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Bridging the Gap Between Extrinsic and Intrinsic Motivation in the Cognitive Remediation of Schizophrenia

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An important development in cognitive remediation of schizophrenia is a focus on motivation. However, following a distinction between the concepts of intrinsic motivation (IM) and extrinsic motivation, discussions of IM-based methods have downplayed or misrepresented the role that extrinsic rewards can, and actually do, serve to promote positive treatment outcomes in cognitive remediation. Therefore, the purpose of this article is to explore the rationale for using techniques incorporating extrinsic rewards into cognitive treatment of people with schizophrenia. To do this, evidence is presented on each of the following points: (1) there is a long history of research demonstrating that delivery of extrinsic reward is associated with positive outcomes in both behavioral and cognitive rehabilitation; (2) basic human brain systems respond strongly to tangible rewards, and this can directly enhance attention, working memory, and other cognitive functions; (3) nearly all data on the negative effects of extrinsic reward on IM have come from studies of healthy children and adults in school or work settings who have adequate IM for target tasks; these findings do not generalize well to cognitive remediation settings for people with schizophrenia, who often have abnormally low levels of IM and low base rates of attentive behaviors; and (4) in real-world situations, cognitive remediation interventions already utilize a combination of intrinsic and extrinsic reinforcers. Future studies are needed to clarify state and trait factors responsible for individual differences in the extent to which extrinsic rewards are necessary to set the conditions under which IM can develop.

Key words: cognition/rehabilitation/treatment/reinforcement/reward

Introduction

In recent years, there has been an increased focus on the role of motivation in cognitive remediation. This is a welcome change as it represents a movement toward a person-centered, recovery-oriented approach that values the goals and quality of the experience of the person engaging in treatment. It also recognizes the long-established findings that (1) cognitive change is not simply a function of the extent of practice but reflects how information is mentally represented[1] and (2) motivation, affect, and cognition are related, and the most effective mental representations and highest performance levels will be created within a context that includes positive affect and personal meaning (see below). There has been debate, however, regarding how motivation should be addressed in efforts to enhance cognitive functioning in schizophrenia.

Traditionally, motivation to engage in tasks has been characterized dichotomously as either intrinsic or extrinsic. Intrinsic motivation (IM) is typically viewed as the more desirable of the 2, representing a desire to engage in a task because it is inherently interesting, enjoyable, and/or meaningful to the person. In contrast, extrinsic motivation (EM) is often discussed solely as desire to engage in a task only to obtain an external reward such as food or money or to avoid punishment. Indeed, EM is often depicted as an undesirable characteristic of behavior change techniques, with EM-based methods being viewed as mechanistic, controlling and punishing, and providing no lasting or internal benefit to the person.[2] Moreover, after an influential series of studies by Deci[3] and Deci et al[4] a prominent position in the literature on normal motivation, as applied to work or learning environments, has been that use of tangible rewards undermines IM and performance. For example, Deci et al[4] (p. 698) concluded that "engagement-contingent and completion-contingent rewards have a substantial and reliable undermining effect on intrinsic motivation." Following this position, the use of extrinsic rewards has been argued against in vocational settings.[5] Similarly, regarding cognitive rehabilitation of schizophrenia, Medalia and Choi[6] (p. 358) noted that "extrinsic motivators, on

the other hand, can decrease the amount of learning that takes place, and educators are thus advised to use them judiciously,'' and '' … social contexts that minimize the salience of external incentives … are more likely to enhance intrinsic motivation, test performance, amount of learning, and sense of well being.'' However, despite evidence that, under certain conditions, use of tangible rewards can indeed undermine IM and performance, debate continues about the generalizability of the undermining effect. For example, it has been argued that intrinsic and extrinsic rewards can have additive effects,[7–9] and it has been noted that undermining effects of extrinsic rewards on IM are stronger in children than in college students,[10] questioning the validity of the inferential leap to mentally ill adults. In addition, in an influential meta-analysis arguing for the undermining role of extrinsic rewards on IM,[4] most of the included studies used designs in which IM for the target behavior was high at baseline and behavior and IM were measured after extrinsic rewards had been withdrawn.[11] As a result, that review has limited generalizability to populations that have low motivation for, and low base rates of, target behaviors. Therefore, the purpose of this article is to bring the debate about extrinsic reward into the field of cognitive rehabilitation of schizophrenia and to demonstrate that in many relevant situations use of extrinsic rewards can lead to enhanced treatment effects.

Statements such as those above regarding the negative effects of extrinsic rewards neglect realities of the ways that they can be used, the range of psychological and biological processes that are associated with their use, and outcomes associated with these methods. For example, extrinsic rewards are typically used in highly supportive interpersonal environments[12] to increase competence and autonomy,[13] and their use can be an integral component of self-managed behavioral change[2] and cognitive enhancement techniques based on self-identified goals.[14] Also, as noted by Ryan and Deci,[15] (p. 55) self-determination theory (SDT) ''proposes that there are varied types of extrinsic motivation, some of which do, indeed, represent impoverished forms of motivation and some of which represent active, agentic states.'' They also noted that EM can be associated with self-endorsed goals that are performed with a sense of volition. EM also has strong effects on brain function and behavior via the interaction of the subcortical reward processing system and frontal circuits involved in attention and working memory.[16,17] The typical polarizing distinction between IM and EM is also unfortunate because it neglects a long and extensive literature on positive outcomes associated with use of extrinsic reward, in terms of work behaviors,[18] creativity,[19] learning,[20] and treatment response.[12,21] Moreover, an important consideration is that while much research demonstrates the important role of IM in student learning and employee performance,[4] almost none of this research has been done with severely disabled psychiatric patients who are characterized by significant motivational and cognitive deficits and whose base rate of spontaneously engaging in therapeutic behavior is very low. For this population, most of the existing data suggest that both IM and EM are required to maximize treatment engagement and benefit. It should be noted that Medalia et al[22,23] demonstrated that cognitive rehabilitation grounded strongly in an IM model was effective with long-stay state hospital patients. However, unlike in studies of methods incorporating tangible external rewards (eg, Silverstein et al[12,24,25]), patients were not chosen specifically and primarily on the basis of their severe attention deficits and prior treatment failures in group-based interventions. Therefore, future studies are needed to clarify the effects of IM- and EM-based interventions on equally impaired groups of patients. At this point, however, it is reasonable to conclude from available evidence that a combination of IM- and EM-based procedures will likely have the greatest impact. One reason for this is consistently strong data on positive effects of cognitive enhancement in animals and schizophrenia patients using a combination of engaging computerized tasks and extrinsic reward[26,27] and evidence that extent of resulting neuroplasticity is dependent on the cognitive association between stimulus and reward.[26] Finally, studies indicate that use of extrinsic rewards did not show negative relationships with IM, locus of control, or job satisfaction[11]; that in contrast to laboratory studies, applied studies have found nonsignificant or positive correlations between use of extrinsic rewards and IM[20]; and that IM mediated a positive relationship between performance-based extrinsic reinforcement and creativity.[19] It has also been argued that rewards can increase self-determination.[28] Given all these considerations, it is timely to reexamine the ways in which extrinsic rewards can be used effectively in cognitive remediation.

An important distinction that must be made at the outset is that between an extrinsic reward and EM. The former refers to a tangible reward, delivered in response to performance of a target behavior, whereas the latter may refer either to (*a*) the presumed internal state associated with behavior in expectation of the delivery of a tangible reward (eg, money, food, tokens, etc) or (*b*) the subjective sense of a person that, to degree *x*, a behavior is being performed solely to gain the extrinsic reward (ie, the locus of control is shifted to an external agent). A point repeated in the discussion below is that in the case where (a) is present during treatment with motivationally impaired schizophrenia patients, IM is not necessarily diminished and may, under many predictable conditions, be increased, along with cognitive functioning and task performance. In contrast, only in cases where use of extrinsic reinforcers causes (b), and where *x* approaches 100%, is treatment benefit unlikely to occur, and such contexts can be easily avoided.

As noted above, the purpose of this article is to explore the rationale for using extrinsic reinforcement–based techniques in cognitive remediation of people with schizophrenia and to demonstrate how these and IM-based techniques can complement each other. To do this, the following points will be elaborated upon further below: (1) despite statements that use of extrinsic reward is undesirable, there is a long history of research demonstrating that its use is associated with positive outcomes related to both behavioral and cognitive rehabilitation from early demonstrations of the positive effects of the token economy up through the present day; (2) this is due to basic human brain systems that normally respond strongly to rewarding stimuli and overlap with systems subserving attention, working memory, and other cognitive functions; (3) there are multiple problems applying findings from research on IM in healthy populations to treatments for people with schizophrenia, including large differences in preexisting base rates of target behaviors and levels of IM; and (4) it can be demonstrated that cognitive remediation interventions already utilize a combination of intrinsic and extrinsic reinforcers, and so the division between IM and EM in terms of a basis for cognitive remediation is more apparent than real. Nevertheless, a focus on reinforcers is important, especially as this can help us identify those stimuli that meet basic human needs and set conditions under which humans learn most effectively.

EM Can Be Effective With People With SMI

There is a long history demonstrating that extrinsic reward can promote behavior and cognitive change in people with SMI. For example, extrinsic reward has been used to help "treatment-refractory" patients reduce inappropriate behaviors, increase appropriate behaviors, and improve cognitive and instrumental functioning.[13,29–32] Reward has also been used to improve performance on a range of cognitive measures of attention and executive functioning.(reviewed in Silverstein et al[21]) Recently, attention shaping procedures (ASPs), which use extrinsic reward to gradually increase attentiveness in skills training groups among highly distractible schizophrenia patients, have been shown to improve both attentiveness and learning of information.[12,25] For example, in the former study, which took place at 3 sites, the effect sizes associated with improved attention and learning were d = 1.51 and 0.72, respectively. Taken together, this literature provides a strong rationale for the use of EM-based procedures to augment cognition (including learning) in people with schizophrenia.

Humans Are Biologically "Wired" to Respond to External Reinforcers

Although much social psychological research on IM indicates that use of extrinsic rewards can undermine IM and reduce performance in school or job settings, this should not be taken to mean that use of extrinsic reward is ineffective in general. Rather, it demonstrates only that there are specific conditions under which it is not useful. These situations typically are those in which people without motivational deficits already have a high base rate of engaging in the target behavior and are already highly intrinsically motivated to do so. However, there are many situations in which use of extrinsic rewards is useful. In addition to the research noted above from studies of people with schizophrenia demonstrating their positive effects, it is clear that many behaviors in everyday life (eg, going to work, attending certain social functions, etc) are driven by a combination of both IM and EM and in some cases nearly exclusively by EM. Given the ubiquity of EM as a characteristic of human life, it would be expected that the human brain has evolved to respond strongly to extrinsic rewards and to link reward processing with enhanced cognitive functioning and behavioral performance. Over the past 10 years, cognitive neuroscience research has begun to support this hypothesis by demonstrating that anticipation of reward and/or receipt of reward for correct performance affects brain activity in regions involved in cognitive functioning. For example, dorsolateral prefrontal cortex and ventral striatum activity was greater during performance of an n-back (working memory) task for reward vs no-reward trials.[33–35] Moreover, increased parietal activation (reflecting spatial allocation of attention) was observed in a spatial cueing task only on rewarded trials.[36] Most recently, sustained activation of the attentional network (frontal and posterior areas) was observed during blocks of rewarded trials during working memory[16] and attentional[17] tasks. These results support the conclusion of Park et al[37] that extrinsic reward, including positive, task-contingent, social interaction, is effective because it leads to subcortical activation of frontal attentional networks during task performance. This conclusion supports data from other functional magnetic resonance imaging (fMRI) studies indicating that the ventral striatum encodes information related to anticipation and timing of rewards and that the orbitofrontal cortex facilitates attentiveness to motivationally relevant stimuli and is sensitive to changes in reward values.[38] A similar view comes from neurophysiology research indicating that the subcortical mesolimbic dopamine system is involved in reward and motivational functions,[39] whereas the mesocortical system plays a role in attention and other aspects of cognition.[40] An impairment in functional connectivity between the prefrontal cortex and the mesolimbic dopamine system has been proposed to account for the inadequate processing of the value of potential reinforcers in people with schizophrenia.[41] Therefore, use of extrinsic rewards, which increase the salience of the link between behavior and reward, may be effective secondary to normalization of dopaminergic tone and increased connectivity between

regions supporting reward processing and those supporting attention and memory.

Taken together, these data indicate that the human brain is highly sensitive to the anticipation and receipt of external rewards and that rewards can increase brain activity in regions that subserve cognitive functioning. These phenomena are likely to account for the effectiveness of the EM-based therapeutic interventions that were described above. It should be noted here that IM is also associated with changes in brain function[42]; however, to date, little work has been done in this area. The point of the above discussion is not to deny the possibility of such IM-related changes but rather to highlight that linking extrinsic reward to performance has predictable and positive effects when used with chronic schizophrenia patients and that these effects can be harnessed to a greater extent than is now done in terms of cognitive and psychiatric rehabilitation. This is especially important in cases where clinician-desired behaviors are occurring at a low base rate.

Problems Applying Research on IM to People With Severe Cognitive and/or Motivational Disturbance

The Problem of Low Base Rate Behavior

A problem with conceptualizing cognitive remediation for people with schizophrenia primarily in terms of IM is that it ignores the problem of the low base rate of spontaneous task engagement in many people with this diagnosis. While much literature on IM notes that the presence of extrinsic rewards can undermine IM and reduce task engagement and performance, this research was conducted nearly exclusively with healthy populations (eg, students, employees) who were presumed not to have illness-related and clinically significant motivational deficits.[4] Moreover, much research demonstrating negative effects of EM took place in artificial laboratory situations used tangible rewards such as money (as opposed to nontangible rewards like praise) and delivered rewards regardless of level of performance.[20,28,43] Under these conditions, extrinsic rewards can undermine IM and performance. However, when the base rate of a desired behavior is low, and IM is low, use of extrinsic reward can be effective in increasing the rate of the behavior, and ultimately of IM, especially when nontangible rewards (eg, verbal praise, social reinforcement) are used and when reward is contingent on an individualized performance level.[20,44]

The Problem of Low Baseline IM

As Ryan and Deci[15] noted, IM will only occur for activities that hold intrinsic interest for a person. They also noted that for activities that are not intrinsically interesting, principles of cognitive evaluation theory (CET), a subtheory of SDT, do not apply. For people with schizophrenia with motivational impairments, it can be assumed that the criterion of intrinsic interest is often not met; due to reduced processing of motivational significance, many tasks will be experienced as not intrinsically motivating. This impairment is evident at both the behavioral and physiological levels. For example, a recent review of behavioral data indicated impaired reward processing in schizophrenia.[45] A recent fMRI study indicated that schizophrenia patients demonstrated reduced activation compared with controls in both cortical and subcortical areas under conditions when a primary reinforcer was likely to be delivered.[46] This suggests that stronger than normal environmental cues are required for people with schizophrenia in order to help them process motivational significance and engage in desired behavior. In such situations, EM-based interventions have demonstrated effectiveness, as noted above.

Clinical data highlight the importance of low baseline IM when attempting cognitive remediation for people with schizophrenia. For example, Choi et al[47] reported that patients with high baseline reports of IM were 5 times more likely to attend cognitive remediation sessions on a frequent basis, 2 times more likely to learn more from math exercises during treatment, and 3 times more likely to demonstrate more resource allocation on a vigilance task. This study also documented a predictive relationship between baseline level of self-competence and post-treatment cognitive skill. While Choi et al[47] emphasized the important role of IM in mediating positive cognitive remediation outcomes, these findings also beg the question of how to improve engagement and performance of people with low IM and low self-competence at baseline. It is in such situations that the use of EM-based procedures—to increase engagement and to allow for the experience of success—such as shaping procedures accompanied by tangible and nontangible rewards can be useful.[12,13,29–31] This conclusion is supported by findings of intact primary reinforcer effects in schizophrenia. For example, the high rates of substance, including nicotine, abuse in schizophrenia suggest that motivation to pursue primary reinforcers is intact. As noted by Heerey and Gold,[48] for many patients, such reinforcers may have relatively increased salience, given the relative failure of mental representations (the basis of appetitive pleasure) of weaker reinforcers to guide behavior. Based on this consideration, the authors concluded that interventions that rely on the physical delivery of rewards can be expected to be more motivating than those that rely on delayed rewards. This conclusion is supported by the many examples of the effectiveness of behavioral procedures (ie, those that link behavior change to delivery of primary reinforcers or secondary reinforcers that can be redeemed quickly for primary reinforcers) for improving instrumental and cognitive functioning in even "treatment-refractory" patients with schizophrenia.[13,29–31] Taken together, these findings suggest that a data-driven

combination of EM and IM could be most useful in many situations faced by clinicians delivering cognitive remediation.

The Problem of Symptom Severity

It should also be noted that most studies demonstrating the importance of IM for cognitive rehabilitation outcomes for schizophrenia patients have involved treatment of relatively asymptomatic patients (important exceptions are the 2 studies by Medalia et al[22,23] noted above). For example, in Choi et al,[47] the outpatients studied had mean Brief Psychiatric Rating Scale item scores that were 2–3 (normal–mild). This is in contrast to studies involving EM (eg, Silverstein et al,[12,13,24,25] Glynn and Mueser,[29] Corrigan and Liberman,[30] and Paul and Lentz[31]) that typically include only highly symptomatic patients. More research is needed on the extent to which IM for cognitive remediation exists or can be generated in patients with prominent positive, negative, and/or disorganized symptoms.

Another illness feature associated with poor motivation is cognitive impairment. Due to working memory impairments, representations of affective stimuli may decay more rapidly in schizophrenia and as a result be less able to activate motivational systems.[48] This supports the hypothesis that deficits in cognition worsen deficits in motivation, rather than the reverse.[48,49] This is a rationale for why patients with severe cognitive impairment need stronger cues to compensate for attentional impairment and to motivate behavior.

Finally, it is also worth considering that amotivation may not reflect an absence of motivation but rather a redirecting of attention toward internal preoccupations and projects.[50] To the extent this is the case with a given individual, environmental manipulation and extrinsic reward may help redirect people to experience the intrinsically motivating properties of specific tasks. This is consistent with the finding that people with schizophrenia can experience pleasure to the same extent as others during engagement in the enjoyable activity (ie, intact consummatory pleasure) and that what appears to be anhedonia is really a reduced ability to anticipate the experience of pleasure in a future activity (ie, reduced appetitive pleasure).[51]

Problems Using Theory to Characterize What Happens in Practice

While EM is often discussed as having an undermining effect on IM, in clinical practice, they can coexist and have additive effects. Moreover, a closer look at existing treatments indicates that even interventions that have traditionally been characterized as involving mainly one or the other type of motivation actually share much in common. A comparison between ASPs (typically viewed as being effective due to EM)[12,52] and the Neuropsychological Educational Approach to Rehabilitation (NEAR) (typically viewed as being effective due to IM)[22] bears this out. Both ASPs and NEAR occur in group settings in which there is a high degree of social interaction and task-specific verbal praise, as well as peer support. Proponents of both ASP and NEAR have noted that these conditions are important for effectiveness. However, whereas NEAR practitioners typically focus on how such conditions promote IM, ASP practitioners typically focus on the same conditions as examples of EM. While it might be possible to view the case of ASP as involving EM with an integration of clinician-defined goals into the patient's self-concept (ie, an example of the most self-determined form of EM as postulated by Ryan and Deci[15] and Deci and Ryan[53]) and the case of NEAR as involving true IM, this risks labeling the type of motivation based on the extent of tangible reinforcers present, rather than on the experience of the person engaged in the activity. Indeed, as an anonymous reviewer of an earlier version of this article noted, reinforcers can be viewed as neither inherently intrinsic nor extrinsic bur rather as environmental contextual events that can serve to promote or inhibit IM or EM, depending on the degree to which perceived locus of control is shifted toward the self or toward an external agent. What appears to be of greatest clinical relevance is the recognition that, just as IM can fulfill basic needs (eg, for self-determination), performance-linked extrinsic reward can fulfill basic needs (eg, for social recognition and reward), and therefore, multiple forms of reward, from intangible (eg, clinician- and peer-delivered verbal and nonverbal positive reinforcement) to tangible (ie, performance-linked tokens), can form core aspects of a positive therapeutic and learning environment. This view is consistent with Basic Psychological Need (BPN) Theory, another subtheory of SDT, which states that the impact of an activity on well-being is a function of the person's experience of the satisfaction of needs for autonomy, competence, and relatedness.[54] According to BPN, activities that afford experiences of volition, effectiveness, and social connection should yield enhancements in well-being. Clearly, this can occur in activities using ASPs (eg, role-playing with positive feedback, successful completion of a real-world task for homework) or NEAR (eg, computer exercises).

The work of Medalia, Choi, and others[15] has been influenced by CET, which is another subtheory of SDT. CET postulates that IM, and performance, will be best when task conditions are responsive to innate needs for competence, autonomy, and relatedness. Moreover, competence needs to be accompanied by a sense of autonomy or internal locus for task engagement (ie, self-determination) for IM to be high. Discussions of CET also note, however, that feelings of competence can be engendered via rewards, communication, and feedback, raising the issue of the extent to which extrinsic rewards

can affect competence and even do so in a way that promotes feelings of self-determination.

A problem with conceptualizing cognitive remediation primarily in terms of SDT is that it assumes a normal ability to experience competence and autonomy and a normal desire for relatedness in people with SMI. This cannot be assumed in every case. For example, Danion et al[55] demonstrated that schizophrenia is characterized by a reduced binding of self-representation with action representations during ongoing behavior. Relatedly, Danion et al[56] demonstrated that schizophrenia patients were impaired in their ability to subjectively assess the correctness of their knowledge and that their behavior was less determined by their subjective experience of response correctness than normal subjects. The implications of these findings are that conditions that are assumed to promote positive internal states and lead to IM-driven behavior change may not have the same effects for many people with schizophrenia. Interestingly, patients in the latter study demonstrated intact sensitivity to incentives, suggesting that this preserved ability can be the basis for effective EM-based interventions even in patients with abnormal processing of their own knowledge and experience.

Ryan and Deci[15] noted that EM can vary greatly in the extent to which it is self-determined. At one extreme, behaviors can be engaged in solely to gain external rewards or to avoid punishment. At the other extreme, a person can consciously value an activity, can self-endorse its goals, and can view them as congruent with overall sense of self. Examples of the latter include taking vitamin supplements daily or going for mammogram or prostate cancer screening examinations. However, Ryan and Deci[15] still distinguish the latter from IM in the sense that there may be little inherent enjoyment and satisfaction when these forms of EM are operative. They claim that "behavior motivated by integrated regulation is done for its presumed instrumental value with respect to some outcome that is separate from the behavior, even though it is volitional and valued by the self"[15] (p. 62). However, as noted above, in many real-world, effective, treatment conditions for people with schizophrenia with motivational impairments, when extrinsic reward is used to increase the base rate of behaviors that are simultaneously associated with IM, this theoretical distinction loses relevance. Ryan and Deci[15] do note that it is possible that a person can begin to engage in a behavior due to EM, and once the behavior's intrinsically interesting properties are experienced, there may be an orientation shift, and the behavior may be maintained by IM. However, this does not appear to characterize what happens in clinical practice when working with people with low levels of motivation and low base rates of behavior. In such situations, both EM and IM can be operative at the same time in the same situations and even in response to the same stimuli (eg, getting money, receiving praise and a smile with performance feedback, and experiencing increased self-competence during an intervention). In short, the incompatibility between EM and IM, and the validity of movement between stages characterized by one type of EM and IM, is most relevant for people with normal IM, where extrinsic rewards can, under certain situations, cause cognitive dissonance or a sense of loss of autonomy and thereby undermine performance. However, for people with low IM, performance-based extrinsic rewards can help generate IM, and both EM and IM can be experienced at the same time. This suggestion that there are state-related cases where promoting EM can be helpful is similar to the trait-related findings of a lesser negative effect of reward on IM for people with more extrinsically oriented personalities, compared with people who are more intrinsically oriented.[7]

An example of how EM and IM can be manifest simultaneously is supported employment, where the psychological benefits of work (eg, sense of competence, sense of having a normal and valued social role, and other experiences that are often infrequent in people with schizophrenia) are combined with the benefits of earning money. While it is of course possible to view the desire for a high paying and interesting job among the general population as also an example of combined IM and EM, it is important to note that the relative deprivation of positive experiences related to IM (eg, sense of competence, sense of autonomy) in people with schizophrenia makes the combination of IM and EM especially powerful as a treatment tool and unlikely to undermine IM in people who have not experienced significant functional recovery.

From the perspective of simply examining results, as Deci and Ryan[15] noted, the more autonomous forms of EM have been associated with greater task engagement, better performance, less dropout, more learning, and greater psychological well-being, results which are often assumed to be associated only with IM-based interventions. This is consistent with the conclusions of an earlier meta-analysis of approximately 100 studies of the effects of EM in classroom situations: " … Rewards can be used to maintain or enhance students' intrinsic interest in schoolwork… . When tangible rewards are offered contingent on level of performance… , students remain motivated in the subject area"[57] (p. 40). These conclusions also apply to studies of EM-based interventions for schizophrenia, as noted earlier.

The critical question is when EM is needed due to low base rates of desired behaviors how can internalization of task goals be promoted? Deci and Ryan[15] suggest that this can occur by promoting relatedness and self-competence. Examples of this would include administering tasks within a supportive group context and providing positive feedback on tasks that are set at optimally challenging levels. As noted above, this occurs within both ASPs and NEAR. It is also important that the environment not be controlling or punishing (eg, aversive feedback for performance

errors) and that deadlines, directives, and competition pressure not be used. These warnings are typically discussed in terms of EM,[15] but clearly they apply equally well to situations attempting to foster IM.

Conclusions

Ryan and Deci[15] noted that many of the tasks that educators want their students to perform are not inherently interesting or enjoyable, and therefore, it is important to know how to maximize active and volitional forms of EM. This same situation applies to cognitive remediation of schizophrenia, despite advances in the quality of software and teaching techniques. Of course, the problem is especially relevant for the treatment of people with schizophrenia with severe motivational impairments. However, the data suggest, for this population, that more active and volitional EM can be promoted by increasing (via use of extrinsic rewards) the frequency of behaviors that would normally be associated with IM and that are consistent with valued personal goals (eg, being less forgetful, getting a job, being more effective at work, making friends, etc). To the extent that patients begin to demonstrate behavior that is sustained by IM, use of tangible rewards becomes less necessary.

It may be useful in clinical practice to evaluate IM for cognitive rehabilitation tasks at the outset of treatment to aid in determining the extent to which EM may need to be engendered and extrinsic rewards incorporated into treatment. This has relevance both for individual patients and for treatment programs where typically tight budgets allow for the purchase or use of only a minimal amount of extrinsic rewards. As noted above, the extent to which use of extrinsic rewards can enhance treatment effects is likely related both to state (eg, amotivation) and trait (less IM as a personality trait) factors. However, at this point, the full range of factors that may be involved, as well as the best methods to assess these variables, has not been established.

In short, in the cognitive remediation of schizophrenia, both IM and EM are important. In designing interventions and the context of their delivery, especially for patients with motivational and functional impairments, it is useful to keep the following 2 considerations in mind: (*a*) IM is always good, but it is not always necessary and (*b*) EM is not bad, and it often is necessary.

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