behaviors being treated. Published studies support the use of the Treatment Self Regulation Questionnaire, assessing the degree of clients' self-determined interest in the treatment process (e.g., Williams et al., 2002). To measure the process of change for specific manualized treatments, existing curiosity measures can be modified to address curiosity in the material being presented, therapist-client dialogue, the self-exploration process, and treatment goals (see fourth row in Table 30.2).

The therapeutic approach of creating, maintaining, and resolving personal discrepancies and conflicts in MI appears to be an extension of existing curiosity theoretical models. Clients can be expected to initially experience anxiety and curiosity when discrepancies are developed. However, as information is continually acquired and refinements in clients' sense of self are assimilated or accommodated, anxiety is expected to dissipate. Curiosity may initially abate, but the exploration of new opportunities to enact novel, healthier behaviors and skills can be expected to enhance further curiosity and self-discovery. Similarly, changes in health-related behaviors and feelings of autonomy, competence, and relatedness can be expected to ebb and flow over the course of treatment. Despite the likelihood of nonlinear trajectories, MI studies have primarily used linear analyses.

Besides examining client improvement (or relapse), of interest is whether intra-individual variability in health-related behaviors covary with changes in treatment-related curiosity and constructs such as anxiety and feelings of self-determination. Aggregating changes within treatment to pre- and postdesigns can mask social and self-regulatory factors that facilitate and hinder clinical gains. Constructs can be assessed before and after each session as a dynamic examination of the change, variability, and structure of curiosity within and between individuals (see third row in Table 30.2). Ainley and Hidi (2002) review examples of more dynamic modes of curiosity assessment that have implications for intervention. This methodology allows for better tests of theoretical models, leading to empirical support or the need for model refinements.

Additional Implications for Motivational Interviewing We believe there is merit in using MI as an adjunct to additional areas of study including psychological disorders, the cultivation of positive characteristics such as prosocial behaviors in children, and the beginning of organizational changes in the workplace. It may be particularly useful for programs with universal implementation such as an entire school (e.g., bullying prevention programs) where some students may fail to perceive a need to change and experience initial amotivation. Other unmotivated clients who may benefit from MI include those for whom treatment is court-mandated. Motivational interviewing appears to be useful to gauge and facilitate motivation such that discrepancies between the present and ideal self are highlighted and curiosity for self-discovery and the products of self-discovery are enhanced.

Table 30.2
Suggestions for Assessment in Curiosity Interventions

Assessment Strategies and Techniques	Rationale
Recognize and assess individual differences in trait and task curiosity.	Individuals differ in the desire, recognition, and active pursuit of novelty and challenge. People can prefer difficult cognitive activity, physically manipulating objects, exploring the environment with others, or thinking about their feelings and thoughts. Gauging general tendencies and task curiosity before, during, and after activities can improve tests of the impact of interventions.
Assess theoretically relevant individual differences variables.	Specific individual difference factors moderate relationships between social contexts and curiosity. These variables can offer insight into matching participants to appropriate activities and identifying good or poor responders.
Conduct dynamic assessments of intra-individual variability in curiosity, affect, beliefs, and contextual variables during activity.	Task curiosity, anxiety, and perceptions of skills and challenges can be expected to change over the course of activity. Dynamic measures can further our understanding of curiosity enablers and inhibitors by examining factors that covary with changes in curiosity. Examine quadratic relationships.
Consider modifying existing curiosity scales to address domain-specificity of curiosity for the specific stimuli, content, or domains targeted by interventions.	Greater concordance between outcome measures and study hypotheses will increase the probability of obtaining clinically useful findings (i.e., decrease in measurement error). Interventions are designed to enhance curiosity and goal-related outcomes in domains such as education, sports, or work, or with even greater specificity (i.e., chemistry, baseball). The specificity of scales should be equivalent to the specificity of the domain under study.
Avoid potential contamination effects between curiosity self-report scales and processes and outcomes of interest.	Several curiosity scales are problematic in that items tap domains such as feelings of competency, autonomy, and meaningfulness. Using these scales would contaminate examinations of these same constructs as potential mechanisms of action or outcomes.

Further Suggestions for Cultivating Curiosity in the Health Domain Clinicians should be creative in using curiosity-enhancing techniques to improve health conditions. Cultivating curiosity-related behaviors may offer adjunctive benefits for patients being treated for degenerative diseases. Patients with Alzheimer's disease have been shown to exhibit a number of cognitive deficits including abilities to process information and consolidate experiences into memories. Specific attentional deficits include difficulties in sustaining attention to external stimulation, tuning out distractions, redirecting resources to novel stimuli, recognition memory of novel stimuli, and visual processing speed (e.g., Rizzo, Anderson, Dawson, Myers, & Ball, 2000). These information-processing difficulties can be expected to interfere with

(1) the active pursuit of novel and challenging opportunities and (2) savoring of pleasurable experiences. These hedonic strategies are contingent on curiosity and exploration of the environment and the self. An experimental study found that early-stage Alzheimer's patients exposed to visual images with intense emotional properties had little difficulty sustaining and redirecting attention to different sections of these pictures compared to their behavior when exposed to less intense images (LaBar, Mesulam, Gitelman, & Weintraub, 2000). Cognitive tasks using visual and audio stimuli with variations in collative properties may serve a restorative function for patients suffering from degenerative diseases by having them practice and improve information-processing skills. One limitation of the LaBar et al. study is that it presented only neutral and negatively valenced images. We believe there is greater benefit in using positively valenced images because the induction of task-positive affect may be more important to the broadening of cognitive processing and building of cognitive resources (Fredrickson, 1998). With computer technology, images can be more fluid and challenging than the two-dimensional pictures used in the experiment. For all clinical innovations, activity-related strategies (see Table 30.1) should be embedded in a framework matching challenges to skills and gently escalating challenges as skills improve.

Curiosity Interventions in Organizations: Work, School, and Sports

There are clear distinctions in the purpose, expectations, and relationships between authority figures and participants in occupational, academic, and athletic domains compared to the health domain. Yet we surmise that the intervention and assessment strategies in Tables 30.1 and 30.2 are equally applicable in organizations. To minimize redundancies for intervention suggestions, we examine findings to support specific techniques that cut across domains as well as domain-specific techniques. Only a few existing interventions have directly promoted positive outcomes such as self-esteem and teamwork with curiosity-related behaviors as a secondary focus, if at all. For these reasons, many of our suggestions have been extrapolated from laboratory and field studies.

Cultivating Self-Determination Support in Leaders

Promotion efforts have focused on training organizational managers (Deci, Connell, & Ryan, 1989), athletic coaches of adolescent ballplayers (Smoll et al., 1993), and student mentors of peer-led teaching groups that supplement faculty lectures (e.g., Tien, Roth, & Kampmeier, 2002). Program components include recognizing and validating the emotions and needs of others, providing information and opportunities for self-initiated choices, engaging in participative decision making, providing genuine encouragement and positive feedback, and avoiding controlling tactics such as threats, punishment, and pressure. These leadership interventions clearly address the three hallmark dimensions of SDT in leadership styles (see Social Environment section of Table 30.1).

Managers, coaches, and peer-teachers exhibited definitive improvements in their promotion of self-determination over the course of training. The transfer from self-determination supportive leaders to self-determined learners to better performance has been found for athletic coaches (Smoll et al., 1993) and peer-led teaching groups (e.g., Tien et al., 2002); without intervention, similar prospective

trends were found for professors (Black & Deci, 2000; Williams & Deci, 1996). Leadership changes among athletic coaches (Smoll et al., 1993) influenced child athletes who rated coaches as more reinforcing and encouraging and less controlling compared to the control group. Children in the intervention also reported greater enjoyment, liking, and knowledge of baseball, and feelings of closeness to their coaches and fellow teammates. Children's global self-esteem increased substantially from preseason to postseason in the intervention whereas there were no changes for controls. Well-replicated findings were also found for peer-led intervention groups with students exhibiting greater curiosity and enjoyment in academic material and better grades than comparison classes without peer-led workshops (e.g., Tien et al., 2002). For work managers, the positive influence of intervention-based leadership changes on workers was less conclusive (Deci et al., 1989). Only 1 of 16 variables reflecting workers' attitudes and feelings about their jobs (satisfaction with potential for advancement) changed as a function of the managerial intervention compared to a control group.

GENERAL STRATEGIES TO IMPROVE INTERVENTIONS

Like MI, the peer-led teaching intervention targeted both the social environment and the activities during the workshop. Matching the activity strategies in Table 30.1, the workshop materials were designed to be challenging, personally meaningful and applicable to the overall course, and suitable for group activities. In contrast, the interventions focusing on athletic coaches and work managers targeted the social environment with no formal emphasis on activities. A failure to target work activities could explain the null relationships between the intervention and worker perceptions; as for performance, it was either not assessed or not reported. Prospective studies have shown that the perceived collative properties of occupational tasks predict worker creativity, performance, and satisfaction (Oldham & Cummings, 1996; Wall & Clegg, 1981). We presume that attention to matches between worker skills and occupational challenges and the creation of tasks that are complex, novel, and personally meaningful will strengthen the impact of leadership changes on the curiosity, performance, and satisfaction of workers. The actual activities at work presumably occupy more time in a workday than interactions with managers, thus having a greater impact on work outcomes. There is reason to believe that there will be a reciprocal relationship with greater curiosity and enjoyment in work activities having a contagion effect on relationships with other workers and managers (cf. Kashdan, Fincham, & Rose, 2003). Future interventions targeting the social environment should examine the additive benefits of targeting activities compared to the social environment with the strategies in Table 30.1. This could lead to further work on dismantling the primary targets and strategies that account for leadership, worker, and work climate changes.

As mentioned with MI, the training of leaders and educators should be conducted in a self-determination supportive style. Support for a trickle-down effect stems from studies showing that medical students who perceived their training to be more supportive of their self-determination experienced greater curiosity and competency during their training, and, in the long term, were more supportive of the self-determination of their own patients (Williams & Deci, 1996). Patients under the care of doctors who were more supportive experienced more

desirable health outcomes. The promotion of self-determination and curiosity-related positive outcomes stemming from leadership interventions and radiating downward should be replicated in various organizational domains.

Fostering Meaningfulness in Activities and the Process of Internalization

All human beings have to engage in activities that are incompatible with their personal values and interests. Students are required to complete classes in math, science, literature, social studies, and physical education irrespective of personal interest; workers in rewarding professional careers may abhor administrative responsibilities. The self-regulatory process of internalization can transform activities that are not self-determined into curiosity-inducing activities (Deci & Ryan, 2000).

Internalizing extrinsic sources of meaning (e.g., parental hopes to be more honest, academic value of reading books, athletic value of practice games), in turn, initiates a trajectory from initial to enduring curiosity. Psychological components of internalized activities include feelings of enjoyment and challenge, autonomy, and competence, thus reinforcing greater participation and persistence in the future. Stronger tendencies to integrate goals of psychology classes (learning and applying information presented) into the sense of self have been shown to predict greater enrollment in subsequent psychology classes, better performance, and greater exploration of psychology-related material and opportunities (Harackiewicz, Barron, Tauer, & Elliot, 2002). As an upward spiral of interactive influences, final grades in initial psychology courses moderated the relationship between initial and future curiosity such that students with higher final grades in introductory psychology were more likely to get further involved in the field of psychology than peers with lower grades. Thus, competency beliefs and task curiosity had cyclical effects on enduring curiosity behaviors. To clarify causal relations, prospective investigations are needed that investigate time-lagged associations; for example, the effects of task curiosity during a workday on perceptions of autonomy, competence, and relatedness reported the following workday (as well as the reverse causal pathway of supported needs on subsequent curiosity). The theoretical attention afforded to the self-regulatory process of internalization has far outpaced data. Pending further psychometric attention and assessment, we can only speculate on its importance and how it can be used to enhance positive outcomes.

Increasing the perceived meaningfulness of an activity presumably increases the likelihood of internalization and task curiosity. For students, whenever possible, the real-world applications and personal value of subject matter should be made readily apparent. In classes on mathematics or statistics, teachers can be autonomy-supportive and ask students to vote on themes for upcoming lectures such as supermarket shopping or a record company executive making decisions about new musicians. Using the students' self-selected theme, different analytic techniques can be taught in a real-world context—broach addition, subtraction, multiplication, and division by having students compute the cost of a concert tour of a famous musical artist. In classes such as science or social studies, hands-on activities such as experiments, field trips, reenactments of historical events, and using multimedia technology can bring meaning to potentially mundane activities. There is abundant evidence that academic lectures and reading materials

manipulated to be more interesting, challenging, or meaningful induce greater curiosity and learning (see Silvia, in press, for review). These intervention suggestions are made in the knowledge that there is no research on the effects of teachers trained to make classes more meaningful on students' initial and enduring curiosity and the acquisition of enduring competencies.

There is reason to believe that strategies to enhance meaningfulness can be effective in academic and work settings. Although work environments cannot be transformed as easily as classroom settings, workers can be provided with greater information, skills, and participation in the organization. Research has shown that workers provided with exposure to and input in organizational changes report greater openness to changes (i.e., task curiosity) and job satisfaction (Axtell et al., 2002; Wanberg & Banas, 2000). Although MI has focused on clinical problems and health promotion, it can be a useful intervention for exploring, supporting, and validating the emotions, cognitions, and personal discrepancies experienced by employees who may be experiencing initial discomfort during organizational changes that will affect their routine behaviors and responsibilities. There is merit in applying MI to this unexplored terrain, as the strategies of MI counselors are elucidated in published resources (tapping nearly all of Table 30.1).

FOSTERING POSITIVE SOCIALIZATION EXPERIENCES

There is a natural, innocent curiosity when students, workers, and athletes enter new environments where they are exposed to unfamiliar people, rules, and language. However, when individuals enter a new job position, attend the first academic lecture of a class, or begin the first athletic practice of the season, the experience may also be fraught with anxiety. During initial engagement, there is a need to acquire knowledge about activity-related technical skills, responsibilities, autonomy, and the needs and values of authority figures and peers on the same team. Failing to obtain these sorts of information has been shown to increase feelings of ambiguity and anxiety that interfere with job performance and satisfaction (Wanberg & Kammeyer-Mueller, 2000). Surprisingly, socialization experiences have been studied only in the occupational domain and have yet to be the target of intervention. Encouraging positive socialization experiences is presumed to be a useful intervention tool in nearly all organizational domains. Organizations should capitalize on new employees' socialization to increase feelings of personal meaningfulness, which includes providing information about how a worker's job is integral to organizational products, the career trajectories their job can lead to, and the different methods in which their job can be performed. Authority figures can express interest in individuals and assist them in gathering relevant information, helping them make sense of this information, and facilitating social bonds with current organizational members. As shown in Table 30.1, these strategies should activate the psychological needs that induce and sustain heightened curiosity in organizational activity.

ASSESSMENT ISSUES

The potential of organizational techniques for enhancing curiosity has not been adequately examined. Table 30.2, therefore, summarizes rationales and strategies for evaluating the success of curiosity-based interventions in organizations.

Many of these rationales are based on discussions in the first half of this chapter (e.g., section on domain specificity of curiosity).

The design and implementation of curiosity interventions should be conducted within a transactional framework. With relevance to the generation of interventions, the issue of Person (reliable individual difference variables) × Situation interactions on task curiosity deserves much more attention. Achievement orientation has been found to moderate task curiosity such that low achievement-oriented individuals exhibit enhanced curiosity when focusing on their skill development (mastery goals), whereas high achievement-oriented individuals exhibit enhanced curiosity when focusing on their ability (performance goals; e.g., Elliot & Harackiewicz, 1994; Harackiewicz & Elliot, 1993). Each achievement-oriented group had their curiosity undermined in the opposing condition. High achievement-oriented people find activities to be challenging and enjoyable when skills and performance outcomes were made prominent. In contrast, low achievement-oriented individuals react negatively to performance-focused activities and prefer mastery-focused activities that offer a safe environment to challenge their competencies (with less concern about failure).

In other examples of person and situation interactions, (1) when more sociable individuals engaged in problem-solving tasks with others, as opposed to alone, they reported greater short-term and enduring curiosity (Issac, Sansone, & Smith, 1999); and (2) when beginning a new job, individuals with greater trait curiosity were more proactive in seeking new information about their task-related responsibilities, the organization, and performance feedback than low trait curious peers (cf. Wanberg & Kammeyer-Mueller, 2000). By definition, high trait curious individuals experience greater enjoyment in actively exploring and confronting new challenges (Kashdan, in press-a; Kashdan et al., in press). In terms of interventions, these data imply that individual difference variables should be considered in assessment, and attention should be given to the possible need for matching participants to different intervention conditions (i.e., optimize person-environment fits; see Table 30.2, row 2). For example, the mastery-focus strategies in Table 30.1 may be vital to individuals high in achievement motivation and undermine the curiosity of those low in achievement motivation. There appears to be differential value in activating relatedness beliefs based on individuals' interpersonal orientations and promoting internalization and socialization experiences based on individuals' trait curiosity level.

Within this transactional framework, interventions need to move beyond task curiosity to additionally include enduring curiosity as an outcome. We propose that the prediction of subsequent engagement in an activity is the result of reciprocal influences between task curiosity and competency-related, autonomy and relatedness beliefs. For example, task curiosity facilitates greater attention; greater attention leads to greater learning and the development of new skills; the activation of new skills results in increased pleasure and feelings of mastery; and these positive subjective experiences reinforce the pursuit of related future experiences. The majority of research efforts have focused on unidirectional pathways from competency-related (and autonomy and relatedness) beliefs to curiosity. The dynamic interplay of these psychological needs and curiosity offers a more realistic framework for accurately targeting and sustaining change in curiosity interventions. Assessment and analytic approaches to intervention need to mirror the complexity and variability of curiosity and its enabling factors.

CONCLUSION

Most of our strategies, techniques, and suggestions for intervention derive from basic research. A great deal of room remains for innovative experimental curiosity research before turning to intervention. The first half of the chapter discussed in some detail the construct of curiosity and related constructs and offered a framework for understanding factors that might facilitate curiosity. We then offered a number of directions for future research that might increase understanding and promotion of curiosity. Central to developing successful curiosity interventions is the enhancement of task curiosity and the concomitants and consequences of curiosity, such as positive affect, feelings of self-determination, performance enhancement, and the acquisition of skill and knowledge. These changes are likely to reflect relatively rapid responses to interventions. Much slower to respond to intervention and more difficult to define is the impact of enduring curiosity on living a more satisfying and meaningful life. The overarching premise of any curiosity intervention is that changes in curiosity have salutary effects on daily and overall life satisfaction and meaning. This is a missing ingredient of existing interventions that we hope will be included in future scientific pursuits.

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