

Introducing the construct curiosity for predicting job performance

PATRICK MUSSEL*

Department of Psychology, Julius-Maximilians University of Würzburg, Würzburg, Germany

Summary

The present paper provides a conceptual and empirical examination regarding the relevance of the construct curiosity for work-related outcomes. On the basis of a review and integration of the literature regarding the construct itself, the construct is conceptually linked with performance in the work context. In line with a confirmatory research strategy, the sample of the present study ($N = 320$) has requirements which reflect this conceptual link. Results from a concurrent validation study confirmed the hypothesis regarding the significance of curiosity for job performance ($r = .34$). Furthermore, incremental validity of curiosity above 12 cognitive and non-cognitive predictors for job performance suggests that curiosity captures variance in the criterion that is not explained by predictors traditionally used in organizational psychology. It is concluded that curiosity is an important variable for the prediction and explanation of work-related behavior. Furthermore, given the dramatic changes in the world of work, the importance is likely to rise, rather than to decline, which has important implications for organizational theories and applied purposes, such as personnel selection. Copyright © 2012 John Wiley & Sons, Ltd.

Keywords: personality; curiosity; job performance; personnel selection

Global economic changes, technological developments, new business strategies, and the development of new branches and industries have brought and continue to bring dramatic changes to organizations and the nature of work (Cascio, 2010; Roe, 2010). These changes include, for example, a shift from manual work to mental or knowledge work, from face-to-face and hands-on work to mediated work, from single location to multiple and mobile locations, from persistent employment to temporary employment, from fixed hours to flexible hours, from stable content and demands to variable and changing content and demands, or from routine work to creative work. Such developments have major impact on our models of organizations and performance as well as human resource management practices.

One of the consequences of a rapidly changing world that psychologists have to deal with is changes in requirements that positions possess. For example, the automatization of production processes decreases demands of mechanical skills, while increasing demands for computer skills and analytical thinking. Similarly, people working in call centers, in telework, or e-business are faced with new challenges that require different knowledge, skills, and abilities.

The purpose of the present paper is to introduce the construct epistemic curiosity to organizational psychology. As outlined in detail in the succeeding texts, epistemic curiosity includes preferences for information and knowledge acquisition, learning, and thinking. Given the ongoing change in requirements of a growing number of positions, it is proposed that this construct, which has been neglected so far in organizational research, has become more important today and is likely to become even more important in the future. Requirements for

*Correspondence to: Dr. Patrick Mussel, Julius-Maximilians University of Würzburg, Department of Psychology I, Differential Psychology, Personality Psychology, and Psychological Diagnostics, Marcusstr. 9-11, 97070 Würzburg, Germany.
E-mail: patrick.mussel@uni-wuerzburg.de

which curiosity is likely to be important are, among others, continuous learning along the working lifespan, effortful thinking when dealing with complexity, novelty, or ambiguity, and dealing with organizational change. Specifically, it is proposed that curiosity explains variance in work-related criteria above the variance explained by predictors traditionally used in organizational psychology. As a unique contribution, the present study reports results regarding the prediction of supervisory ratings of job performance over and above 12 predictors, which represent our current knowledge regarding the prediction of work-related outcomes by individual difference variables. Therefore, this research enhances our knowledge about personality variables explaining and predicting work-related outcomes, which contributes to our understanding of the nature of work and might be beneficial for applied purposes, such as personnel selection or promoting adaptive behavior. This article begins with a definition of the construct curiosity and a review of recent evidence regarding its latent structure and its nomological net, followed by an examination of the conceptual link between curiosity and behaviors related to work and performance.

Construct Definition and Structure

Content

People are curious about many things. Some want to know whether they have new mail in their mailbox. Others wonder what fellow travelers in the subway are talking about. Again others want to know how Indian rice and curry tastes like. These kinds of behaviors have all been subsumed under the label curiosity but are of little relevance regarding the description and prediction of work-related behavior and, therefore, for the construct under investigation in the current study. Of presumably greater importance, however, is being curious with regard to seeking new knowledge, a trait that has first been labeled as scientific curiosity by William James (1890/1890) and later as epistemic curiosity by Daniel E. Berlyne (1960). Berlyne used the term to describe purely human behaviors that are directed at obtaining knowledge-related information and delimited epistemic curiosity from perceptual curiosity. In his studies, perceptual curiosity accounted for research with animals (e.g., a mouse exploring a maze) and involved interest in and giving attention to novel perceptual stimulation, which motivates visual and sensory inspection. Later, perceptual curiosity was used to also describe human behavior that involves interest in novel stimuli as sight, sound, touch, and taste (e.g., discovering new places, enjoy different food, prefer new songs; Collins, Litman, & Spielberger, 2004). Therefore, regarding the content of the construct, the term curiosity has been used for a wide range of behaviors.

The conceptions within epistemic curiosity also differed somewhat across research groups and in course of time. Berlyne (1978) emphasized quests for knowledge or information that are rather simple, such as an incomplete perception of an object or event, and referred to the corresponding behavior as exploratory responses. Similarly, the more cognitively oriented approach of Loewenstein's (1994) information gap theory, which explains curiosity in terms of a gap between what one knows and what one wants to know, focuses on simple perceptions, such as realizing a picture when solving a puzzle. More complex forms of epistemic curiosity were put forward from a pedagogical perspective, emphasizing the role of curiosity in gathering and understanding information and, therefore, learning (e.g., Arnone, Grabowski, & Rynd, 1994; Day, 1982). Recent studies extended the content of epistemic curiosity even further by including preferences for thinking, problem solving, and dealing with complex theories (Litman & Spielberger, 2003). For example, Collins et al. (2004) noted that epistemic curiosity was aroused by complex ideas such as scientific theories and intellectual conundrums, which motivate asking questions or testing hypotheses to gain knowledge. Therefore, contemporary concepts address complex epistemic behaviors rather than their more simple underlying functions and perceptions.

Processes

Several attempts were made to describe how curiosity influences behavior and, therefore, how curiosity operates in interaction with situational properties. Berlyne's (1960, 1978) studies, which treated curiosity as a state rather than a trait, were mainly concerned with the investigation of situational features, so-called collative variables such as novelty, complexity, ambiguity, or uncertainty, which have the potential to arouse curiosity. More recent concepts still point to the relevance of these variables but view them no longer as properties of the situation but rather as appraisals of an individual (Silvia, 2008a). Therefore, Silvia considers curiosity as the emotion of interest that depends on whether a situation is *appraised* new, complex, or uncertain to the individual, combined with *appraisals* of the ability to comprehend the situation (in terms of Lazarus, 1991).

Day (1971) was the first to take an individual difference perspective on curiosity by developing a personality measure of specific curiosity. The theoretical basis of specific curiosity is also grounded in Berlyne's conceptions and refers to a tendency for exploratory behavior when confronted with a situation that can be described in terms of collative variables (e.g., solving a puzzle, reading an unknown theory). Specific curiosity can be distinguished from diverse curiosity, which refers to exploratory behavior in the absence of collative variables. Actually, Berlyne (1978) considered diverse curiosity to be initiated by feelings of boredom and directed toward stimuli that are more arousing, such as entertainment or play. However, more recent definitions of diverse curiosity no longer build upon Yerkes–Dodson law of optimal arousal but rather consider diverse curiosity in terms of being curious about a wide range of topics. On the basis of this conception, Litman and Spielberg (2003) developed a personality measure of diverse and specific epistemic curiosity. The authors reported high correlations (.56) between the two dimensions, presumably due to a common higher order factor.

Regarding cognitive and emotional aspects, high subjective appreciation and positive emotional experiences of the respective actions characterize specific and diverse curiosity. However, as Litman and Jimerson (2004) discuss, curiosity-related behaviors are also associated with rather unpleasant and aversive feelings of uncertainty that accompany curiosity, such as being annoyed of not knowing the answer to a question. The authors labeled this aspect as *curiosity as a feeling of deprivation*, which contains persisting in exploratory behaviors until desired information are obtained or problems are solved. Similarly, Maw and Maw (1970) proposed that curiosity is demonstrated when a person “persists in examining and exploring stimuli in order to know more about them” (p. 31).

To integrate the facets diverse curiosity, specific curiosity, and curiosity as a feeling of deprivation, it is suggested that these facets can be discriminated by relating to different processes and circumstances that accompany curiosity-related behavior. Specifically, it is suggested that these facets of the trait epistemic curiosity can be interpreted as describing behavior that is of different relevance for different stages in the course of an action. Diverse curiosity is related to seeking out situations that have the potential to be perceived as interesting. Therefore, an individual seeks out optimally challenging situations that possess an incongruity between a stimulus input and some standard of comparison (Deci, 1976) and allows obtaining new information, learning, and thinking. Specific curiosity refers to behaviors after being exposed to an interesting situation, either because the situation was sought out by the individual intentionally or because the individual had been confronted with the situation. Specific curiosity refers to the extent that individuals engage in exploratory behaviors to learn more about and deeply understand the situation. Finally, curiosity as a feeling of deprivation concerns maintaining and preserving exploratory behaviors until new information is understood, initial complexity of the situation is reduced, and uncertainty is overcome as a result of learning new ideas and understanding of a topic. Such behaviors aim at conquering the challenge and reduce incongruity. The sequence of seeking, engaging, and conquering is an ongoing process that, ultimately, leads to higher levels of competence. From an individual difference perspective, persons with higher levels of trait-related epistemic curiosity will be more likely to seek out, explore, and conquer situations that are appraised in terms of novelty, complexity, and ambiguity and, therefore, more often possess behaviors such as information seeking, learning, and thinking, which finally leads to higher levels of competence.

Summary

Definitions of curiosity found in the literature, either explicitly stated or implicitly assumed, are quite heterogeneous, depending on the point of time that the research was conducted and on the group of researchers being involved. The present section summarized the prevailing research by distinguishing between the content, that is, the kinds of behaviors that the construct curiosity is referred to, and the processes through which individual differences manifest themselves in behavior. Regarding content, the conception underlying the present study focuses upon epistemic aspects of the construct curiosity, including information and knowledge acquisition, learning, and thinking, thereby excluding aspects such as perceptual or social curiosity. Regarding process, it was outlined that manifestation of these preferences in behavior can take place in different stages of an action, such as seeking out, engaging, and conquering corresponding situations, which have been investigated in terms of the facets diverse curiosity, specific curiosity, and deprivation-type curiosity. Given the high correlations between corresponding measures of these facets (Mussel, 2010) and the salient loadings on the same factor when factor analyzed (Litman & Silvia, 2006), the postulation of a general, underlying factor *epistemic curiosity* is indicated and in line with hierarchical models of personality (Digman, 1990).

Nomological Network

This section reviews the literature regarding relationships between curiosity and related cognitive and non-cognitive constructs. Figure 1 also illustrates these results, whereby constructs with higher correlation with curiosity are displayed closer to the center and constructs with lower correlation further outside. As can be seen, the three constructs learning goal orientation, need for cognition, and typical intellectual engagement have shown relatively high correlations to curiosity (Mussel, 2010, 2011; Olson, Camp, & Fuller, 1984), with correlations up to .75 for learning goal orientation, from .59 to .74 for need for cognition, and from .46 to .52 for typical intellectual engagement. These results reflect conceptual overlap to these constructs with regard to behavioral preferences in learning, thinking, and problem solving, whereas preferences for learning and information seeking discriminate curiosity from need for cognition and typical intellectual engagement.

Regarding Big Five personality traits, curiosity is most strongly related to openness, especially to the facet openness for ideas (Mussel, 2010; see Mussel, Winter, Gelléri, & Schuler, 2011). Moreover, curiosity was found to be moderately related to conscientiousness, presumably due to the aspect of persistence and diligence that both

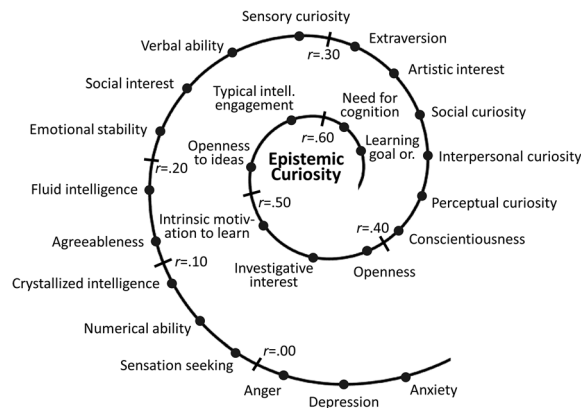


Figure 1. Nomological net of curiosity; constructs with higher correlation with curiosity are displayed closer to the center

constructs have in common. Correlations with extraversion are moderate, and with agreeableness and emotional stability rather low to moderate.

Furthermore, curiosity is related to intrinsic motivation to learn (Deci & Ryan, 1993). Indeed, several researchers conceptualized curiosity as an element of intrinsic motivation to learn (Amabile, Hill, Hennessey, & Tighe, 1994) or even as the nucleus of intrinsic motivation (Schiefele & Schreyer, 1994). Also, curiosity is related to interest (Krapp, 1998). Naylor (1981) reported moderate correlations with investigative interest and small-to-moderate correlations with artistic and social interest. Silvia (2008b) interpreted trait curiosity as individual differences in the emotion of interest, that is, curious people are generally more often interested.

Several constructs that have also been labeled curiosity share general approach-related behaviors but are directed toward sensations or people rather than epistemic content such as knowledge acquisition or learning and, correspondingly, are only moderately correlated. For example, Litman, Collins, and Spielberg (2005) reported correlations between .27 and .32 between a measure of epistemic curiosity and sensory curiosity, a construct that refers to searching for novel and unusual sensory experiences, such as hiking through a remote rain forest. Research with regard to the related construct perceptual curiosity is less clear, with coefficients ranging from .21 to .57 (Byman, 2005; Collins et al., 2004; Litman & Spielberg, 2003). The recently proposed constructs social curiosity (Renner, 2006) and interpersonal curiosity (Litman & Pezzo, 2007) refer to interest in other people and include aspects of spying and snooping; again, epistemic curiosity is only moderately correlated.

Positive even though small, correlations up to .19 have been reported between curiosity and fluid, but not crystallized intelligence (Mussel, 2010). Naylor (1981) found trait curiosity to be slightly correlated with verbal ability, but not with numerical ability. Positive correlations between fluid intelligence have also been reported for peer ratings of curiosity (Maw & Maw, 1970) and for samples with children (Alberti & Witryol, 1994). It can be hypothesized that the relationship between the two variables is due to a direct influence of fluid intelligence on the development of curiosity (Moutafi, Furnham, & Crump, 2006). Persons with high scores on intelligence have the ability to quick thinking, reasoning, seeing relationships, solving complex problems, and efficient learning (Brody, 1992). Therefore, these persons are likely to succeed in situations involving such skills, which make these situations more rewarding for them. Accordingly, they will value them more positively and approach them in the future. The definition of epistemic curiosity mirror such behavioral tendencies and attitudes, as provided earlier. Similarly, individuals low on fluid intelligence are likely to fail such situations and try to avoid them in the future. However, these relationships remain speculative until evidence from longitudinal studies supports them. A similar pattern of results, that is, small but significant correlations around .20 with fluid intelligence, has been reported for openness to ideas (Moutafi et al., 2006), need for cognition (Cacioppo, Petty, Kao, & Rodriguez, 1986), and typical intellectual engagement (Ackerman & Heggestad, 1997), and similar hypothesis regarding the development of these constructs have been proposed.

Regarding discriminant validity, epistemic curiosity is hardly related to sensation seeking (Zuckerman, 1994), correlations range between $-.02$ and $.27$ (Litman & Spielberg, 2003; Reio & Wiswell, 2000), and corresponding measures load on different factors when factor-analyzed (Vidler & Rawan, 1974). Even though both constructs are approach-related with regard to novel stimuli, sensation seeking is rather concerned with sensations (such as perceptual curiosity) and, above all, included the aspect of risk taking, which is unique to sensation seeking and not shared with any definition of curiosity. Furthermore, epistemic curiosity is uncorrelated with anger and depression and uncorrelated or slightly negatively correlated with anxiety (Kashdan et al., 2009; Litman & Spielberg, 2003; Litman & Jimerson, 2004; Litman & Pezzo, 2007).

Relevance of Curiosity for the World of Work

Despite some recent controversy (Morgeson et al., 2007), the use of personality measures to predict job performance is widely accepted (Barrick, Mount, & Judge, 2001; Ones, Dilchert, Viswesvaran, & Judge, 2007).

Actually, several studies found validity of personality constructs to generalize across jobs (Barrick & Mount, 1991; Ones, Viswesvaran, & Schmidt, 1993). However, more recently, several authors emphasized that the relevance of personality for the prediction of work-related outcomes is strongly depending on the specific circumstances, which is mirrored by large standard deviations of validity coefficients (Tett & Christiansen, 2007). Correspondingly, confirmatory research strategies have been favored in which personality measures are hypothesized *a priori* to be linked logically or theoretically to specific job performance criteria and job requirements (Rothstein & Goffin, 2006). Actually, studies using a confirmatory research strategy consistently found higher validity, compared with exploratory research designs (Tett, Jackson, & Rothstein, 1991; Tett, Jackson, Rothstein, & Reddon, 1999). Thus, it is crucial that personality traits are linked to job requirements.

As outlined in the introduction of the present paper, the world of work undergoes dramatic changes due to globalization, global economic changes, technological developments, or the development of new branches and industries (Cascio, 2010; Roe, 2010). From the viewpoint of confirmatory research strategies, differing job demands that accompany these changes have an immediate impact on the validity of personality measures (Tett & Burnett, 2003). The present study builds upon these effects. Especially, it is proposed that today, numerous jobs possess requirements that are conceptually and in part uniquely mirrored by the construct curiosity. Therefore, curiosity might explain the variance in job performance that is not being explained by constructs traditionally investigated in organizational psychology. Surprisingly, thus far, empirical research has neglected the role of curiosity in the work context. However, as outlined in the following texts, the relation between curiosity and performance can be expected on conceptual grounds.

On the basis of the definition provided earlier, curiosity can be expected to be of particular importance in context of job requirements that are characterized by high demands for learning. Curiosity has been found to enhance learning in studies using self-report measures of knowledge (Jones, 1979) as well as knowledge tests (Arnone et al., 1994; Kang et al., 2009). A special case of workplace learning occurs when individuals enter a new organization, possessing the demand of socialization-related learning. Indeed, two studies found positive correlations between trait measures of curiosity and socialization-related learning (Reio & Wiswell, 2000) and information seeking (Harrison, Sluss, & Ashforth, 2011); interestingly, socialization-related learning was found to moderate the relationship between curiosity and job performance, even though the assessment of job performance via self-ratings limits the conclusiveness.

Furthermore, curiosity might facilitate adapting to a changed environment as well as proactive behavior. According to Griffin, Neal, and Parker (2007), adaptability refers to the necessity to respond to, cope with, or adapt to changes in work roles, the environment, the team, or the organization. Examples of such changes include the introduction of new technology, work redesign, changes in strategy, mergers, and restructuring, that is, situations that are typically characterized by uncertainty and interdependence. A central aspect in dealing with such situations is to learn new skills, which help master new challenges and cope with changes in core tasks, teams, and the organization (Allworth & Hesketh, 1999; Pulakos, Arad, Donovan, & Plamondon, 2000). Referring to the literature that has been discussed earlier, curiosity facilitates learning new skills; therefore, employees with high levels of trait-related curiosity will learn more new skills and, accordingly, adapt more efficiently to changes in their environment. Also, Pulakos et al. (2000) noted that individuals who tend to display traits such as curiosity when confronted with novel situations should be less likely to perceive change as stressful and more likely to adapt more effectively, which is in line with findings from Mussel, Spengler, Litman, and Schuler (2012) who reported negative correlations between curiosity and vulnerability. Furthermore, one of the applied settings that is typical for being exposed to a changed environment is international executives and expatriates, and several authors conceptualized curiosity as a potential predictor of successful adaption and performance of expatriates (Kets de Vries & Mead, 1991; McCall, 1994; Spreitzer, McCall, & Mahoney, 1997; Van der Zee & van Oudenhoven, 2000). Curiosity also shares aspects of the proactive personality (Crant, 2000); correspondingly, Seaton and Beaumont (2008) reported a positive relationship between curiosity and proactive coping. In sum, curiosity might facilitate adapting to and proactively dealing with new situations.

Summary

This section contained hypotheses regarding the expected relationship between curiosity and performance in the work setting. Among others, curiosity is expected to explain work-related behavior due to its relevance for learning, especially socialization-related learning, and in situations that demand dealing with uncertainty and change. In light of the major changes in the world of work as a result of globalization, economic changes, or technological developments, as discussed earlier, such competencies are more important today than ever before. Furthermore, it can be expected that these requirements will even increase in the future; and, therefore, the relevance of curiosity for the explanation and prediction of work-related behavior will also increase.

Hypotheses

The present study investigates two hypotheses. First, it is hypothesized that curiosity in its epistemic form, as defined earlier, is a significant predictor of job performance. This hypothesis is based upon the conceptual overlap between definitions of curiosity on the one hand and typical job requirements that characterize the modern world of work on the other (Tett & Burnett, 2003). More specifically, as outlined earlier, curiosity is expected to be a significant predictor of job performance in jobs which are characterized by high demands for learning or dealing with uncertainty and interdependence, such as in the context of organizational change, as curiosity has been found to enhance learning and developing new skills, which help master challenges and cope with organizational change.

The second hypothesis claims that curiosity explains variance in job performance beyond the variance accounted for by predictors traditionally used to predict job performance. Regarding the latter, the present study investigates 12 constructs, including general mental ability (GMA), fluid intelligence, tacit knowledge, the Big Five (emotional stability, extraversion, openness, conscientiousness, and agreeableness), integrity, achievement motivation, social competence, and customer service orientation. The constructs included in this state-of-the-art test battery have been intensively researched over the last century, with overwhelming evidence regarding their relevance in the work context (Barrick et al., 2001; Ones & Viswesvaran, 2001; Schmidt & Hunter, 1998, 2004). The hypothesis that curiosity predicts job performance beyond those variables is based on the observation that requirements for certain jobs are mirrored by the definition of curiosity, as outlined earlier, but not by definitions of these constructs. On the basis of the variance in performance criteria that is uniquely predicted by curiosity, it is proposed that curiosity possesses incremental validity above these constructs. Additional exploratory analyses investigate the impact of demographic variables and job cluster (see Method section) to explore whether the results generalize across gender, age groups, and positions.

The present study utilizes a confirmatory research strategy by *a priori* linking job demands to the construct of curiosity. Therefore, the position under investigation in the present study possesses demands to incumbents which are conceptually related to the personality construct of curiosity (see method section for details). Curiosity was operationalized by a one-dimensional measure of epistemic curiosity, which is in line with the hierarchical conceptualization of curiosity, as outlined earlier; although distinguishing between facets within epistemic curiosity might be interesting for certain research questions, no specific hypotheses were deployed regarding their relevance for work-related outcomes. Regarding the criterion, the present study focussed on the relationship between curiosity and job performance using three measures to assess task proficiency. Although other criteria are of importance and can be expected to be predicted by curiosity as well, task performance is the most often used criterion in personnel psychology. Therefore, as the present study is the first to provide evidence regarding the prediction of job performance by curiosity, it seemed important to address this criterion to allow comparison to the existing literature.

Method

Sample

A total of 320 regularly employed incumbents¹ of a large internationally operating industrial company in the automotive sector participated in the current study. Participants were currently enrolled in a three-year technical (58 percent) or commercial (42 percent) apprenticeship, typically a career entrance position. Jobs within the technical cluster can be classified as realistic in terms of Hollands' (1997) RIASEC model; typical jobs included mechanic, mechatronic technician, parts processor, machine operator, varnisher, and electronics engineer. Within the commercial cluster, typical jobs included industrial clerk, industrial sales representative, management assistant in office communication, management assistant in warehouse logistics, and information technology officer, therefore typical jobs from the conventional domain. On average, participants were 19.3 years old ($SD = 1.99$), 32 percent were female. Regarding school education, the majority had a secondary school degree (60 percent), whereas some had university-entrance diploma (32 percent). *Post hoc* power analyses revealed $\beta = .99$ for a medium correlation of .30 (Cohen, 1988); correlations of .14 and larger are found with power of $\beta > .80$. Participation was voluntary; however, as participants were allowed to take the test during their regularly working hours, response rate was nearly 100%.

Research context

The sample was chosen as work-related curiosity can be expected to be a relevant trait for several requirements of that position. These requirements include (i) work-related learning, an explicit requirement with corresponding federal state examinations within and at the end of the apprenticeship; (ii) organizational change, as the organization recently sold a major business field, also resulting in a changed company name; (iii) socialization, as participants have only recently entered the organization and, therefore, the world of work (within the last two years).

Measures

For the assessment of curiosity, the Work-Related Curiosity Scale (Mussel et al., 2012) was administered. The scale consists of 10 items ($\alpha = .83$) and has a one-dimensional structure (eigenvalues 3.95; 0.91; 0.85; 0.76; . . .). A sample item is *I carry on seeking information until I am able to understand complex issues*. In recent studies, high convergent validities between .71 and .79 have been reported with other curiosity scales such as the Curiosity and Exploration Inventory (Kashdan, Rose, & Fincham, 2004) and Epistemic Curiosity Scale (Litman & Spielberger, 2003). However, in comparison with these scales, the Work-Related Curiosity Scale was specifically developed for research and application in organizations, using a frame-of-reference approach with work-related item contents.

Additionally, subjects responded to several cognitive and non-cognitive constructs to investigate construct-related and incremental validity of curiosity. All these constructs as well as their corresponding measures have been found to be relevant for work-related criteria and have been shown to possess high construct and criterion-related validity. GMA was assessed using a 28-item measure ($\alpha = .91$) with numerical, figural, and verbal contents (S & F Personalpsychologie, 2006), similar to the Wonderlic personality test (Wonderlic, 1992). The test takes approximately 18 minutes, and high validities with job performance (.44, corrected) and training performance (.42) have been reported. Furthermore,

¹Choosing incumbents, rather than applicants, allowed for obtaining measures of job performance. However, using a concurrent validation design might affect results by range restriction due to prior selection of candidates. However, for two reasons, effects of range restriction can be expected to be small or negligible. First, no direct range restriction occurred, as selection was not based on any of the measures used in the present study. Second, selection decisions were based on diverse criteria, including interviews, which are known to have low correlations with the study variables (Huffcutt, 2011).

subjects responded to a battery of 16 tests to assess fluid intelligence (S & F Personalpsychologie, 2004, 2008). Example items include calculation of percentages, rule of three, and reasoning ($\alpha = .86$). Each item had a work-related cover story (e.g., working in warehouse logistic and calculating how much material is needed for packing goods). High convergent validity to other fluid intelligence tests (.74) and criterion-related validity to job performance (.54) and training performance (.42) have been found (Schuler, Mussel, & Schmidtborn, 2008). Additionally, a 10-item situational judgment test ($\alpha = .77$) assessed tacit knowledge. Items tapped typical work-related situations, such as customer service situations, which were formerly developed on the basis of critical incidents. Therefore, participants ranked five alternatives regarding the likelihood that they will behave correspondingly in the respective situation.

Regarding temperamental constructs, the measures administered assessed the Big Five personality traits as well as several criterion-focused occupational personality scales (Ones & Viswesvaran, 2001). The Big Five personality measure is based on 48 items (S & F Personalpsychologie, 2005). Items were specifically developed for work-related contexts using a frame-of-reference approach with work-related item contents. Construct validities with corresponding dimensions of the NEO Five Factor Inventory (Borkenau & Ostendorf, 1993) are .89 for emotional stability, .91 for extraversion, .50 for openness, .65 for agreeableness, and .81 for conscientiousness (somewhat lower construct validities for openness and agreeableness can be explained due to the work-relatedness, as, for example, facets such as openness to feelings or openness to fantasy were not represented). In the present sample, internal consistencies were between .63 and .77 (see Table 1 for details), which seem still acceptable, given the breadth of the constructs on one hand and the length of the measure on the other. Regarding criterion-oriented personality scales, a 45-item measure assessed integrity ($\alpha = .90$; Mussel, 2003), a 20-item measure social competence ($\alpha = .85$; S & F Personalpsychologie, 2001), a 55-item measure achievement motivation ($\alpha = .81$; S & F Personalpsychologie, 2003), and an 81-item measure customer service orientation ($\alpha = .93$; S & F Personalpsychologie, 2007). All tests were administered in proctored environment using the web-based system platform Jobmatcher.

The tests used in this study have been developed for consulting purpose and are, therefore, not publicly available. However, they have been extensively validated, and, over the years, applied to hundreds of thousands of candidates. To overcome the limitation that readers might not be readily familiar with these measures, Table 1 provides complete information regarding construct-related and criterion-related validities for these measures based on the data of the current study. Furthermore, a confirmatory factor analysis with 12 latent variables, one for each measure, showed an acceptable model fit ($\chi^2 = 317$, $df = 165$, $\chi^2/df = 1.9$, goodness-of-fit index = 0.93, $CFI = 0.96$, root mean square residual = 0.04, $RMSEA = 0.05$), which was significantly superior compared with a one-factorial model ($\Delta\chi^2 = 3685$, $df = 67$, $p \leq .000$).

Three indicators measured job performance. First, supervisors provided ratings via a specifically developed task-performance measure used for validation purpose only; that is, no personnel decisions such as promotion or salary were linked to these ratings (see Brandstätter & Schuler, 2004 for details). Examples include reliability in executing work orders, interaction with co-workers, and willingness to work hard, as well as one item assessing overall work performance ($\alpha = .90$ across 15 items). The second indicator, goal attainment, refers to typical tasks that incumbents are given by their supervisors. Supervisors rated the level of goal attainment on 11-point scales. For some participants, two ratings were available, which were subsequently aggregated. Internal consistency across the two ratings was .59, which can be regarded as lower level estimate, as these ratings referred to varying tasks. Third, vocational school grades assessed job-related knowledge and skills via written examinations, at the end of up to five semesters ($\alpha = .91$). All three measures are indicators of task performance, i.e. activities that are formally recognized as part of incumbents jobs (Borman & Motowidlo, 1993). Therefore, in addition to reporting the results separately for goal attainment, supervisory ratings, and vocational school grades, an aggregated value across the three indicators is reported. Aggregating across the three indicators was also supported by results from an exploratory principal component analysis. Indeed, according to the Kaiser–Gutman criterion and parallel analysis (Watkins, 2000), results showed that the three variables can be reasonably explained by one underlying factor, which accounts for 69% of the variance in the manifest variables, with factor loadings of .89 for goal attainment, .73 for supervisory ratings, and .86 for vocational school grades. Furthermore, the three indicators of job performance show acceptable internal

Table 1. Bivariate correlations for all study variables (lower triangle).

	N	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1: Curiosity	320	.83	.26	.13	.25	.43	.66	.62	.23	.36	.68	.56	.68	.10	.48	.46	.48	.29
2: General mental ability	320	.24**	.91	.78	.15	.03	.27	.09	.01	.11	.15	.16	.13	.27	.54	.50	.42	.59
3: Fluid intelligence	320	.12*	.70**	.86	.19	.02	.25	.10	.20	.09	.09	.08	.12	.51	.64	.51	.68	.72
4: Emotional stability	320	.23**	.13*	.17**	.63	.28	.26	.26	.41	.54	.17	.23	.44	.21	.15	.10	.19	.15
5: Extraversion	320	.38**	.03	.01	.25**	.68	.43	.43	.28	.28	.47	.76	.77	.06	.26	.25	.26	.17
6: Openness	320	.59**	.24**	.23**	.23**	.38**	.66	.49	.32	.30	.47	.47	.58	.27	.42	.37	.41	.29
7: Conscientiousness	320	.55**	.08	.09	.23**	.38**	.43**	.77	.44	.46	.53	.41	.67	.08	.34	.31	.49	.26
8: Agreeableness	320	.21**	.01	.10	.36**	.25**	.29**	.39**	.64	.65	.15	.04	.39	.30	.23	.14	.42	.26
9: Integrity	320	.32**	.10	.18**	.48**	.25**	.27**	.41**	.58**	.90	.29	.10	.46	.37	.36	.19	.54	.41
10: Achievement m.	320	.61**	.14*	.08	.15**	.42**	.42**	.47**	.14*	.26**	.81	.59	.61	.08	.32	.32	.33	.27
11: Social competence	320	.50**	.14*	.07	.21**	.68**	.42**	.37**	.04	.09	.52**	.85	.86	.09	.34	.33	.15	.26
12: Customer service o.	320	.61**	.11*	.11*	.40**	.68**	.52**	.60**	.35**	.41**	.54**	.76**	.93	.26	.34	.29	.32	.27
13: Tacit knowledge	320	.08	.22**	.42**	.17**	.05	.22**	.07	.25**	.31**	.06	.08	.21**	.77	.41	.33	.40	.48
14: Job performance	287	.34**	.39**	.46**	.11	.19**	.31**	.24**	.16**	.26**	.23**	.24**	.25**	.30**	.77			
15: Supervisory ratings	224	.33**	.36**	.37**	.07	.18**	.27**	.22**	.10	.14*	.23**	.24**	.21**	.24**	.97	.90	.88	
16: Goal attainment	130	.35**	.30**	.49**	.14	.19*	.30**	.35**	.30**	.39**	.24**	.11	.23**	.29**	.47**	.59	1.00	
17: Vocational school g.	190	.21**	.42**	.52**	.11	.13	.21**	.19*	.19*	.30**	.19**	.18*	.20**	.35**	.46**	.64**	.91	

Note: Achievement m.: Achievement motivation; Customer service o.: Customer service orientation; Vocational school g.: Vocational school grades. In the upper triangle, correlations are corrected for unreliability. Cronbach's alphas are displayed in the diagonal. Construct-related validities (within predictors as well as within criterion variables) were corrected for unreliability in both variables; criterion-related validities were only corrected for unreliability in the criterion; validity generalization methods by Hunter and Schmidt (2004) were applied; regarding reliability estimates, meta-analytic coefficients of .89 for personality variables (Barrick, Mount, & Gupta, 2003), .90 for cognitive variables (Huffcutt, Roth, & McDaniel, 1996), .76 for tacit knowledge (Chan & Schmitt, 2002), and .52 for job performance (Viswesvaran, Ones, & Schmidt, 1996) were used; as discussed, range restriction was not expected, given the design of the study.

* $p < .05$;

** $p < .01$ (for correlations in the lower triangle, i.e., uncorrected for unreliability).

consistency ($\alpha = .77$). In case of missing data on one or two of the three indicators (see Table 1 for sample size), the remaining values served as an indicator for job performance, which seemed appropriate given the results reported earlier.²

Results

No sex differences were found for the Work-Related Curiosity Scale, $F(1, 306) = 0.04$, *ns*. Regarding age, small positive correlations were found (.17), indicating that curiosity might increase with age. However, age was confounded with highest school degree, as on average, participants with university-entrance diploma were older (21.1 years) than participants with secondary school degree (18.6 years). Indeed, controlling for highest school degree, correlation between curiosity and age was not significant any more ($r = .04$).

Bivariate correlations for all variables under investigation can be found in Table 1, which are uncorrected in lower triangle and corrected for unreliability in upper triangle (see Table 1 for details regarding correction methods). Regarding construct-related evidence, small positive and significant correlations were found between curiosity and the two cognitive variables. Thereby, correlations with GMA were somewhat larger, compared with fluid intelligence.

Regarding temperament constructs, high correlations between curiosity and openness were found, as expected. In line with recent findings (Mussel et al., 2012), high correlations were also found with conscientiousness. The work relatedness of curiosity items that include, for example, aspects of achievement and persistence when solving complex problems might explain these results. The latter might also explain high correlations with achievement motivation. However, high correlations with social competence and customer service orientation were unexpected, as neither construct definition nor item content includes interpersonal aspects. It might be assumed that this pattern of results is due to construct saturation by conscientiousness. As noted, correlations between curiosity and conscientiousness were expected, as both constructs include aspects of persistence and hardworking. Furthermore, correlations between social competence and customer service orientation on the one hand and conscientiousness on the other might be due to aspects of goal achievement and work relatedness that these constructs share. However, controlling for conscientiousness only partially reduced the correlation between curiosity and social competence on the one hand (.38) and customer service orientation (.42) on the other. Similarly, controlling for extraversion (which is based on the hypothesis that all three constructs share an aspect of activity) led to similar results. Also, it might be expected that the pattern of results is due to an interest in other people, as mirrored by the construct social curiosity. However, this construct was found to be only moderately correlated with epistemic curiosity (Litman & Pezzo, 2007). Finally, given that all predictor measures were obtained at the same time, it is possible that common method variance partially accounts for high correlations (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003).

In order to estimate the uniqueness of curiosity, it is informative to inspect the magnitude of correlations corrected for unreliability. Indeed, despite the interpretation of correlations as high, none of these variables account for even 50% of variance on a construct level, which underlines the uniqueness of the construct curiosity. Finally, tacit knowledge was unrelated to curiosity.

Regarding criterion-related validity, curiosity was found to be a significant predictor for job performance. The correlation with job performance can be interpreted as high, compared with criterion-related validities of personality variables reported in the literature (Barrick et al., 2001; Ones & Viswesvaran, 2001). Separate analyses for the three performance indicators revealed significant correlations for all indicators, therefore confirming my first hypothesis.

²Unfortunately, some of the supervisors did not report some or all of the three indicators. To ensure that missing data occurred at random, mean differences in curiosity were calculated for cases with or without missing data on each of the three criterion indicators. It turned out that none of the three analyses reached significance ($d = 0.08$ across the three analyses). Furthermore, on average, subjects with or without missing data on one of the three criterion indicators did not differ with regard to the other two indicators ($d = 0.10$ across the six analyses). Therefore, it can be concluded that missing data occurred at random, and, correspondingly, criterion-related results are reported using pairwise deletion of missing data.

As can be seen in Table 1, except for emotional stability, all variables under investigation were significant predictors of job performance. These results are in line with the literature showing that cognitive and non-cognitive variables applied in the present study are relevant for job-related behavior, and they demonstrate that the measures used in the current investigation are appropriate for this purpose. However, given these results on the one hand and the high construct saturation of curiosity by these variables on the other, it is especially crucial to investigate incremental validities of curiosity over and above these variables. Otherwise, it would be reasonable to assume that the criterion-related validity of curiosity is just due to the fact that curiosity measures also assess GMA, conscientiousness, achievement motivation, and so forth.

Table 2 presents results from hierarchical regressions analyses. Multi-collinearity was not present, with tolerance values of .20 or above for all variables. The 12 predictors were entered in four groups, with cognitive ability measures entered in Step 1, Big Five variables in Step 2, criterion-orientated personality tests in Step 3, and tacit knowledge test in Step 4. As can be seen in Table 2, each group of variables incrementally predicted performance; together, the 12 predictors explained 33 percent of variance in the criterion, which was highly significant. The bottom of Table 2 displays standardized beta weights. For testing the hypotheses regarding the incremental validity of curiosity above these predictors, the Work-Related Curiosity Scale was entered as an additional variable in Step 5. Indeed, curiosity had incremental validity over the set of predictors ($\Delta R^2 = .02$; $p = .01$). Accordingly, curiosity was found to have a significant standardized beta weight. These results show clearly that curiosity explains variance in job performance above the variance explained by traditional methods, therefore confirming my second hypothesis.

In addition to the results presented earlier, separate hierarchical regressions for the 12 variables investigated in the present study can be found in Figure 2, indicating the incremental validity of curiosity above each individual variable. To ease interpretation of the various analyses, results are graphically illustrated by using Venn diagrams, which indicate the amount of variance explained by the predictors. For example, validity of curiosity is .34 (Table 1),

Table 2. Results from multiple regression analysis: Incremental validity.

	Step 1	Step 2	Step 3	Step 4	Step 5
Model summary					
R	.47	.54	.56	.58	.59
R^2	.22	.29	.32	.33	.35
R^2_{adj}	.22	.27	.29	.30	.32
ΔR^2	.22	.07	.03	.01	.02
ΔF	40.94	5.17	2.86	5.54	6.76
p	.00	.00	.02	.02	.01
Standardized beta weights					
General mental ability	.16*	.14*	.13	.14*	.11
Fluid intelligence	.36**	.33**	.32**	.27**	.29**
Emotional stability		-.05	-.10	-.09	-.08
Extraversion		.05	-.02	.00	.02
Openness		.13*	.11	.10	.04
Conscientiousness		.12*	.07	.10	.06
Agreeableness		.07	.02	.01	.02
Integrity			.20**	.18**	.16**
Achievement motivation			.03	.04	-.02
Social competence			.16	.16	.16
Customer service orientation			-.07	-.11	-.17
Tacit knowledge				.13*	.14*
Curiosity					.21**

Note: The 13 variables were entered in five steps, with cognitive ability variables in Step 1, Big Five variables in Step 2, criterion-oriented personality tests in Step 3, and tacit knowledge in Step 4. Curiosity was entered as last variable in Step 5.

* $p < .05$;

** $p < .01$.

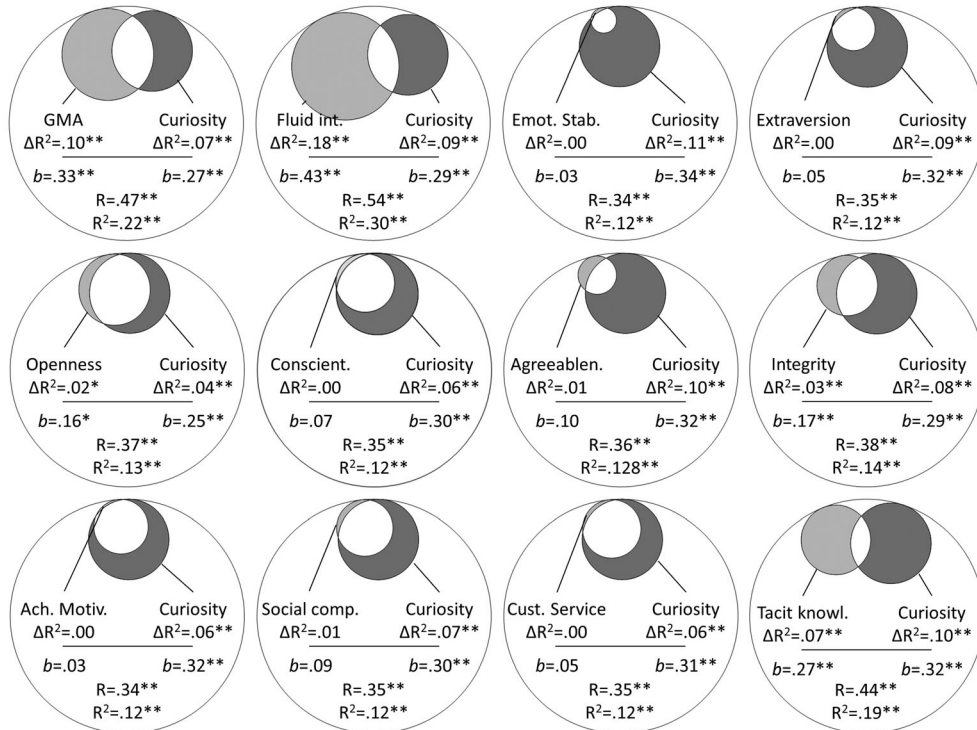


Figure 2. Incremental validities of curiosity over 12 cognitive and non-cognitive predictors (dark gray) and vice versa (light gray)

which equals 11.8 percent of explained variance; therefore, the area of the circle representing curiosity is 11.8 percent, compared with the larger outer circle (representing the variance in the criterion). Variance in the criterion that is explained by both predictors is indicated by the area in which the two predictor circles overlap; on the contrary, non-overlapping areas represent variance proportions that are only explained by one predictor. These areas are shaded in light or dark gray and represent incremental validity of one predictor over the other. Results from corresponding hierarchical regression analyses (ΔR^2 and significance level) can be found next to these shaded areas. The variance explained by both predictors together is represented by the area of both circles together, and corresponding R^2 and significance level can be found at the bottom of each Venn diagram, along with standardized beta weights.

As can be expected from the results presented in Table 2, curiosity had incremental validity above all variables investigated in the present study. Regarding GMA, both variables had incremental validity above each other. Together, these two variables explain 22 percent of variance in job performance, which can be interpreted as high. Similar results were also found for fluid intelligence. Incremental validity of curiosity above fluid intelligence was 9 percent and therefore even larger compared with incremental validity of curiosity over GMA, which can be explained by the differences in construct overlap between the predictors (i.e., smaller correlations between curiosity and fluid intelligence, compared with curiosity and GMA). The variance explained by curiosity and fluid intelligence was 30 percent (uncorrected for reliability) and can be considered as very high.

As for cognitive variables, curiosity had also significant incremental validity above the Big Five personality measures as well as the four criterion-oriented personality scales. These results are strong evidence for the significance of curiosity for predicting work-related outcomes and underline that curiosity can predict and explain behaviors and outcomes that cannot be explained by personality variables that have regularly been utilized in organizational psychology. On the contrary, it is striking that only openness and integrity showed incremental validity above curiosity. A similar pattern was also found for tacit knowledge, with significant incremental validities of curiosity above the

situational judgment test and vice versa. These results suggest that, in the present study, the variance that is explained in the criterion by conscientiousness, emotional stability, extraversion, agreeableness, achievement motivation, social competence, and customer service orientation is also explained by curiosity and that curiosity predicts additional variance in job performance that is not captured by any of these constructs.

Three additional analyses were run. First, given the reported correlation between age and curiosity, results reported in Table 2 were controlled for demographic variables. Therefore, in Step 4, age and gender were included as predictors, in addition to the 12 predictors mentioned earlier ($R = .60$, $R^2 = .36$, $F = 10.5$, $p \leq .00$). It turned out that results did not change; that is, curiosity significantly predicted job performance above the variance explained by each of the 12 predictors, together with age and gender ($\Delta R^2 = .02$; $p = .01$).

Second, a potential moderator effect for age and gender was investigated. Therefore, the multiple regression reported earlier was extended by including interaction terms between curiosity and these variables in Step 6. It turned out that the interaction terms did not explain incremental variance ($\Delta R^2 = .006$, $F = 1.22$, $p = .30$), and neither term was found to have significant beta weights ($b = -.01$, $p = .79$ for age * curiosity, $b = .08$, $p = .14$ for gender * curiosity).

Third, an additional analysis was made to investigate whether validity for curiosity was moderated by position (technical vs. commercial). Using a general linear model, it turned out that the interaction between curiosity and position was not significant for job performance ($F = 0.81$, $p = .37$). Therefore, it can be concluded that validity for curiosity generalizes across the two positions investigated in the present study.

Discussion

Curiosity has been found to be an important variable for a wide range of criteria and life domains, such as building interpersonal relationships (Kashdan & Roberts, 2004), subjective well-being (Kashdan & Steger, 2007), advertising (Menon & Soman, 2002), school-related (Day, 1982) and academic-related (von Stumm, Hell, & Chamorro-Premuzic, 2010) learning, cognitive development (Sternberg, 1994), meaning of life (Kashdan & Steger, 2007), health (Gallagher & Lopez, 2007), and even mortality rates (Swan & Carmelli, 1996). On the contrary, research has largely neglected the role of curiosity with regard to work-related outcomes. Given the changes in the world of work as a result of globalization, economic changes, or technological developments, it can be expected that demands for which curiosity is a relevant predictor will become more and more important; therefore, it can be assumed that curiosity is more important today than it used to be, and it can be predicted that its significance is likely to rise, rather than to decline. Furthermore, insofar as job demands are mirrored uniquely by curiosity, it has been proposed that curiosity explains variance in job performance above the variance explained by constructs that have been traditionally investigated in organizational psychology.

The hypothesis was tested using a confirmatory research approach by selecting an organization and a position that holds requirements that can be interpreted as demands for the construct curiosity. Especially, employees of a particular organization had to deal with an ongoing change process that resulted from selling off a major business field; furthermore, high demands on learning and knowledge acquisition were set, both for socialization, as they just recently started with their first job, and for completing the federal state examinations at the end of their apprenticeship. However, it is important to note that the job requirements of the present study are not exceptional or extraordinary. On average, employees enter a new organization every four years, which each time requires them to adapt to the new situation. Organizations undergo a major restructuring, such as changing from a functional structure to a divisional structure once every three to five years (Jefferson, 1970). Furthermore, lifelong learning is required for almost every job, and the apprenticeship under investigation in the present study is chosen by 36 percent as qualification in Germany (Statista, 2010). Therefore, although it is important to state that the significance of curiosity is depending on the specific requirements that are set by the task, the team, or the organization, it is likely that many jobs actually possess such requirements.

Results from the present study suggested that curiosity has high predictive validity for task performance. Furthermore, significant incremental validity above a total of 12 variables, including GMA, Big Five personality traits, integrity, social competence, customer service orientation, and tacit knowledge, confirms the hypothesis that curiosity captures variance in the criterion above the variance that traditional predictors explain. These results show clearly that curiosity explains variance in job performance that cannot be explained by these variables, probably because aspects such as the preference of behaviors, for example, learning and thinking are of particular importance (at least in the present sample) and are not fully covered by the personality variables traditionally used in personnel psychology.

Practical implications

The present research has major implications for applied purposes. Certainly, the main contribution is with regard to recruiting and selecting. On the basis of the results from the present study, it could be demonstrated that an important work-related criterion, namely job performance, was predicted by a measure of curiosity. Therefore, for jobs comparable with the one investigated in the present research, the application of measures of curiosity for selection and promotion is recommended. Furthermore, it can be expected that curiosity will also possess validity for other jobs, given that the demands of the particular position are of relevance with regard to the construct. For example, if a position is to be filled for a specialist in research and development, typical requirements are problem solving, fostering innovations, and dealing with complexity; given that these requirements activate curiosity, individuals with higher levels of curiosity are more likely to perform well, compared with individuals with lower levels. Future studies are needed to investigate these relationships and their underlying mechanisms.

Regarding applied purposes, such as recruiting and selecting, it is especially important to also keep in mind the results regarding the validity of curiosity in context of predictors with well-known validity. Selection decisions are usually based on a combination of several indicators, each of which can be expected to relate to performance criteria as defined by the organization. Especially, cognitive ability tests, which are known to have high validity, are used often in a selection context (Schuler, Hell, Trapmann, Schaar, & Boramir, 2007). Therefore, the use of additional indicators must be justified with regard to their incremental validity, above predictors that used to be available. Indeed, regarding job performance, curiosity possessed incremental validity above 12 predictors, which represent a state-of-the-art test battery. On the basis of uncorrected validities, these predictors explained 33 percent of variance in job performance ratings. However, curiosity added significantly to that prediction, with additional 2 percent of explained variance.

Even though practitioners are keen on using test batteries with high validity, they also have to keep other aspects in mind, such as test time. Therefore, using a large test battery is usually expensive, both regarding the costs for test licenses and for administering them. Furthermore, candidates less prefer tests lasting for several hours, which in turn affects the acceptance of the recruiting process and the image of the organization negatively. For example, the test battery used for the present study took, on average, three and a half hours, a duration that might not be accepted under certain circumstances. The multiple regression analysis presented in Table 2 indicated that only 4 of 13 predictors had significant beta weights: fluid intelligence, tacit knowledge, integrity, and curiosity. Indeed, these four measures explained 32 percent in variance, and adding all other variables did not result in a significant improvement in validity, $F(11, 257) = 1.2, p = .32$. Especially, the 10-item Work-Related Curiosity Scale takes about four minutes to complete. Therefore, it is through using curiosity in selection situations that a test battery with high validity and reasonable length can be provided.

Another aspect that might be relevant for applied purposes refers to fostering behavior related to curiosity. If behavior such as acquiring new knowledge is correlated with performance, an alternative to selecting employees with corresponding personality profiles would be to foster curiosity-related behavior of those who have already been selected and are currently employed. Referring to the pedagogical literature, there are several examples of fostering inquiry learning (van Zee, Hammer, Bell, Roy, & Peter, 2005), raising curiosity and enthusiasm for the learning

process (Alvarado & Herr, 2003), promoting students' exploration and appropriation of knowledge through curiosity and thinking (Hill & McGinnis, 2007), or using questions and answers to promote scientific inquiry and intelligence development (Sternberg, 1994). Most of these approaches have been conducted with children, and transferring these findings to a work setting is still to be carried out. Therefore, fostering curiosity rather points to a future applied setting.

In sum, the findings of the present study suggest that curiosity is an important individual difference variable in work settings. Enhancing curiosity-related behavior might be an important application for the future. Using measures of curiosity for recruiting and selecting is immediately recommended from the results of the present study. Especially, the Work-Related Curiosity Scale (Mussel et al., 2012) can be recommended, as it is the only curiosity measure that has been developed within a frame-of-reference approach for a work context. Such contextualized measures have been found to have higher criterion-related validity and are more accepted by test takers, compared with non-contextualized measures (Hough & Oswald, 2008; Heggstad & Gordon, 2008).

Limitations and Future Research

The purposes of the present study were to introduce curiosity to work and organizational psychology and to provide evidence that curiosity explains variance in the criterion that is not explained by traditional predictors. However, although the hypotheses were confirmed for the criterion of job performance, the present study did not investigate *why* individuals with higher levels of curiosity actually perform better. For example, it might be expected that job knowledge mediates the relationship between curiosity and performance. Investigating these processes is important to understand why curiosity relates to performance and how curiosity can be activated, maintained, and raised. Although the investigation of mediating processes was beyond the scope of the present study, future research should investigate the processes and circumstances that explain why curiosity predicts performance.

Next, expanding the criterion domain can be expected to provide a fruitful avenue for future research. The present study reported results for job performance, assessed by three indicators. However, other criteria such as training performance or adaptability might also be expected to be predicted by curiosity. Furthermore, it is possible that job satisfaction and commitment are related to curiosity, as curiosity was found to correlate with well-being and meaning in life (Kashdan & Steger, 2007). Also, creative contributions and withdrawal behavior are important criteria for future research. On another note, curiosity might be an important individual difference variable that interacts with training designs with regard to learning and performance in the context of workplace learning; for example, individuals high in curiosity might be expected to more strongly benefit from learner-centered training designs or error training (Bell & Kozlowski, 2010).

Moreover, the present study investigated incremental validity above 12 variables, including several cognitive tests, Big Five personality factors, criterion-oriented personality scales, and tacit knowledge. However, given that reliability for some of the Big Five factors was only moderate, future research is needed to replicate incremental validity of curiosity above the Big Five, using a measure with a larger number of items. Furthermore, it would be interesting to expand the list even further. Among others, vocational interests, especially investigative interests, and intrinsic motivation are occasionally used variables in selection procedures that have not been covered by the present study. Likewise, although measures of GMA and fluid ability were available, crystallized intelligence was not investigated. Given high construct saturation, it would also be interesting to compare validity of curiosity with those of need for cognition or typical intellectual engagement; as these variables have barely been investigated in selection settings, results might point to promising new areas of research. A similar point can be made for constructs such as novelty, cognitive flexibility, learning goal orientation, and adaptability.

A final area for future research refers to the circumstances and requirements under which curiosity is relevant for work-related behavior. For example the testing situation might have an impact on the validity of curiosity. In the present study, subjects participated voluntarily. Therefore, the effect of high stakes situations needs to be

investigated, especially with regard to faking. Furthermore, validity of curiosity can be expected to depend on the specific requirements of the position. Although it is not expected that curiosity—in its epistemic form, as investigated in the present research—will be negatively related to performance, the strength of the relationship is likely to vary from not important at all (i.e., uncorrelated) to very important (such as in the present study, or beyond). Trait activation theory (Tett & Burnett, 2003) provides a sound theoretical framework for such analyses, including the investigation of demands, distracters, and constraints that moderate curiosity–performance relationships.

Acknowledgements

I thank Maik Spengler and three anonymous reviewers for their valuable comments on an earlier version of the manuscript. Furthermore, I thank the HR Diagnostics AG for supporting the process of data collection, including the administration of cognitive and non-cognitive measures and the use of the system platform Jobmatcher.

Author biography

Patrick Mussel is a postdoctoral research assistant in the Department of Psychology, Julius-Maximilians University of Würzburg, Germany. His professional interests focus on personality, including structure, measurement, neural foundation, and applications in the organizational context.

References

- Ackerman, P. L., & Heggestad, E. D. (1997). Intelligence, personality, and interests: Evidence for overlapping traits. *Psychological Bulletin*, *121*, 219–245.
- Alberti, E. T., & Witryol, S. L. (1994). The relationship between curiosity and cognitive ability in third- and fifth-grade children. *Journal of Genetic Psychology*, *155*, 129–145.
- Allworth, E., & Hesketh, B. (1999). Construct-oriented biodata: Capturing change-related and contextually relevant future performance. *International Journal of Selection and Assessment*, *7*, 97–111.
- Alvarado, A. E., & Herr, P. R. (2003). *Inquiry-based learning using everyday objects: Hands-on instructional strategies that promote active learning in grades 3–8*. Thousand Oaks, CA: Corwin Press.
- Amabile, T. M., Hill, K. G., Hennessey, B. A., & Tighe, E. M. (1994). The work preference inventory: Assessing intrinsic and extrinsic motivational orientations. *Journal of Personality and Social Psychology*, *66*, 950–967.
- Arnone, M. P., Grabowski, B. L., & Rynd, C. P. (1994). Curiosity as a personality variable influencing learning in a learner controlled lesson with and without advisement. *Educational Technology Research and Development*, *42*, 5–20.
- Barrick, M. R., & Mount, M. K. (1991). The Big Five personality dimensions and job performance: A meta-analysis. *Personnel Psychology*, *44*, 1–26.
- Barrick, M. R., Mount, M. K., & Gupta, R. (2003). Meta-analysis of the relationship between the five-factor model of personality and Holland's occupational types. *Personnel Psychology*, *56*(1), 45–74.
- Barrick, M. R., Mount, M. K., & Judge, T. A. (2001). Personality and performance at the beginning of the new millennium: What do we know and where do we go next? *International Journal of Selection and Assessment*, *9*, 9–30.
- Bell, B. S., & Kozlowski, S. W. J. (2010). Toward a theory of learner-centered training design: An integrative framework of active learning. In S. W. J. Kozlowski, & E. Salas (Eds.), *Learning, training, and development in organizations* (pp. 263–300). New York, NY: Routledge.
- Berlyne, D. E. (1960). *Conflict, arousal, and curiosity*. McGraw-Hill series in psychology. New York, NY: McGraw-Hill.
- Berlyne, D. E. (1978). Curiosity and learning. *Motivation and Emotion*, *2*, 97–175.
- Borkenau, P., & Ostendorf, F. (1993). *NEO-Fünf-Faktoren-Inventar (NEO-FFI) nach Costa und McCrae*. Handanweisung. Göttingen: Hogrefe.

- Borman, W. C., & Motowidlo, S. J. (1993). Expanding the criterion domain to include elements of contextual performance. In N. Schmitt, & W. C. Borman (Eds.), *Personnel selection in organizations* (pp. 71–98). San Francisco, CA: Jossey-Bass.
- Brandstätter, H., & Schuler, H. (2004). Overcoming halo and leniency—A new method of merit rating. In H. Schuler (Hrsg.), *Beurteilung und Förderung beruflicher Leistung* (pp. 359–363). Göttingen: Hogrefe.
- Brody, N. (1992). *Intelligence* (2nd ed.). New York, NY: Academic Press.
- Byman, R. (2005). Curiosity and sensation seeking: A conceptual and empirical examination. *Personality and Individual Differences*, *38*, 1365–1379.
- Cacioppo, J. X., Petty, R. E., Kao, C. F., & Rodriguez, R. (1986). Central and peripheral routes to persuasion: An individual difference perspective. *Journal of Personality and Social Psychology*, *51*, 1032–1043.
- Cascio, W. F. (2010). The changing world of work. In P. A. Linley, S. Harrington, & N. Garcea (Eds.), *Oxford handbook of positive psychology and work* (pp. 13–24). New York, NY: Oxford University Press.
- Chan, D., & Schmitt, N. (2002). Situational judgement and job performance. *Human Performance*, *15*, 233–254.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Collins, R. P., Litman, J. A., & Spielberger, C. D. (2004). The measurement of perceptual curiosity. *Personality and Individual Differences*, *36*, 1127–1141.
- Crant, J. M. (2000). Proactive behavior in organizations. *Journal of Management*, *26*, 435–462.
- Day, H. I. (1971). The measurement of specific curiosity. In H. I. Day, D. E. Berlyne, & D. E. Hunt (Eds.), *Intrinsic motivation: A new direction in education*. New York, NY: Holt, Rinehart & Winston.
- Day, H. I. (1982). Curiosity and the interested explorer. *Performance and Instruction*, *21*, 19–22.
- Deci, E. L. (1976). Notes on the theory and meta-theory of intrinsic motivation. *Organizational Behavior and Human Performance*, *15*, 130–145.
- Deci, E. L., & Ryan, R. M. (1993). Die Selbstbestimmungstheorie der Motivation und ihre Bedeutung für die Pädagogik [Self-determination theory and its significance for pedagogy]. *Zeitschrift für Pädagogik*, *39*, 223–228.
- Digman, J. M. (1990). Personality structure: Emergence of the five-factor model. *Annual Review of Psychology*, *41*, 417–440.
- Gallagher, M. W., & Lopez, S. J. (2007). Curiosity and well-being. *The Journal of Positive Psychology*, *2*, 236–248.
- Griffin, M. A., Neal, A., & Parker, S. K. (2007). A new model of work role performance: Positive behavior in uncertain and interdependent contexts. *Academy of Management Journal*, *50*, 327–347.
- Harrison, S., Sluss, D. M., Ashforth, B. E. (2011). Curiosity adapted the cat: The role of trait curiosity in newcomer adaptation. *Journal of Applied Psychology*, *96*, 211–220.
- Heggstad, E. D., & Gordon, H. L. (2008). An argument for context-specific personality assessments. *Industrial and Organizational Psychology*, *1*, 320–322.
- Hill, M. E., & McGinnis, J. (2007). The curiosity in marketing thinking. *Journal of Marketing Education*, *29*, 52–62.
- Holland, J. L. (1997). *Making vocational choices. A theory of work personalities and work environments*. Odessa: Psychological Assessment Resources, Inc.
- Hough, L. M., & Oswald, F. L. (2008). Personality testing and industrial–organizational psychology: Reflections, progress, and prospects. *Industrial and Organizational Psychology: Perspectives on Science and Practice*, *1*, 272–290.
- Huffcutt, A. (2011). An empirical review of the employment interview construct literature. *International Journal of Selection and Assessment*, *19*, 62–81.
- Huffcutt, A. I., Roth, P. L., & McDaniel, M. A. (1996). A meta-analytic investigation of cognitive ability in employment interview evaluations: Moderating characteristics and implications for incremental validity. *Journal of Applied Psychology*, *81*, 459–474.
- Hunter, J. E., & Schmidt, F. L. (2004). *Methods of meta-analysis: Correcting error and bias in research findings*. Newbury Park, CA: Sage.
- James, W. (1890/1950). *The principles of psychology*. Oxford, England: Dover Publications.
- Jefferson, R. (1970). Planning and the innovation process. *Progress in Planning*, *1*, 233–312.
- Jobmatcher: Web-based system platform [Software]*. Stuttgart, Germany: HR Diagnostics AG.
- Jones, S. (1979). Curiosity and knowledge. *Psychological Reports*, *45*, 639–642.
- Kang, M. J., Hsu, M., Krajchich, I. M., Loewenstein, G., McClure, S. M., Wang, J. T., & Camerer, C. F. (2009). The wick in the candle of learning: Epistemic curiosity activates reward circuitry and enhances memory. *Psychological Science*, *20*, 963–973.
- Kashdan, T. B., Gallagher, M. W., Silvia, P. J., Winterstein, B. P., Breen, W. E., Terhar, D., & Steger, M. F. (2009). The Curiosity and Exploration Inventory—II: Development, factor structure, and psychometrics. *Journal of Research in Personality*, *43*, 987–998.
- Kashdan, T. B., & Roberts, J. E. (2004). Social anxiety's impact on affect, curiosity, and social self-efficacy during a high self-focus social threat situation. *Cognitive Therapy and Research*, *28*, 119–141.
- Kashdan, T. B., Rose, P., & Fincham, F. D. (2004). Curiosity and exploration: Facilitating positive subjective experiences and personal growth opportunities. *Journal of Personality Assessment*, *82*, 291–305.

- Kashdan, T. B., & Steger, M. F. (2007). Curiosity and pathways to well-being and meaning in life: Traits, states, and everyday behaviors. *Motivation and Emotion, 31*, 159–173.
- Kets de Vries, M., & Mead, C. (1991). Identifying management talent for a pan-European environment. In S. Makridakas (Ed.), *Single market Europe* (pp. 215–235). San Francisco, CA: Jossey-Bass.
- Krapp, A. (1998). Entwicklung und Förderung von Interessen im Unterricht. *Psychologie in Erziehung und Unterricht, 44*, 185–201.
- Lazarus, R. S. (1991). *Emotion and adaptation*. New York, NY: Oxford University Press.
- Litman, J. A., Collins, R. P., & Spielberger, C. D. (2005). The nature and measurement of sensory curiosity. *Personality and Individual Differences, 39*, 1123–1133.
- Litman, J. A., & Jimerson, T. L. (2004). The measurement of curiosity as a feeling of deprivation. *Journal of Personality Assessment, 82*, 147–157.
- Litman, J. A., & Pezzo, M. V. (2007). Dimensionality of interpersonal curiosity. *Personality and Individual Differences, 43*, 1448–1459.
- Litman, J. A., & Silvia, P. J. (2006). The latent structure of trait curiosity: Evidence for interest and deprivation curiosity dimensions. *Journal of Personality Assessment, 86*, 318–328.
- Litman, J. A., & Spielberger, C. D. (2003). Measuring epistemic curiosity and its diversive and specific components. *Journal of Personality Assessment, 80*, 75–86.
- Loewenstein, G. (1994). The psychology of curiosity: A review and reinterpretation. *Psychological Bulletin, 116*, 75–98.
- Maw, W. H., & Maw, E. W. (1970). Nature of creativity in high- and low-curiosity boys. *Developmental Psychology, 2*, 325–329.
- McCall, M. (1994). Identifying leadership potential in future international executives: Developing a concept. *Consulting Psychology Journal, 46*, 49–63.
- Menon, S., & Soman, D. (2002). Managing the power of curiosity for effective web advertising strategies. *Journal of Advertising, 31*, 1–14.
- Morgeson, F. P., Campion, M. A., Dipboye, R. L., Hollenbeck, J. R., Murphy, K., & Schmitt, N. (2007). Reconsidering the use of personality tests in personnel selection contexts. *Personnel Psychology, 60*, 683–729.
- Moutafi, J., Furnham, A., & Crump, J. (2006). What facets of openness and conscientiousness predict fluid intelligence score? *Learning and Individual Differences, 16*, 31–42.
- Mussel, P. (2003). Persönlichkeitsinventar zur Integritätsabschätzung (PIA) [Integrity test PIA]. In J. Erpenbeck, & L. v. Rosenstiel (Hrsg.), *Handbuch Kompetenzmessung* (S. 3–18). Stuttgart: Schäffer-Poeschel.
- Mussel, P. (2010). Epistemic curiosity and related constructs: Lacking evidence of discriminant validity. *Personality and Individual Differences, 49*, 506–510.
- Mussel, P. (2011, July). A theoretical framework for the personality of intellectual achievements. Paper presented at the meeting of the International Society for the Study of Individual Differences, London.
- Mussel, P., Spengler, M., Litman, J. A., & Schuler, H. (2012). Development and validation of the German work-related curiosity scale. *European Journal of Psychological Assessment, 28*(2), 109–117.
- Mussel, P., Winter C., Gelléri, P., & Schuler, H. (2011). Explicating the openness to experience construct and its sub-dimensions and facets in a work setting. *International Journal of Selection and Assessment, 19*, 145–156.
- Naylor, F. D. (1981). A State-Trait Curiosity Inventory. *Australian Psychologist, 16*, 172–183.
- Olson, K. R., Camp, C. J., & Fuller, D. (1984). Curiosity and need for cognition. *Psychological Reports, 54*, 71–74.
- Ones, D. S., Dilchert, S., Viswesvaran, C., & Judge, T. (2007). In support of personality assessments in organizational settings. *Personnel Psychology, 60*, 995–1027.
- Ones, D. S., & Viswesvaran, C. (2001). Integrity tests and other criterion-focused occupational personality scales (COPS) used in personnel selection. *International Journal of Selection and Assessment, 9*, 31–39.
- Ones, D. S., Viswesvaran, C., & Schmidt, F. L. (1993). Comprehensive meta-analysis of integrity test validities: Findings and implications for personnel selection and theories of job performance. *Journal of Applied Psychology, 78*, 679–703.
- Podsakoff, P. M., MacKenzie, S. B., Lee, J., & Podsakoff, N. P. (2003). Common method bias in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology, 88*, 879–903.
- Pulakos, E. D., Arad, S., Donovan, M. A., & Plamondon, K. E. (2000). Adaptability in the workplace: Development of a taxonomy of adaptive performance. *Journal of Applied Psychology, 85*, 612–624.
- Reio, Jr., T. G., & Wiswell, A. (2000). Field investigation of the relationship among adult curiosity, workplace learning, and job performance. *Human Resource Development Quarterly, 11*, 5–30.
- Renner, B. (2006). Curiosity about people: The development of a social curiosity measure in adults. *Journal of Personality Assessment, 87*, 305–316.
- Roe, R. A. (2010, July). What is new in work psychology? State-of-the-art lecture. 27th International Conference of Applied Psychology, Melbourne, Australia.
- Rothstein, M. G., & Goffin, R. D. (2006) The use of personality measures in personnel selection: What does current research support? *Human Resource Management Review, 16*, 155–180.
- S & F Personalpsychologie Managementberatung GmbH. (2001). VSI. Unpublished test.

- S & F Personalpsychologie Managementberatung GmbH. (2003). BMT-A. Unpublished test.
- S & F Personalpsychologie Managementberatung GmbH. (2004). PROFFICE. Unpublished test.
- S & F Personalpsychologie Managementberatung GmbH. (2005). Take5. Unpublished test.
- S & F Personalpsychologie Managementberatung GmbH. (2006). KAPPA. Unpublished test.
- S & F Personalpsychologie Managementberatung GmbH. (2007). Custom!ze. Unpublished test.
- S & F Personalpsychologie Managementberatung GmbH. (2008). PRODUCTION. Unpublished test.
- Schiefele, U., & Schreyer, I. (1994). Intrinsische Lernmotivation und Lernen. Ein Überblick zu Ergebnissen der Forschung. *Zeitschrift für Pädagogische Psychologie*, 8, 1–13.
- Schmidt, F. L., & Hunter, J. E. (1998). The validity and utility of selection methods in personnel psychology: Practical and theoretical implications of 85 years of research findings. *Psychological Bulletin*, 124, 262–274.
- Schmidt, F. L., & Hunter, J. E. (2004). General mental ability in the world of work: Occupational attainment and job performance. *Journal of Personality and Social Psychology*, 86, 162–173.
- Schuler, H., Hell, B., Trapmann, S., Schaar, H., & Boramir, I. (2007). Die Nutzung psychologischer Verfahren der externen Personalauswahl in deutschen Unternehmen [Use of psychological assessment tools for selecting external candidates in German companies]. *Zeitschrift für Personalpsychologie*, 6, 60–70.
- Schuler, H., Mussel, P., & Schmidtborn, A. B. (2008, April). Crossing GMA and work samples: Hybrid tests as multimodal conceptualizations. Paper presented at the 23rd annual conference of the Society for Industrial and Organizational Psychology, San Francisco.
- Seaton, C. L., & Beaumont, S. L. (2008). Individual differences in identity styles predict proactive forms of positive adjustment. *Identity*, 8, 249–268.
- Silvia, P. J. (2008a). Appraisal components and emotion traits: Examining the appraisal basis of trait curiosity. *Cognition & Emotion*, 22, 94–113.
- Silvia, P. J. (2008b). Interest—The curious emotion. *Current Directions in Psychological Science*, 17, 57–60.
- Spreitzer, G. M., McCall, M. W., & Mahoney, J. D. (1997). Early identification of international executive potential. *Journal of Applied Psychology*, 82, 6–29.
- Statista. (2010). Welche Art von Ausbildung oder Weiterbildung machen Sie zurzeit? Available online: <http://de.statista.com/statistik/diagramm/studie/108042/umfrage/art-der-ausbildung-oder-weiterbildung>
- Sternberg, R. J. (1994). Answering questions and questioning answers. *Phi Delta Kappa*, 76, 136–139.
- von Stumm, S., Hell, B., & Chamorro-Premuzic, T. (2010, September). Neugier als dritte Säule der Studienleistung [Curiosity predicts academic performance]. Paper presented at the 47. Congress of the Deutschen Gesellschaft für Psychologie, Bremen, Germany.
- Swan, G. E., & Carmelli, D. (1996). Curiosity and mortality in aging adults: A 5-year follow-up of the Western Collaborative Group Study. *Psychology and Aging*, 11, 449–453.
- Tett, R. P., & Burnett, D. D. (2003). A personality trait-based interactionist model of job performance. *Journal of Applied Psychology*, 88, 500–517.
- Tett, R. P., & Christiansen, N. D. (2007). Personality tests at the crossroads: A response to Morgeson, Campion, Dipboye, Hollenbeck, Murphy, and Schmitt. *Personnel Psychology*, 60, 967–993.
- Tett, R. P., Jackson, D. N., & Rothstein, M. (1991). Personality measures as predictors of job performance: A meta-analytic review. *Personnel Psychology*, 44, 703–742.
- Tett, R. P., Jackson, D. N., Rothstein, M. G., & Reddon, J. R. (1999). Meta-analysis of bidirectional relations in personality–job performance research. *Human Performance*, 12, 1–29.
- Van der Zee, K. I., & Van Oudenhoven, J. P. (2000). The multicultural personality questionnaire: A multidimensional instrument of multicultural effectiveness. *European Journal of Personality*, 14, 291–309.
- Vidler, D., & Rawan, H. (1974). Construct validity of a scale of academic curiosity. *Psychological Reports*, 35, 263–266.
- Viswesvaran, C., Ones, D. S., & Schmidt, F. L. (1996). Comparative analysis of the reliability of job performance ratings. *Journal of Applied Psychology*, 81, 557–574.
- Watkins, M. W. (2000). *Monte Carlo PCA for parallel analysis [Computer Software]*. State College, PA: Ed & Psych Associates.
- Wonderlic, E. F. (1992). *Manual of the Wonderlic personnel test & scholastic level exam II*. Vernon Hills, IL: Wonderlic Personnel Test, Inc.
- van Zee, E. H., Hammer, D., Bell, M., Roy, P., & Peter, J. (2005). Learning and teaching science as inquiry: A case study of elementary school teachers' investigations of light. *Science Education*, 89, 1007–1042.
- Zuckerman, M. (1994). *Behavioural expressions and biosocial bases of sensation seeking*. Cambridge: Cambridge University Press.