CONTEMPORARY APPROACHES TO RESEARCH IN LEARNING INNOVATIONS

Non-cognitive Skills and Factors in Educational Attainment

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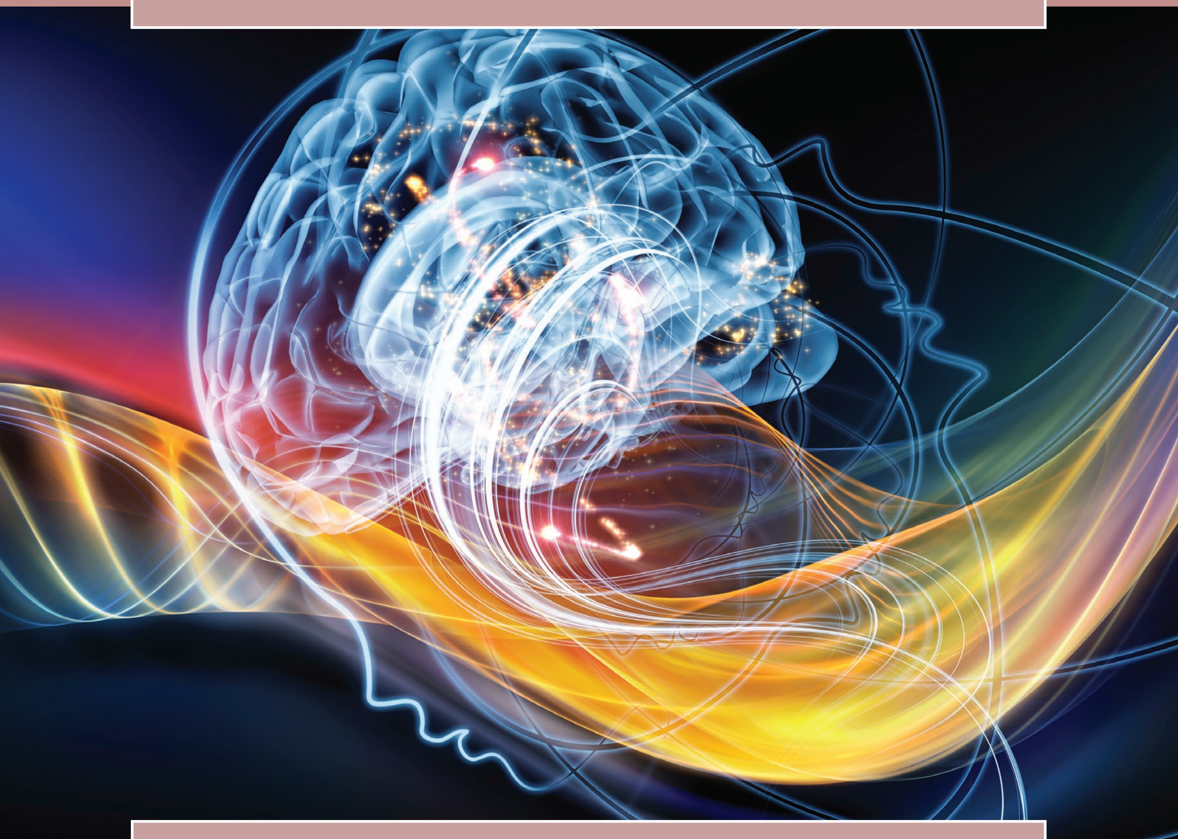

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Rationale

Learning today is no longer confined to schools and classrooms. Modern information and communication technologies make the learning possible anywhere, any time. The emerging and evolving technologies are creating a knowledge era, changing the educational landscape, and facilitating the learning innovations. In recent years educators find ways to cultivate curiosity, nurture creativity and engage the mind of the learners by using innovative approaches.

Contemporary Approaches to Research in Learning Innovations explores approaches to research in learning innovations from the learning sciences view. Learning sciences is an interdisciplinary field that draws on multiple theoretical perspectives and research with the goal of advancing knowledge about how people learn. The field includes cognitive science, educational psychology, anthropology, computer and information science and explore pedagogical, technological, sociological and psychological aspects of human learning. Research in these approaches examines the social, organizational and cultural dynamics of learning environments, construct scientific models of cognitive development, and conduct design-based experiments.

Contemporary Approaches to Research in Learning Innovations covers research in developed and developing countries and scalable projects which will benefit everyday learning and universal education. Recent research includes improving social presence and interaction in collaborative learning, using epistemic games to foster new learning, and pedagogy and praxis of ICT integration in school curricula.

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6. UNDERSTANDING ATTITUDES IN EDUCATION

New Directions for Assessment

UNDERSTANDING ATTITUDES IN EDUCATION: NEW DIRECTIONS FOR ASSESSMENT

For decades researchers have been trying to identify and classify characteristics that contribute to students' academic success. The plethora of meaningful predictors is covered in the current volume by scores of distinguished contributors, and the reader will discover that all of the suggested lists and models are in no way complete or definitive. Let us mention a few examples. The Partnership for 21st Century Skills, for example, listed critical thinking, communication, collaboration, and creativity as four key factors of skills necessary for scholastic achievement. The Collaborative for Academic, Social, and Emotional Learning (CASEL) presented five "competency clusters" that include self-awareness, self-management, social awareness, relationship skills, and responsible decision-making. Roberts, Martin, and Olaru (2015) suggest that the Big 5 personality theory be used as the organizing framework for all noncognitive predictors of academic success (see also Lipnevich, Preckel, & Roberts, in press). Finally, Lipnevich, MacCann, and Roberts (2013) provided a taxonomy of some of the most commonly researched noncognitive constructs, grouped into four domains: (a) attitudes and beliefs, (b) social and emotional qualities, (c) habits and processes, and (d) personality traits. Attitudes and beliefs, however, may be considered more proximal to the behavior in question than other noncognitive constructs (Ajzen & Fishbein, 2005). Thus, the current chapter we will focus on the first group of noncognitive factors and will review existing theories, research, and discuss the role these skills play in academic achievement.

DEFINITION OF ATTITUDES

Attitudes can be broadly defined as a person's evaluation of an entity (Ajzen & Fishbein, 1977). The entity can be, for example, a person or a group, an object, a political party, an activity, or a school subject. Individuals may hold several evaluative beliefs about an entity ranging on dimensions such as good-bad, likable-dislikable, joyful-sad (Ajzen, 2001). The sum of beliefs about an entity form the attitude towards that entity.

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The importance of studying, assessing, and, potentially, changing attitudes derives from the underlying premise that attitudes predict volitional behavior. That is, when a person holds a positive attitude towards something, he or she will also perform positive behaviors related to it (e.g., engage in activities to protect the environment). Although research conceded that the strength of the attitude-behavior link may vary depending on the accessibility, stability, certainty, consistency, and the amount of direct experience with the attitude object (Kraus, 1995, see also Cooke & Sheeran, 2004; Glasman & Albarracin, 2006), the general notion is that people will direct their behavior to be consistent with their attitudes (Ajzen & Fishbein, 1977).

Two theories have evolved to model the attitude-behavior link: the Theory of Reasoned Action (Fishbein & Ajzen, 1975) and its successor, the Theory of Planned Behavior (Ajzen, 1991). Both theories posit that the behavioral intentions people form on the basis of their attitudes mediate the link between attitudes and behavior. Furthermore, both theories assume that attitudes alone are not sufficient to predict intentions and behavior. Rather, they posit that people form intentions on the basis of their attitudes and their perception of social pressure (which is assumed by both theories) and the perception of control they have to exert the targeted behavior (which is assumed by the Theory of Planned Behavior). So, the Theory of Planned Behavior is an extension of the Theory of Reasoned Action and is next described in more detail.

The Theory of Planned Behavior

The TPB posits that a core predictor of volitional behavior is a person’s intention to engage in that behavior (Ajzen, 1991, 2006). A person’s intention, in turn, is mutually determined through attitudes, subjective norms, and perceived behavioral control. While we have defined attitudes above as the overall positive or negative evaluation of the target behavior, we can further distinguish experiential and instrumental aspects of attitudes. Experiential attitudes target the affective aspect of an attitude (e.g., to like or to dislike an entity or a behavior). Instrumental attitudes are formed through evaluative beliefs about the usefulness of an entity or a behavior (e.g., is it important or not). Subjective norms capture an individual’s perception of the social pressures to engage (or not to engage) in an activity. Finally, an individual’s perception of the behavioral control he or she has over exerting a certain behavior also contributes to forming intentions.

These three components of the TPB (attitudes, subjective norms, and perceived behavioral control) consist of a set of underlying beliefs as the cognitive foundation of the respective component. E.g., a student may think that math is fun, enjoyable, and interesting and thus form an overall positive attitude towards math. Another student may think that one should work hard to master math because her or his friends, parents, and teachers say so and thus exert social pressure (high subjective norms). Finally, a student may think that math homeworks, assignments, and in class activities are actually quite easy to do and thus view behavioral control over math activities as high. Together, the three components predict behavioral intentions and subsequent, attitude-related behavior. Thus, intentions act as a mediator between those three components and behavior. Furthermore, TPB posits that perceived behavioral control also has a direct, that is, an unmediated effect on behavior (see Figure 1). Or, as Armitage and Conner (2001, p. 472) stated, perceived behavioral control "provides information about the potential constraints on action as perceived by the actor, and is held to explain why intentions do not always predict behavior".

In addition to the aforementioned components, the TPB acknowledges that other personal qualities (personality, knowledge, skills) may be relevant in predicting target behavior. However, these qualities are – according to the TPB – seen as background variables that may contribute to the targeted behavior via attitudes, subjective norms, and perceived behavioral control (Ajzen & Fishbein, 2005). For instance, having the knowledge of how to learn math (i.e., knowing adequate learning strategies) may contribute to the intention to learn and subsequently to learning activities through perceived behavioral control. However, empirical evidence about background variables and the mediating role of TPB components is currently sparse (cf. Ajzen & Fishbein, 2005).

The core assumptions of the TPB have been empirically confirmed in many studies, for many different attitude entities, and across a variety of samples (e.g., Sheeran, 2002). For example, Notani (1998) provided meta-analytical evidence across 63 studies supporting the assumed structure of the TPB. In another meta-analysis, Armitage and Conner (2001) were able to confirm that TPB variables accounted for a substantive amount of variance in intention and (self-reported and observed) behavior. These authors also reported evidence for the role of perceived behavioral control as a direct determinant of behavior. Generally, the TPB has been used to predict intentions and behavior in several domains, such as physical exercise, smoking, safe driving, and nutrition (Godin & Kok, 1996; Godin, Valois, & Lepage, 1993; Parker, Manstead, Stradling, Reason, & Baxter, 1992).

Although attitudes specifically and the components of the TPB in general have been found to predict intentions and behavior, we would like to emphasize that their predictive validity varies depending on several factors. Glasman and Albarracin (2006), for example, identified attitude accessibility and stability as moderators of the attitude-behavior link. Cooke and Sheeran's (2004) review additionally outlined attitude certainty, ambivalence, direct experience, and affective-cognitive consistency as moderators of the attitude-behavior relation. Overall, authors agree that more research is needed to further elucidate the link between attitudes and behavior (e.g., Armitage & Christian, 2003). Next, we will focus on the relevance of attitudes in educational contexts, and, specifically, in predicting math performance.

Attitudes and Educational Outcomes

Understanding factors that promote academic success has important implications for all learners in educational settings. Student attitudes and behavior have been linked to previous achievement, level of engagement, and perceived academic competence (Akey, 2006). More specifically, student beliefs about academic competence (an antecedent for attitudes towards a content area), were demonstrated to improve academic achievement in subjects such as reading and mathematics. Research has indicated that even among young children (ages 4–7), attitudes towards school predicted academic performance (Geddes, Murrell, & Bauguss, 2010; Ak & Sayil, 2006; Marjoribanks, 1992; Petscher, 2010). Overall, the relationship between attitudes and school performance outcomes, has been shown to be significant and positive (Reynolds & Weigand, 2010; Guzmán, Santiago-Rivera, & Hasse, 2005; Juter, 2005).

A large meta-analysis of correlations between reading achievement and attitudes towards reading indicated that there was a strong relationship between the two variables for students in elementary school and a moderate relationship for students in middle school (Petcher, 2010). A key implication of this finding is that attitudes influence academic achievement even among the youngest learners. Attitudes towards specific subject areas, such as reading, are formed in the early years and are consistently shown to influence levels of achievement. Recent research has indicated that positive attitudes do not only relate to achievement in school subjects, but also contribute to orientations towards career choices. For example, Uitto (2014) found that positive attitudes towards biology in school was related to the likelihood to pursue biology-related careers. In the remainder of this section, we will discuss specific attitudes as applied to a single academic domain – mathematics. Additionally, a meta-analysis on study habits, attitudes, and study skills, indicated that habit and attitude inventories were the single most significant predictors of academic performance (Credé & Kuncel, 2008).

Math Attitudes

Attitudes toward mathematics in the TPB can be described as the overall positive or negative evaluation of mathematics-related behavior ("Studying math makes me nervous"). Subjective norm reflects social pressures on the individual to perform mathematics-related behavior ("Most of my friends think that math is an important subject"). Perceived behavioral control describes the extent to which an individual perceives his/her ability to control the outcome of a behavior ("If I invest enough effort, I can succeed in math"). These three components determine individuals' intention to exert a certain behavior ("I will try to work hard to make sure I learn math"). Before we turn to math-related outcomes predicted by math attitudes, let us first discuss attempt to differentiate math attitudes from mathematics anxiety – the construct that has been erroneously used as a synonym of mathematics attitudes.

Mathematics as a school subject is generally known to elicit anxiety in some students (e.g. Ashcraft, 2002; Frenzel, Pekrun, & Goetz, 2007). Mathematics anxiety can be defined as "an unpleasant emotional response to math or the prospect of doing math" (Beilock, Gunderson, Ramirez, & Levine, 2010, p. 1860). Mathematics anxiety has been frequently and successfully applied to predict mathematics achievement (see Hembree, 1990; Ma, 1999). Conceptually, mathematics anxiety—especially its emotionality component (see Sarason, 1984)—is very closely related to the attitudes component of the TPB, which according to Ajzen (2006) is reflected by adjectives such as *pleasant* or *enjoyable*. However, the math attitudes comprise more math-related beliefs than those pertaining to anxiety, such as whether math is interesting or important.

Math Attitudes and Educational Outcomes

Math performance. Achievement in mathematics is seen as a gateway to higher-education, lucrative career opportunities, and an indicator of the ability to compete with the demands of a global economy (Jerald, 2008). Especially in the area of mathematics, researchers, practitioners, and educational policy decision-makers seek to pinpoint and understand specific factors that contribute to achievement in mathematics. Comparative education research has repeatedly shown that the U.S. does not measure up to other developing countries in mathematics achievement (Lee, Grigg, & Dion, 2007). Hence, investigating meaningful predictors of performance that can be enhanced through interventions is of utmost importance to the field.

Mathematics is conceptualized as a subject that builds upon its foundational concepts and serves as a cognitive multiplier or as a subject that builds upon elementary concepts (Sweller, 1994). This is an important distinction between mathematics and other school subjects. The nature of mathematics forces educational psychologists to investigate how achievement in the subject develops, which factors influence the development of relevant skills, and to what degree are these factors stable across time. Furthermore, the importance of early competencies and later academic achievement is most evident in mathematics. Early mathematics achievement has been shown to be a significant predictor of later overall academic success, even when accounting for general cognitive skills (e.g., attention) and reading ability (Duncan et al., 2007). The overall positive attitudinal profile of a student in relation to the may facilitate learning and mastery in the domain of mathematics (Lipnevich, Preckel, & Krumm, 2016).

Gender differences are often discussed in relation to math performance and other math-related characteristics. Studies have revealed that male students tended to have higher perceptions of their math ability, higher performance expectations, stronger intentions to keep taking math courses, and lower math anxiety compared to female students (Brownlow, Jacobi, & Rogers, 2000; Meece, Wigfield, & Eccles, 1990; Trankina, 1993). Given the attitudinal pathways to math achievement, these findings suggest that female students are at risk for intentionally avoiding advanced math classes. Trends in postsecondary education major selections between 1995 and 2001, indicate that only 14% of females enter science, technology, engineering, and mathematics (STEM), when compared to 33% of men (Chen, 2009). Of note, women represent 40% of the American workforce, but only 23% of the STEM fields (Beede, Julian, Langdon, McKittrick, Khan, & Doms, 2011; Phillips, Barrow, & Chandrasekhar, 2002; Stake & Mares, 2005).

So, it is pivotal to understand how math skills are acquired and how mathematics achievement can be sustained throughout the formal academic years. The relationship between attitudes towards mathematics and achievement in mathematics can provide a framework for developing such academic competencies that lead to success in secondary school and in future careers.

The link between attitudes towards mathematics and mathematical ability in predicting mathematics achievement is complex and is explained by multiple factors (Furinghetti & Morselli, 2009). There are mixed research findings about the cause-effect precedence between attitudes and attainment. So, whether it is low performance in mathematics that leads to negative attitudes and affects responses towards the subject or whether the relationship is reversed remains unclear. Another important question concerns specific factors that interact with prior achievement, affect, and attitudes, and contribute to later mathematics achievement. Despite existing gaps in our understanding of these complex relationships, there are strong research findings showing that significant positive relationships between attitudes towards mathematics and mathematics achievement exist (Ai, 2002; Ma & Kishor, 1997). Longitudinal studies have revealed that prior mathematics achievement and attitudes towards mathematics related strongly to later mathematics achievement (Hemmings, Grootenboer, & Kay, 2010). In a meta-analysis, the causal relationship between attitudes towards mathematics as a predictor variable and achievement in mathematics as an outcome variable, was shown to be statistically significant (results were not significant for the causal relationship of the alternative direction) (Ma & Kishor, 1997). These findings are in line with results reported for the domain of statistics, which generally yield significant positive relationships between attitudes towards statistics and statistics outcomes (Dempster & McCorry, 2009; Emmioglu & Capa-Aydin, 2012; Sizemore & Lewandowski, 2009).

To our knowledge, only few studies have examined mathematics attitudes making use of the TPB framework (Lipnevich, McCann, Krumm, Burrus, & Roberts, 2011; Lipnevich et al., 2016). Lipnevich and colleagues successfully applied a TPB based questionnaire on mathematics attitudes (MAQ) to predict mathematics achievement. The authors were able to explain up to 32% of variance in mathematics grades in Belarusian and US samples. Moreover, Lipnevich et al. (2016) examined the incremental validity of mathematics attitudes above and beyond cognitive ability and Big 5 personality traits and revealed that math attitudes explained up to 25% of incremental variance. So, albeit these findings are obtained from cross-sectional studies and evidence from longitudinal or experimental studies is still lacking, shaping math attitude components as suggested by TPB may be particularly beneficial in increasing math performances.

Another key outcome of education, as it relates to the domain of math, is career choices. Meece et al. (1990), for example, showed that higher mathematics anxiety levels were related to less mathematics courses students choose to take. These authors argue that the avoidance of mathematics courses inevitably results in a deficit of students entering scientific and mathematical professions. Studies also show that stable negative emotional profile toward the domain of mathematics (i.e., trait emotions, or experiential attitudes (Ajzen, 2002)) relates to individuals' intention to take challenging courses and pursue additional tasks in the domain of mathematics (Goetz, Cronjaeger, Frenzel, Lüdtke, & Hall, 2010). Thus, substantial correlations between mathematics attitudes and career interests in a field which require a higher mastery of mathematics is evident. More specifically, career interests of students are also determined by norms established by their peers (as reflected in the subjective norms component of the TPB). Studies consistently demonstrate that peers can exert significant influence over individuals' career choices (Smith, 1992). For example, in his classical study Johnson (1987) found links between experiences within early adolescent groups and later vocational identity. Similarly, Sax and Bryant (2006) showed that aspects of environment, including the peer culture, contributed to shifts in individuals' career choices. Hence, as the reviewed research demonstrates, mathematics attitudes matter for academic achievement in math, as indexed through student grades and test scores, and greatly relate to student choice of vocation. Assessing students' attitudes with the goal of developing potential interventions to enhance this characteristic is of utmost importance to the field of education.

ASSESSMENT OF ATTITUDES

Although attitudes is an important construct accepted globally among researchers, educators, and social scientists, the currently available assessment approaches vary in their quality. While in many studies attitudes towards school are conceptualized as a "non-cognitive" construct (among math self-efficacy, elaboration, and motivation) (Morony, Kleitman, Lee, & Stankov, 2013), in other studies attitudes are indexed as self-beliefs (see Straus, 2014), attributions (see Kozina & Mlekuž, 2014), self-confidence (see Kadijević, 2008) or achievement-related emotions (see Daniels et al., 2008). In some large-scale assessments, attitudinal factors are derived from student self-report questionnaires that may or may not have been developed with the intention to measure attitudes towards academics. For example, in Kadijević (2008), attitudes towards mathematics was measured by using student survey data on answers to questions such as "I enjoy mathematics" and "I need mathematics to learn other school subjects." Other approaches towards assessing attitudes towards specific subject-areas include administering assessments that have been developed specifically for measuring attitudes. For example, the Survey of Attitudes Toward

Statistics (SATS; Schau, Stevens, Dauphinee, & Del Vecchio, 1995) has been used to understand the attitude-achievement relationship in statistics. Another approach for assessing attitudes is through student interviews based on prompts of relevant situations (see Hannula, 2002).

TPB-Based Approaches

The TPB outlined in a previous section, provides a framework of assessing, understanding, and predicting mathematics achievement. While previous mathematics achievement and mathematics ability test scores are important predictors of later mathematics achievement, the components of the TPB, have been shown to explain an additional significant variation of grades in mathematics (Lipnevich et al., 2011).

Consequently, the Organisation for Economic Co-operation and Development (OECD) began incorporating Ajzen's theory of planned behavior model into the background student questionnaire in 2012. This approach was accounted for in Straus's (2014) analysis of math-related attitudes, socio-economic background, and their effect of academic achievement. The framework of the TPB was used to understand the likelihood of student behavior through subjective norms. More specifically, subjective norms revealed a significant relationship with mathematics achievement among the U.S., Canadian, and German students. Kozina and Mlekuž (2014) also took the TPB measurement approach to understanding mathematics achievement through subjective norms and perceived control. Control beliefs were used to assess attributions for success in mathematics and predict mathematics achievement. Results indicated that there were significant effect sizes noted of perceived control and its impact on math achievement in several of the countries studied (including Slovenia, Estonia, and Netherlands).

A questionnaire specifically developed to assess the four components of the theory of planned behavior (i.e., Attitudes, Subjective Norms, Perceived Behavioral Control, and Intentions) is the Mathematics Attitudes Questionnaire (MAQ; Lipnevich et al., 2011). In this questionnaire students are asked to rate each item on a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). The authors initially developed an item pool of 40 items (10 for each component of the TPB) and reduced this pool on the basis of results obtained from exploratory factor analysis to 22 items. Six items address attitudes (e.g., "I enjoy studying math"), five items address subjective norms (e.g., "My friends think that math is an important subject"), five items represented perceived behavioral control (e.g., "If I invest enough effort, I can succeed in math"), and six items address intentions (e.g., "I will try to work hard to make sure I learn math"). The total scores are build by summing students' responses for each of the four components. Lipnevich et al. (2011) demostrated that this questionnaire yielded satisfactory to good internal consistency reliabilities across two samples from different cultures. Moreover, the factorial structure of the TPB was replicated with the MAQ across different cultures. Importantly, the MAQ predicted a substantial proportion of variance in math performance (Lipnevich et al., 2011; Lipnevich et al., 2016).

Large-Scale Assessments of Attitudes

Large-scale national and international assessment of attitudes provide us with valuable information about student achievement across many grade levels, contexts, and outcomes of interest. The Trends in International Mathematics and Science Study (TIMSS) and the Programme for International Student Assessment (PISA) are internationally recognized efforts of evaluating achievement and performance standards in specific subject areas. The TIMSS and PISA are administered every few years to students in participating countries to assess competencies in science and mathematics (as well as reading and literacy for PISA). In addition to domain-specific assessments, the data collected includes student background characteristics and surveys to measure factors that may influence achievement (e.g., approach towards subject area, attitudes, utility for subject area, positive or negative affect towards subject, academic self-beliefs).

In predicting mathematics achievement, attitudes (seen as learner-related variables) towards mathematics, have been an important component of understanding achievement in cross-cultural analyses (Papanastasiou, 2000). Using data from the PISA, positive correlations were found for the relationship between attitudes towards school and several academic outcomes including scores in reading, mathematics, and science (OECD, 2003). More generally, positive relationships between domain-specific (e.g., mathematics, science) attitudes and achievement have been trending in studies using secondary data-analyses procedures from large-scale assessments. However, across several analyses using the TIMSS 1995 data, the relationship between attitudes and mathematics was significant in few of the of the countries examined (Martin, Mullis, Gregory, Hoyle, & Shen, 2000). Several factors could be explaining the inconsistency of results across countries; (1) that there are meaningful cultural differences when examining the attitude-achievement relationship, (2) that measurement of "attitudes towards mathematics" was not culturally sensitive (see Kadijević, 2003), and (3) that "attitudes" is a multidimensional construct that is represented differently between samples (see Lipnevich et al., 2011).

Within the last decade, dimensions of attitudes towards mathematics and mathematics achievement have been refined in research studies using data from large-scale assessments. By utilizing survey responses from the TIMSS 2003 data, self-confidence in learning mathematics and favoring mathematics were conceptualized as dimensions of attitudes towards mathematics. These constructs were shown to be significant predictors of mathematics achievement in almost all countries that were studied, which included the United States, Sweden, Japan, and England (Kadijević, 2008). While controlling for family background characteristics such as socioeconomic status, mathematics-related attitudes showed a significant effect size on mathematics achievement test scores measured in the PISA assessment

(Straus, 2014). Measures of mathematics-related attitudes included student responses on subjective norms in mathematics (i.e., the perceived utility of mathematics in future encounters and the enjoyment of mathematics).

INTERVENTIONS

Once attitudes are formed, they can be rather stable (Glasman & Albarracin, 2006). However, the formation of attitudes takes place through an individual's socialization and can thus be influenced by various factors throughout the socialization process. Learning processes are among the factors discussed in the literature on attitude formation (Hogg & Vaughan, 2009). One way of learning is to have direct (positive) experience with the attitude object. In its simplest form, attitudes can be changed by mere exposure with the attitude object (Zajonc, 1968, 2001). Learning may also occur through classical and instrumental conditioning. Building on the principles of classical and instrumental conditioning, parents, teachers, and others can reinforce attitude-related behavior or the (positive) consequences resulting from such behavior. This is, for example, evidenced by Olson and Fazio (2001) who showed that attitudes towards objects that were paired with unrelated positive items were significantly more positive than attitudes towards items that were paired with unrelated negative items. Furthermore, significant others (e.g., parents, friends, teachers) can serve as role models and thus shape attitudes.

Another pathway to attitude formation can be through individuals' behavior. Bem (1972) introduced the self-perception theory, which argues that people form self-concepts on the basis of what they do. For example, a person may frequently attend a psychology lecture and, as a result, infer that he or she must like psychology (cf. Olson & Zanna, 1993). Other research suggests that it may particularly effective to change attitudes by combining cognitive and behavioral interventions. Krahé and Altwasser (2006) were able to show that attitudes towards physically disabled individuals changed significantly (in comparison to a control group) when participants were given information about disabilities and engaged in paralympic activities. Notably, these effects remained stable in a three month follow up. Several other factors relevant in attitude formation are currently discussed (for an overview see, for example, Greenwald, Brock, & Ostrom, 2013), but may not serve the purpose of delineating approaches to attitude change (e.g., genetic influences on attitude formation).

In addition to targeting learning processes, the TPB may be used as a point of departure for developing specific interventions. Specifically, interventions can be designed to change the underlying beliefs of the three components of the TPB (behavioral beliefs as determinants of attitude toward the behavior, normative beliefs as determinants of subjective norms, and control beliefs as determinants of perceived behavioral control). A very illustrative example for interventions targeting those beliefs in the domain of risky driving was presented by Parker, Stradling, and Manstead (1996). These authors designed video scenes specifically targeting behavioral, normative, and control beliefs. For instance, the video on normative beliefs shows an actor (Tom) "pulling up to a curb on three separate occasions. On each occasion, he is accompanied by a passenger. In the first scene, the passenger is his partner (i.e., husband, wife, boyfriend, girlfriend); in the second scene it is a same-gender close friend; and in the third, it is his (male) child. As Tom leaves the car to go into a shop, each of these passengers speaks to the camera, complaining about Tom's driving, and in particular about the fact that he drives too fast on narrow residential roads. The main message from each of Tom's passengers is that they are not impressed by his speeding and would much prefer it if he kept to the 30-mph (48-kph) speed limit. This video, then, features the wishes of others who are important to Tom. It is designed to convey to the audience the message that people do not like being driven by someone who exceeds the 30-mph (48-kph) speed limit in residential zones" (Parker et al., 1996, p. 5). Other videos were similar but specifically designed to address a distinct belief. Their results, however, showed that only half of their videos (particularly those addressing normative beliefs) had an effect on attitude change. The authors acknowledge that the videos were produced with a relatively low budget. So, future interventions along these lines may provide more insights into the malleability of TPB-related beliefs through videos.

Obviously, changing TPB-related beliefs is not restricted to video interventions. For example, persuasion through written or spoken messages may also target specific beliefs (e.g., Brubaker & Fowler, 1990). A meta-analysis conducted by Webb and Sheeran (2006) revealed that TPB-based interventions had a medium effect on intentions (d = .58) and on actual behavior (d = .40). Thus, TPB-based interventions can overall be considered effective in changing attitudes and, subsequently, in changing intentions and behavior. In the future, such interventions may not only help creating more favorable attitudes towards certain attitude objects but can also be used in controlled experiments to examine the causal link between attitudes and behavior.

FUTURE DIRECTIONS

Novel Approaches Toward Assessment

The strengths of using large-scale assessments to assess the effect of attitudes on academic achievement, also present limitations. Although cross-cohort and cross-cultural analyses are ways of understanding factors that contribute to academic achievement, the large-scale data proposes strains on measuring psychological factors that are important to predicting student achievement. There have been several efforts to incorporate more refined measures of student attitudes, behaviors, and attributions. For example, in PISA 2012, Ajzen's (1991) model of the theory of planned behavior was used as a framework to measure value and expectancy components of behavior through self-report methods in the Student Questionnaire (OECD, 2012). As mentioned earlier in the chapter, measuring attitudes proposes a challenge because of a perceived notion that attitudes are easily changeable. If attitudes are easily recalled and situational, they are better measured. Using the advantages of self-report questionnaires (usability, ease of administration) and creating more effective items that measure attitudes in relevance to education, we become better equipped to understand these psychological constructs and their impact on academic achievement. Especially in the topic of measuring non-cognitive constructs (i.e., attitudes), several challenges have immersed (see Duckworth & Yeager, 2015) after considering the research-base that non-cognitive factors are as important as cognitive factors in predicting achievement (Duckworth & Seligman, 2005).

An assessment approach that has re-gained awareness in the scientific literature are situational judgment tests (SJTs). SJTs typically consist of written scenarios followed by a set of multiple-choice response options (Motowidlo, Dunnette, & Carter, 1990). Test takers are asked what they would or should do in each one of the situations. SJTs are frequently used in personnel assessment and selection (Whetzel & McDaniel, 2009), but have not yet been applied to the domain of attitudes. Considering that attitudes always refer to a specific object (e.g., math), SJTs may be apposite to capturing attitudes as they present typical situations in which the attitude object occurs or an attitude towards that object becomes relevant. Such SJTs may, for example, present typical situations related to the attitude object and assess test takers' attitude-related beliefs. The situations used in such SJTs may also be geared towards emphasizing a specific attitude component (as included in the TPB) and capture test takers' response to such situations. However, whether SJTs indeed provide added value beyond self-reports in the domain of attitudes is an open research question.

Causal Evidence

Currently, very few studies provided evidence for the causal role of attitudes on educational outcomes. This is surprising for several reasons. First, ample correlational studies have been conducted that linked attitudes to educational outcomes. Hence, the initial groundwork justifying more sophisticated and expensive follow-up studies. Second, the dependent variable is of major interest, both from an individual as well as from a societal perspective. For example, achievement in mathematics is viewed as pivotal for higher-education and lucrative career opportunities (Jerald, 2008). Third, teachers and researchers in education have a genuine interest in developing interventions to improve school-related attitudes. The TPB provides specific recommendation on how to create such interventions (Ajzen, 2002; Armitage & Conner, 2001). Such interventions can be used in controlled experiments to establish causal links between attitudes and outcomes. Fourth, technology as well as easy to apply methodology are available to derive causal evidence from non-experimental studies (e.g., through cross-lagged panel analysis). Research along these lines might also benefit from a more in-depth assessment of behavior (e.g., through ambulatory assessments). In fact, multi-time assessments may also shed light on reciprocal relationships between behavior and attitudes as well as on dynamics of potential upward or downward spirals.

Inclusion of Background Variables and Multiple Outcomes

The TPB acknowledges several background variables (e.g., personality, knowledge), some of which are also included in taxonomies of 21 century skills (see Intro of this chapter). However, evidence on the interplay of attitudes and several other important personal qualities is sparse. Indeed, the components of the TPB may not simply act as mediators between background variables and intentions (cf. Ajzen & Fishbein, 2005). Rather, their interaction may be more complex (for instance, attitudes towards math may be less predictive when students' show high levels of conscientiousness). Moreover, students' attitudes may be more or less open to interventions depending on other student characteristics. So far, research has not been devoted so much to disentangling the interplay between attitudes, other noncognitive and cognitive characteristics.

An important avenue for future research may also lie in the inclusion of further outcome variables. While the natural focus of researchers so far was on behavior and performance in several educational domains, fruitful insights may also be gained from including outcomes such as extracurricular activities, interests, satisfaction, commitment, stress, etc. A narrow focus on domain-related behavior and performance may in fact ignore important side effects of shaping students' attitudes.

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