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Focal Article

The Assessment of 21st Century Skills in Industrial and Organizational Psychology: Complex and Collaborative Problem Solving

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In this article, we highlight why and how industrial and organizational psychologists can take advantage of research on 21st century skills and their assessment. We present vital theoretical perspectives, a suitable framework for assessment, and exemplary instruments with a focus on advances in the assessment of human capital. Specifically, complex problem solving (CPS) and collaborative problem solving (ColPS) are two transversal skills (i.e., skills that span multiple domains) that are generally considered critical in the 21st century workplace. The assessment of these skills in education has linked fundamental research with practical applicability and has provided a useful template for workplace assessment. Both CPS and ColPS capture the interaction of individuals with problems that require the active acquisition and application of knowledge in individual or group settings. To ignite a discussion in industrial and organizational psychology, we discuss advances in the assessment of CPS and ColPS and propose ways to move beyond the current state of the art in assessing job-related skills.

When examining the tasks that people perform in their daily workplaces, we see a trend in recent decades toward increases in the importance of nonroutine and interactive tasks. This trend is accompanied by a corresponding decline in routine operations. Jobs that previously entailed repetitive and routine work have been either extended to include nonroutine tasks or removed altogether (e.g., Autor, Levy, & Murnane, 2003; Cascio, 1995). That is, developments in the working world are emphasizing tasks that require active problem solving and that include the need to collaborate with others.

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By contrast, the number of tasks that people can perform by relying on organizational routines and practices is declining. In economic research, these broader trends have been labeled skill-based technological change, job polarization, and offshoring and have led to a range of insights into the enormous breadth and worldwide scope of the increases in nonroutine and interactive tasks (e.g., Autor, Katz, & Kearney, 2006; Autor et al., 2003; Baumgarten, Geishecker, & Görg, 2010; Becker, Ekholm, & Muendler, 2013; Goos & Manning, 2007; Goos, Manning, & Salomons, 2009; Grossman & Rossi-Hansberg, 2008; Spitz-Oener, 2006).

Widely visible examples of increasing workplace sophistication include the expansion of the role of the modern secretarial staff, the emergence of mechatronics engineers, and the recent extension of the board of directors to include chief operating officers. Secretarial staff members have been taking over former managerial tasks, such as planning, organizing, and supporting meetings and conferences, which is even leading to adaptations of secretarial vocational education. Mechatronics engineering combines several different disciplines into one occupation (i.e., mechanical engineer, electric engineer, and computer scientist), and this job profile itself is an answer to multidisciplinary job demands. On a structural level, organizations increasingly employ chief operating officers, who help to deliver operational excellence in a work environment of increasing complexity. Across industries, chief operating officers have become common on most companies' supervisory boards because of the increase in the numbers of nonroutine and interactive problems. By contrast, only a relatively small number of companies employed executives in this position just 2 decades ago.

As a result of the increasing numbers of nonroutine and interactive tasks, individuals, groups, and organizations are faced with a host of new challenges. Across a wide range of jobs, individuals need to engage in on-the-spot problem-solving behavior without the possibility of resorting to well-defined organizational practices and routines (e.g., Middleton, 2002) and without sufficient time and resources to make decisions about problem-solving measures by following rational models of problem solving (e.g., G. Klein, Orasanu, Calderwood, & Zsambok, 1993; Zsambok & Klein, 1997). In addition, problems increasingly involve the collaboration of multiple individuals from various backgrounds, thus leading to new job requirements; for instance, the integration of diverse pathways toward problem solving within a group comprising members from different backgrounds (e.g., Keane & Nair, 2001; C. Klein, DeRouin, & Salas, 2006, Reiter-Palmon & Illies, 2004).

Organizations consequently need to select, guide, and train individual employees, teams, and leaders who are capable of dealing with emerging job requirements (e.g., Vargas Cortes & Beruvides, 1996). For instance, given the broad range of challenges awaiting a mechatronics engineer taking care of an assembly-line robot in a manufacturing plant, he or she has to be able to anticipate, recognize, and communicate problems within a diverse team. Such an engineer also has to quickly become acquainted with a vast array of complex systems that require immediate and creative solutions when problems occur. In summary, this engineer has to cope with the increased importance of nonroutine and interactive tasks.

As one result, this rise in the importance of nonroutine and interactive tasks has led to broad efforts on multiple levels to specify the accompanying shifts in requirements and skill sets and the facilitation of skills summarized under the umbrella of so-called 21st century skills (e.g., Griffin, McGaw, & Care, 2012; National Research Council, 2012; Organisation for Economic Co-operation and Development 2013c, 2013d). Widely visible, these trends toward nonroutine and interactive tasks have found their way into prominent large-scale assessment efforts such as the Organisation for Economic Co-operation and Development's (OECD's) Programme for the International Student Assessment (PISA; OECD, 2013c, 2013d), which assesses the competencies of more than half a million students worldwide, and the Programme for the International Assessment of Adult Competencies (OECD, 2013b), which targets adult competencies. Whereas those engaged in these efforts used to focus on assessing the skills that individuals acquired during formal education in relation to classical domains such as mathematics and reading, these efforts increasingly feature the assessment of the skills that enable individuals to successfully cope with the requirements of the 21st century and a lifelong perspective.

The realm of general cognitive research has identified two 21st century skills that are strongly related to the demands that have been produced by the changes in the working lives of individuals (e.g., successfully addressing new and complex problems and working collaboratively on a team). The two concepts we deem especially relevant are complex problem solving and collaborative problem solving (CPS and ColPS), a view that is shared by the OECD (OECD, 2013c, 2013d) and other stakeholders (e.g., National Research Council, 2012).

Whereas CPS deals with individuals' transversal skill in successfully handling complex and intransparent situations (i.e., those without a readily apparent solution), requiring the active acquisition and application of knowledge in various domains, ColPS is directed toward problem solving in group settings, adding the necessity of social skills to the ones captured by CPS (e.g., Greiff, 2012; OECD, 2013d). For the mechatronics engineer, these skills can be directly linked to the problems that require attention on a regular basis. Not only do these problems require the gathering of knowledge to generate the understanding of multiple interrelated problem features (e.g., technical and safety requirements, time for implementation, etc.), they also need to be solved in an environment in which vital information is distributed across different members of teams and levels of hierarchies.

Together, CPS and ColPS assess aspects of performance in nonroutine tasks (CPS) and interactive tasks (ColPS) that have been identified as important by Autor et al. (2003) and other researchers (e.g., Cascio, 1995; Spitz-Oener, 2006, see also the literature mentioned above). In addition, researchers studying CPS and ColPS are also committed to conceptual integration and thorough operationalization and assessment, consequently offering solid theoretical and empirical foundations as well as valid assessment methods for their work (e.g., Greiff, Wüstenberg, & Funke, 2012). To this end, both constructs will serve as points of reference for the integration of an assessment of 21st century skills in industrial and organizational (I-O) psychology. In this article, we present CPS and ColPS, their assessment, and potential avenues for the integration of both constructs and their assessment into I-O psychology focusing on skills that enable successful reactions to the challenges of the 21st century.

I-O psychology can be thought of as an applied science with the potential to address, inform, and advise important human-capital (HC) challenges (Cascio & Aguinis, 2008), emphasizing guidance toward practical interventions based on a scientist–practitioner model (Bass, 1974; Dunnette, 1990; Murphy & Saal, 1990; Rupp & Beal, 2007). We believe the field of I-O psychology would benefit from incorporating advances in the definition of 21st century skills and their assessment.

Before taking a closer look at the two constructs of CPS and ColPS, a discussion of three competing approaches to assessment already integrated in I-O psychology is useful because existing assessment methods might in principle allow for the handling of the requirements of the 21st century without the need to resort to new constructs or ways of assessment. Instead of relying on CPS and ColPS, one might argue for the utilization of application-oriented constructs, job-and-work-analysis-based instruments, or well-established constructs targeting basic human functioning. In the following, we take a closer look at all three of these alternatives.

Paths to the Assessment of 21st Century Skills

As a first alternative for employing valid and reliable 21st century skill assessment, we look at constructs that originated from direct observations of the work environment and that developed into nonroutine and interactive tasks. Generally speaking, there are a multitude of constructs addressing the questions of practitioners and business leaders in I-O psychology and management education in an application-oriented way (e.g., building on learning agility: De Meuse, Dai, & Hallenbeck, 2010; Eichinger & Lombardo, 2004; Lombardo & Eichinger, 2000; or the notion of talent and talent management: Cappelli, 2008; Collings & Mellahi, 2009; Ready & Conger, 2007, to give two examples). The constructs and their empirical operationalizations are deeply embedded in their respective fields, and the constructs and operationalizations exhibit close links to practice and application. The point of departure in assessing and using these skills usually occurs when there is an attempt to address a specific need or problem of high visibility and relevance to practitioners and organizations, and the focus of the constructs is consequently related to ways to deal directly with these needs or problems.

As an example, the construct of learning agility originated from the issue of identifying high-potential employees who are capable of performing successfully within a dynamic environment (e.g., Eichinger & Lombardo, 2004; Lombardo & Eichinger, 2000). The relation between learning agility and the trend toward nonroutine and interactive features in the workplace is straightforward: A person confronted with a nonroutine task and the absence of readily applicable routine solutions should directly profit from a higher level of learning agility by being able to better learn from experience in new or first-time conditions (cf. De Meuse et al., 2010).

Hence, selecting individuals on the basis of their learning agility and fostering this agility via training and development seems like a straightforward answer to the trend toward the need to increase performance on nonroutine tasks, thus addressing a highly relevant practical problem (e.g., Dries, Vantilborgh, & Pepermans, 2012). For example, it might be important to select a mechatronics engineer with a highly developed learning agility that allows him or her to actively adapt to changes in the various related domains, such as mechanical and electrical engineering, and that allows him or her to take on future leadership responsibilities. If new safety regulations are introduced, he or she needs to be able to gather the necessary knowledge, assess the influences on various levels, and coordinate the appropriate actions, all of which can be fostered by a high level of learning agility.

On the downside, application-oriented constructs oftentimes lack a clear integration and an explicit connection to their nomological networks. That is, a conceptual and empirical comparison of the commonalities of concepts such as learning agility with regard to well-established and validated constructs and even other application-oriented constructs is largely missing (e.g., for learning agility: Arun, Coyle, & Hauenstein, 2012; DeRue, Ashford, & Myers, 2012; for talent management: Collings & Mellahi, 2009; Lewis & Heckman, 2006; and for a general discussion of the separate discourses oriented toward practice and science: Cohen, 2007; Rynes, Giluk, & Brown, 2007). As an example, whereas learning agility is conceptually related to the notion of reacting to the increasing importance of nonroutine tasks, according to Autor et al. (2003), the conceptual and empirical overlap of such tasks with constructs such as intelligence, personality, or cognitive styles remains unclear (cf. DeRue et al., 2012). In the above example of the mechatronics engineer, it remains unclear whether the successful adaptability of developments in the field can be attributable to a higher level of learning agility or whether such adaptability is a consequence of higher general ability levels, for example, as indicated by intelligence.

At first glance, this does not necessarily lead to problems in situations in which the focus is on the issue of selecting the best fitting mechatronics engineer or in other situations in which the application-oriented construct appropriately meets the environment for which it was developed. However, opportunities to gain more general insights, make long-term predictions, and derive valid conclusions in areas outside the specific focus of the construct have been left unexploited, and theoretical and empirical integration is largely missing. In the example of learning agility, the lack of empirically scrutinized links to personality, intelligence, and other basic constructs leads to doubts about the scientific value of the construct (DeRue et al., 2012) and to missing insights into the range of influenced behaviors and effects on performance. More important, if there is still doubt about whether there is something else other than intelligence in the domain of learning agility, interventions specifically tailored to foster the learning agility of a mechatronics engineer could face massive obstacles (i.e., via boundaries imposed by general levels of intelligence).

Furthermore, and resulting partially from the lack of scientific integration, assessment problems have become widespread in application-oriented constructs, especially with regard to performance measures, jeopardizing the usefulness of the constructs on a fundamental level. When looking at typical instruments that target learning agility, DeRue et al. (2012) identified considerable problems related to both the validity and reliability of the instruments. Lewis and Heckman (2006) showed comparable problems when investigating assessment instruments that targeted the notion of "talent." However, if practitioners and researchers are not able to assess an individual's learning agility in a reliable and valid way, they will not be able to trust practice-oriented advice or conclusions regarding the relations between agility and other constructs and outcomes.

In summary, application-oriented constructs do not necessarily offer the answers required to address the challenges associated with the changes in the working world. Hence, we take a look at a second approach that begins with the very tasks that are becoming less routine and more interactive. Job and work analysis (e.g., Brannick, Levine, & Morgeson, 2007; Fleishman & Reilly, 1992; Rasmussen, Pejtersen, & Goodstein, 1994; Schippmann et al., 2000; Vicente, 1999) offers a long tradition of guidance in matters of personnel selection, training, and planning, going back to the work of Frederick Taylor

(1911) and his *Principles of Scientific Management*, and job and work analysis has been a major part of I-O psychology ever since.

Generally speaking, job and work analysis aims to specify the elements and requirements of a specific job or occupation, usually focused on either the work tasks (task-oriented job analysis, e.g., hierarchical task analysis; Annett & Duncan, 1967; Shepherd, 2001) or the individual performing on the job (worker-oriented job analysis, e.g., position analysis questionnaire; McCormick, Jeanneret, & Mecham, 1972; see, e.g., Clifford, 1994; Dierdorff & Wilson, 2003; Levine, Ash, Hall, & Sistrunk, 1983; Pearlman, 1980, for comparisons between approaches). Building on existing occupations and their descriptions, these efforts have led to considerable knowledge about the elements and requirements of specific jobs and occupations, culminating, for example, in the Occupational Information Network (O*NET) of the United States Department of Labor (http://www.onetonline.org/).

Based on this knowledge of occupations and their associated tasks, job and work analysis also allows for the construction of well-directed assessment instruments targeted precisely at the requirements of a specific job. If researchers and practitioners know what kinds of tasks an individual will most likely be performing in a specific job, they can assemble a corresponding assessment suite to target the associated requirements via job-based tests and work simulations (e.g., Fleishman & Reilly, 1992). In the example of the mechatronics engineer, such instruments may target, for example, the required mathematical skills, knowledge of engineering and technology, and abilities related to deductive reasoning (see also the comprehensive profile of the mechatronics engineer on O*NET, Standard Occupational Classification Code 17-2199.05).

Building on an analysis of job contents and the resulting requirements on the individual level can certainly help to address changes in the working world as it moves toward nonroutine and interactive tasks. Job and work analysis can help researchers and practitioners to quantify the number of changes within jobs and the corresponding requirements (e.g., Cascio, 1995) and can help them to describe, compare, and support newly emerging jobs and work situations within established frames of reference (see, e.g., Naikar, Moylan, & Pearce, 2006; Vicente, 1999). For example, the occupation of mechatronics engineer was specifically added to the O*NET in an effort to include new and emerging occupations in the 21st century (National Center for O*NET Development, 2009), thereby allowing for an analysis of the occupation's tasks and comparisons between this occupation and other (non)engineering jobs.

However, the bottom-up approach of job and work analysis also has its downsides. First, there is the need for a detailed specification of the job and work tasks and the corresponding requirements. There has been incredible progress in this area both in methodology and in content (e.g., the integration of normative and descriptive approaches by Vicente, 1999). Nonetheless, the nonroutine and interactive tasks that are increasing in importance because of the developments in the working world are much harder to grasp and specify specifically because of their nonroutine nature (e.g., Braune & Foshay, 1983; Naikar et al., 2006; Schippmann et al., 2000). Consequently, the effort needed to specify the characteristic tasks in assessment and evaluation is much higher and will increase even more with the ongoing trends toward increases in nonroutine and interactive tasks.

Furthermore, a job-and-work-analysis-based approach to 21st century work environments must rely on a perspective that focuses on already existing and formalized jobs and occupations (even though there are efforts to increase the range to include future developments, e.g., Schneider & Konz, 1989). Because of accelerated technical and social developments and high competitive pressure, there is a vital need to react to changes in work requirements in a proactive way, aligned with the strategic vision and the evolving HC needs of the organization (e.g., Schippmann et al., 2000; but see, e.g., Cascio, 1998; Harvey & Bowin, 1996; and Siddique, 2004, for attempts to integrate job analyses and human resource [HR] strategies). An approach based on job and work analysis necessarily has its limits in this regard because the future jobs and occupations are not yet available for task analyses and job simulations.

Finally, reacting to the increase in the number of nonroutine and interactive tasks based on job and work analysis is a time-consuming and expensive approach (e.g., Levine, Sistrunk, McNutt, & Gael, 1988). Every new job has to be analyzed in detail, and the typical tasks and requirements associated with each job have to be identified. This analysis takes a lot of effort and requires skilled analysts, especially with regard to jobs characterized by nonroutine tasks. This investment can be reduced by efforts to utilize resources, such as the O*NET (e.g., McEntire, Dailey, Osburn, & Mumford, 2006), but such resources are generally not easy to obtain for small and medium-sized organizations, which provide roughly half of all jobs in Western economies (e.g., OECD, 2013a). The great effort necessary to specify the tasks and requirements of a specific job becomes even more problematic when changes in the environment lead to shifting requirements and tasks within these jobs on a regular basis.

The third approach that can be used to assess the challenges resulting from the shifts in the working world toward 21st century skills is to target overarching transversal characteristics that span jobs, problems, and domains by building on established (psychological) research on basic human functioning. The valid and reliable assessment of theoretically well-founded psychological constructs (e.g., intelligence and personality) have historically allowed for extensive progress in I-O psychology (e.g., Barrick & Mount, 1991; Hunter & Schmidt, 1996; Schmidt & Hunter, 1998; Schmidt, Hunter, Outerbridge, & Goff, 1988; Schooler, Mulatu, & Oates, 1999). Furthermore, the constructs are also used as prominent and established markers to assess, analyze, and address HC issues on an individual level (e.g., Barrick & Mount, 1991; Hogan & Holland, 2003; Jones & Schneider, 2006; Seibert & Kraimer, 2001; Weede & Kämpf, 2002). Consequently, these constructs will serve as the third point of departure from which to investigate the consequences of and the answers to the changes in the working world as nonroutine and interactive tasks increase independently of specific jobs or occupations (e.g., Scherbaum, Goldstein, Yusko, Ryan, & Hanges, 2012).

Generally speaking, constructs such as intelligence, personality, or working memory capacity can be viewed as precursors of job performance across a wide array of situations (e.g., Gottfredson, 1997). For example, one would expect that a mechatronics engineer with higher intelligence and a high level of conscientiousness would be generally better at deriving the necessary conclusions in a given problem situation resulting from the challenge of constantly refined and changing technologies (e.g., learning faster and making fewer mistakes when security guidelines related to a new software framework need to be followed).

In contrast to application-oriented constructs, building on constructs such as intelligence leads to theoretically and empirically integrated nomological networks and reliable and valid assessment instruments because the roots of this work are in psychological research. In contrast to a job-and-work-analysis-based approach, the constructs do not have to be bound to specific work tasks or the comprehensive analysis of an occupation to be of considerable use.

Still, given the generality of the constructs and the unspecified interactions between them in concrete situations, personality, intelligence, and other constructs targeting the foundations of human functioning offer only limited help in concrete situations. When looking for individuals who cope well in problem situations that are characterized by a combination of sheer complexity; the need to engage in self-initiated learning behavior (e.g., Warr & Bunce, 1995); and the prerequisite to interact with other individuals, groups, and organizational processes (e.g., Brannick & Prince, 1997), the combination of all potentially relevant constructs makes predictions cumbersome to say the least. Hence, the constructs that dominate current testing and assessment in work organizations as such do not offer the most promising and straightforward solutions when dealing with the changes described by Autor et al. (2003). Awareness of this problem within the realm of I-O research can be seen, for example, in the calls by Brouwers and Van De Vijver (2012) and Oswald and Hough (2012) for the clarification of the pathways between intelligence and actual I-O-related behavior and the calls to take real-life decision processes more seriously in (cognitive) research (e.g., from researchers targeting naturalistic decision making, e.g., G. Klein et al., 1993).

In addition, there are factors that influence the problem situation but are not included in intelligence, personality, and other basic constructs in direct and readily applicable forms. Invoking the mechatronics engineer, we note that he or she needs to analyze, merge, and assemble mechanical, electrical, and electronic components of different generations and within unforeseeably alternating interactions. Furthermore, when production is at full capacity, the targets of production need to be balanced with considerations of the durability of plants and the requirements of working creatively and innovatively with and within research and development teams.

The array of these tasks results in requirements related to (a) the ability to actively generate the information that is needed to see a problem as a complex interplay of developments in the first place, (b) the skills needed to simultaneously balance the changing demands of multiple stakeholder groups, and (c) the prerequisites to interact with various colleagues to pool resources. None of these factors are included in either intelligence assessment or other basic ability tests in a straightforward way (e.g., Funke, 2010). Consequently, targeting HC issues by building on basic constructs and their assessment is restricted, as vital information on performance in situations of rising importance is unavailable. These restrictions are especially relevant when one takes into account the importance of the aforementioned features of decision making in the work environment (G. Klein, 2008; Zsambok & Klein, 1997).

In summary, the comprehensive answer needed to address the call for the adequate assessment of 21st century skills cannot be found in application-oriented constructs situated within I-O psychology or management education, in approaches building on job and work analysis, or in constructs dealing with basic human functioning on a general level. Consequently, we have to look for a direct assessment of 21st century skills as required by the developments in the working environment to be able to build practical advice. CPS and ColPS are considered two prominent representatives of 21st century skills specifically targeting the skills of individuals in problem situations that are characterized by nonroutineness and interactivity. They also allow for an integration of insights across domains and situations, thereby leading to fewer problems in transferring skills across changing environments. Finally, they promote integration into the broader discourse of research and build on solid assessment instruments.

Complex and Collaborative Problem Solving

CPS and ColPS are generally considered integral parts of 21st century skills (Griffin et al., 2012; National Research Council, 2012; OECD, 2013c, 2013d) and have recently been found to have a substantial impact in the area of education. For example, CPS and ColPS are employed in the arguably most important large-scale assessment worldwide, the PISA in its 2012 and 2015 cycles, respectively (OECD, 2013c, 2013d). PISA assesses and compares the skills of students in domains such as mathematics and science across a range of countries to foster policy creation in education, and PISA recently adopted CPS and ColPS as representatives of domain-general transversal skills with clear connections to practice.

Intriguingly enough, whereas both concepts appear to fit the area of I-O psychology rather naturally because they represent the skills necessary to cope with complex and collaborative problems and, hence, the challenges of this context, the widespread application of these concepts in research and practice has mainly been restricted to the field of education. A noticeable exception is the large-scale project “LLLight’in’Europe,” in which the CPS skills of more than 4,000 employees of 70 companies in 15 countries are being assessed and analyzed with regard to their relations to income, lifelong learning behaviors, and innovation across various industries, organizations, and jobs (www.lllightineurope.com).

Complex problem solving. CPS targets how humans interact with problems that are characterized by complexity, intransparency, and dynamics, which is sometimes also referred to as dynamic decision making (e.g., Brehmer, 1992; Buchner, 1995; Funke, 2001, 2010; Gonzalez, Lerch, & Lebiere, 2003; Gonzalez, Vanyukov, & Martin, 2005; Schmid, Ragni, Gonzalez, & Funke, 2011). That is, in contrast to historical notions of problem-solving research, CPS targets problem situations featuring a multitude of interrelated elements that have to be actively explored to find a solution, thus requiring the complex interplay of basic cognitive and noncognitive processes (e.g., Fischer, Greiff, & Funke, 2012; Funke, 2010; Osman, 2010).

More specifically, the defining characteristics of problems targeted in CPS are the complexity of the problem structure (i.e., a multitude of interrelated elements), the dynamics of the system (i.e., changes due to time or to interacting with the problem), the interconnectedness of elements (i.e., a change in one part of the system has repercussions in other parts), the multiple goals requiring simultaneous consideration, and the intransparency of the problem situation requiring active investigation (see also the classic definition of complex problems by Buchner, 1995). Naturally, such features are also part of real-life problem solving in the world of I-O psychology in which static problems with a fixed set of options are seldom seen (e.g., Cohen, March, & Olsen, 1972; Smith, 1997). From the perspective of nonroutine tasks as utilized by Autor et al. (2003), there is also a large overlap between the problems targeted in CPS and the larger trends in the working world: Both emphasize the importance of adapting to new situations and problems for which no routine solution is readily available.

With respect to the problem solver, the skills targeted in CPS are clustered around the basic processes of knowledge acquisition and knowledge application (e.g., Fischer et al., 2012; Novick & Bassok, 2005; Osman, 2010). In the example of the mechatronics engineer, knowledge acquisition is related to the gathering of information about a new tool (e.g., an instrument indicating the amount of abrasion), whereas knowledge application can be seen when this knowledge is put to use (e.g., when utilizing the new tool to calibrate a manufacturing robot).

In contrast to basic abilities and constructs (e.g., intelligence or personality), measures of CPS assess performance with a focus on the interaction of individuals in complex problem environments with the individuals' need to actively explore, build, and apply knowledge. In contrast to an approach that builds on job and work analysis, the general importance of CPS constructs is clear and straightforward even without detailed information about the respective jobs or occupations involved. Furthermore and in contrast to application-oriented concepts such as learning agility, CPS is built on a tradition of theoretical and empirical research; thus, it is embedded in a comprehensive nomological network and is measured with reliable and validated assessment instruments.

With regard to this nomological network, CPS has been shown to be conceptually and empirically different from other basic, individual-level constructs such as reasoning ability (Greiff, Fischer, et al., 2013; Sonnleitner, Keller, Martin, & Brunner, 2013; Wüstenberg, Greiff, & Funke, 2012), working memory capacity (Schweizer, Wüstenberg, & Greiff, 2013), and personality as measured by the five-factor model (Greiff & Neubert, 2014). Furthermore, CPS has been shown to be separable from constructs related to specific requirements of the 21st century, such as literacy in information and communication technology, a construct targeting the basic knowledge, skills, and attitudes needed for dealing with computer technology (Greiff, Kretzschmar, Müller, Spinath, & Martin, 2014). With regard to predictive validity, positive and distinct relations between CPS and indicators of successful problem solving in various contexts, ranging from schools and universities to organizations from a range of industries, have been empirically shown on the level of performance measures (e.g., Danner et al., 2011; Greiff, Fischer, et al., 2013; Greiff, Wüstenberg, et al., 2013).

Collaborative problem solving. ColPS, the second construct presented here, is an extension of CPS because it is also related to complex and ill-defined problems. However, whereas CPS targets the skills of individual problem solvers in interacting with complex, intransparent, and dynamic problems, ColPS is dedicated to the assessment of similar skills in interactive settings (i.e., multiple problem solvers working on the same problem; O'Neil, Chuang, & Chung, 2004).

Consequently, processes of knowledge acquisition have to be extended to the group, thus resulting in specific requirements in terms of sharing the understanding and effort required to come to a solution. Also, the pooling of knowledge, skills, and efforts to reach a solution has become vital in both phases of dealing with a problem: knowledge acquisition and application (see, e.g., the definition of ColPS utilized by the OECD in their assessment framework; OECD, 2013d). In the example of the mechatronics engineer introduced before, tasks such as working with experts from other fields to find and address the reasons for the failure of an assembly-line robot clearly involve processes captured by ColPS (e.g., the need to construct a common understanding of the problem at hand).

In line with the rise of collaborative tasks in everyday work environments (e.g., Cascio, 1995; C. Klein et al., 2006), interest in such interactive aspects of problem solving has led to an increase in scientific efforts in recent years (e.g., Greiff, 2012; O'Neil et al., 2004; OECD, 2013d). Still, the nomological network of ColPS and its empirical relations are not as well established as are those for CPS, leaving ample room for future research (e.g., OECD, 2013d). Nonetheless, current research on ColPS has emphasized the connections of ColPS to basic constructs and viable routes for its assessment and application, thereby addressing vital aspects of the problem-solving environments of our times (Greiff, 2012). In light of the rising importance of interactive tasks in the work environment, the skills targeted by ColPS and the assessment of these skills should certainly be incorporated into future discussions in I-O psychology.

The Assessment of Complex and Collaborative Problem Solving

Even in large-scale assessments such as PISA, the assessment of both constructs, CPS and ColPS, has become practical with the help of computer-based microworlds that allow for the simulation of complex and collaborative problems that need to be actively explored and controlled (e.g., Greiff et al., 2012). That is, the skills of individuals in addressing complex and collaborative problems can be assessed directly as those individuals interact with such problems as simulated on a computer or tablet.

To secure the systematic variation in problem features along theoretically derived dimensions (e.g., including a specific type and a specific number of problem features), one usually describes the problems used in these microworlds according to formal frameworks. That is, the computer-based assessment of both CPS and ColPS builds on formal descriptions that enable the construction and systematic variation of problem features in assessment (e.g., a formalization via linear structural equations or finite state automata; Funke, 2001; Greiff & Wüstenberg, 2014).

As a consequence, characteristic features of complex and collaborative problems can be systematically varied in assessment, building on the construct in focus and following theoretically defined and empirically validated dimensions. For example, the number of goals and the number of interconnections that need to be considered can be varied independently. In assessment, these features can be combined systematically, and the characteristics can be compared between problems based on their formalization (e.g., Greiff & Wüstenberg, 2014). By contrast, neither classical tests of intelligence nor job-based simulation instruments can account for these characteristic elements of nonroutine and interactive tasks on the basis of both theoretically sound foundations and reliable and valid instruments.

Building on formally comparable problems and including a specific range of these problem features, the integration of several computer-simulated microworlds in one assessment session leads to the reliable estimation of individual performance levels across specific complex problems (e.g., Greiff et al., 2012). It is important to note that the assessment of CPS and ColPS can tap into actual performance instead of relying on self-reported preferences. The assessment of CPS and ColPS is therefore considerably more closely related to actual performance than are assessment instruments targeting learning agility, cognitive styles, or personality, in which the sole source of information is typically questionnaires filled out by the people themselves.

In addition, because of the use of computer-based assessment, data reflecting the processes of individuals (e.g., when exploring a collaborative problem) become available for analysis. That is, in contrast to assessments via questionnaires as traditionally employed in assessments of basic constructs (e.g., intelligence) or application-oriented concepts (e.g., learning agility), the final performance of individuals can be related to the specific challenges and behavioral foundations of success and failure (e.g., inappropriate exploration strategies for the collaborative problem at hand).

For CPS, existing valid and reliable instruments allow for the estimation of an individual's skills in dealing with complex problems, thereby building a solid foundation for further analyses and interventions in I-O psychology (e.g., MicroDYN: Greiff et al., 2012; GeneticsLab: Sonnleitner et al., 2012; Tailorshop: Putz-Osterloh, 1981; Danner et al., 2011). For ColPS, the development of assessment has progressed tremendously, partly building on the experience already available from CPS assessment. Still, some assessment-related questions need further clarification; for example, how can one take into account multiple problem solvers in one assessment setting (e.g., O'Neil et al., 2004). Nevertheless, we consider it essential to extend problem-solving research to collaborative settings, especially when we keep in mind the rise of related tasks within jobs.

In summary, assessments of CPS and ColPS build on innovative ways for researchers and practitioners to assess the performance of individuals who are dealing with complex and collaborative problems. Because of the computer simulation of problems, requirements found in the example of the mechatronics engineer (e.g., an active search for information when trying to find the source of an error) are systematically included in such assessments and can be systematically varied. Consequently, assessments of CPS and ColPS combine the solid theoretical and psychometric foundations of basic constructs with innovative assessment methods and a focus on application as featured by application-oriented concepts.

Complex and Collaborative Problem Solving and Industrial and Organizational Psychology

Building on the constructs of CPS and ColPS and reliable and valid assessment instruments, how can researchers and practitioners from I-O psychology profit from integrating CPS and ColPS into their toolkits? Answering the call by Cascio and Aguinis (2008) for more HC-related I-O psychology research, we explore the opportunities for and benefits of integrating CPS and ColPS into I-O psychology. These opportunities address the trend in the working world toward nonroutine and interactive tasks as laid out by Autor et al. (2003). To this end, the explorations are grouped around thematic clusters loosely following the classifications of I-O psychology and the field of organizational behavior (e.g., Armstrong, Cools, & Sadler-Smith, 2012; Buchanan & Huczynski, 2010). Against the backdrop of CPS and ColPS, how do individuals enter organizations, strive for career success, develop an actionable transversal skill set, and eventually exceed organizational expectations under the guidance of good leadership?

More specifically, we identify the potential consequences and insights for researchers and practitioners from increasing their attention toward a utilization of CPS and ColPS within I-O psychology. We direct attention to (a) occupational topics further delineated toward personnel selection and career development, (b) human resource (HR) development and learning, and (c) organizational change and the CPS and ColPS side of leadership.

Personnel selection and career development. Generally speaking, both CPS and ColPS are transversal skills that offer researchers the opportunity to better understand general, domain-unspecific problem-solving behaviors that can be explicitly linked to workplace problem solving. Both are promising constructs for bridging the distance between abstract domain-unspecific and general problem-solving skills and concrete work tasks, such as attentive planning, the implementation of complex hardware and software systems (e.g., an assembly line in a milk plant), and the initiation of a system as a team effort. It is important to note that these links can be built on solid foundations in terms of valid and reliable assessment and conceptually clarified constructs, thus reducing the influence of measurement error and conceptual confusion. In the following, we discuss more specifically how personnel selection strategies and career development can profit from a consideration of CPS and ColPS as individual-level prerequisites.

Personnel selection: A matter of fit between candidates and organizations. When entering an organization, it is of great interest for both the new hire and the organization to be compatible with each other in order to pave the way toward successful employment. A fit on multiple organizational levels between an individual's prerequisites and the organization refers to the congruency between the attributes of the person and those of the work environment and encompasses task demands, group phenomena, and organizational features. This so-called person–organization (P-O) fit is of viable interest to selection researchers (Chan, 1996) because certain facets of P-O fit have empirically been shown to predict job-relevant outcomes such as commitment and turnover (e.g., Adkins, Russell, & Werbel, 1994; Chatman, 1989; O'Reilly, Chatman, & Caldwell, 1991; Rynes & Gerhart, 1990).

Most studies have analyzed whether personal values, goals, and interests are congruent with organizational culture, climate, and norms (Adkins et al., 1994; Holland, 1985; O'Reilly et al., 1991; Vancouver & Schmitt, 2006), whereas in general, the cognitive side and, in particular, an ability–demands perspective on P-O fit (e.g., Caplan, 1987; Edwards, 1991; Kristof, 1996) have fallen behind. Hence, it is worthwhile to delineate the contributions of CPS and ColPS to the ability–demands perspective on P-O fit and the implications of these constructs for personnel selection.

Developed as one essential facet of P-O fit (Kirton, 1976; Taylor, 1989), the construct of cognitive misfit, which is operationalized with an emphasis on cognitive styles that range along a continuum from adaption to innovation, invites an exemplary integration of CPS and ColPS. According to Kirton (1976), adaptors solve problems on the basis of incremental change by improving already existing practice, whereas innovators are more likely to initiate change by applying previously unknown ways of doing things. According to empirical results by Chan (1996), cognitive misfit between an individual's cognitive problem-solving style and the demands of the respective work context eventually contributes to increased turnover rates. This style–demands view perceives cognitive styles as unequivocally distinctive from the ability–demands perspective (e.g., Riding, 1997).

A possible synthesis of the cognitive misfit construct with CPS and ColPS and hence the quest for deeper insights into both CPS and ColPS

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and P-O fit could build on the adaption–innovation continuum and CPS as the construct of choice for an ability–demands perspective. That is, if one combines cognitive styles with CPS, the emerging cognitive-style-skill matrix would highlight the innovator-high-CPS-skill profile as a promising candidate for many 21st century jobs that confront the employee with constantly changing complex problems and require continuous learning of the new. For mechatronics engineers with a drive to innovate, CPS skills and a matching cognitive style are presumably required for creating practical solutions. That is, a mechatronics engineer, or another employee, might fail to solve complex problems in his or her job because the engineer lacks CPS skills even if he or she is equipped with a matching cognitive style and vice versa.

Obviously, the questions of whether employees with a drive to innovate and high CPS skills are readily equipped for 21st century jobs and how they are differentiated from other combinations require further empirical research. However, certainly both CPS and ColPS can be used to increase the efficiency of staff selection procedures and to optimize the degree of fit between potential hires and job roles. Eventually, incorporating these concepts into personnel selection test batteries should add value to companies; for example, by preventing turnovers, which jeopardize HC development intentions and result in losses of organizational knowledge.

Career development: Modern careers and transversal skills. After becoming part of an organization on the basis of mutual compatibility, an employee's attention usually centers on the potential to grow personally and to ascend the career ladder. Turning to the individual confronted with the changes in the working world, the reduced significance of traditional organizational career paths that rely on organizational structures with a paternalistic approach to career management, vertical mobility, and reasonable stability becomes a central factor (e.g., Allred, Snow, & Miles, 1996; Arthur & Rousseau, 1996).

In modern organizational work environments, the classic career approach has broadly been replaced by new career paradigms that deemphasize organizational factors and stress the importance of the individual and his or her skill set (Arthur & Rousseau, 1996; Bird, 1994; Greenhaus, Callanan, & Kaplan, 1995; Hall & Mirvis, 1996). Some of these newer concepts speak, for instance, of a protean or boundaryless career, which emphasizes the transferability of skills and acknowledges that individuals need to take responsibility for managing their own careers, to reveal lateral mobility, and to take on different roles in multiple projects.

Whereas self-knowledge, interpersonal knowledge, and environmental knowledge are identified as the key factors in the literature on new careers (e.g., Anakwe, Hall, & Schor, 2000), the requirements that individuals have to face also show considerable overlap with the skills targeted by CPS and ColPS. Both research directions emphasize the central role of transversal skills and transferable knowledge at work (Anakwe et al., 2000; Griffin et al., 2012).

Reacting successfully to new situations that cannot be handled solely on the basis of factual knowledge and experience in a fixed environment necessarily builds on transferable domain-generalizable skills such as CPS and ColPS. Because of the transversal nature of both skills and in line with developments in modern careers, benefits from developing one's CPS and ColPS skills will not be restricted to a specific area of application (e.g., a specific tool, job, or organization). For example, mechatronics engineers with an enhanced CPS and ColPS skill set will be able to utilize these skills in several different work environments, for instance, when they are transferring a project from the pilot to the production phase. These mechatronics engineers will also be able to translate their skills into palpable career development even if they change from one organization or job role to another, due to the rather context-independent nature of the skills. In short, CPS and ColPS are both factors with incredible potential for selecting, developing, and supporting individuals in their modern day careers and spearheading the way toward tangible insights and evidence-based reactions to changes in career development.

Human resource development and learning. Any career requires the development of an actionable skill set for heightened task performance. HR practitioners are concerned with the skill development and lifelong learning of their organization's employees and definitely require access to pertinent high-quality information. The availability of transversal skills, such as CPS and ColPS, opens gateways for improvements in HR practice, which, at the moment, mostly relies on the development of domain-specific knowledge (e.g., via job and work analysis; e.g., Cascio, 1998; Levine et al., 1988). Thus, the question arises: How can transversal skills such as CPS and ColPS be integrated into occupational assessment and trainings?

An example might be a product designer in the research and development department of a company in the electronics industry. Fulfilling a variety of individual and team tasks, including the handling of complex and innovative products, the designer has a job that requires CPS and ColPS skills to a great extent because domain-specific knowledge is not sufficient for dealing with the changing requirements. Connections to specific competencies are required in that the designer has to ensure the aesthetic quality of interfaces and the alignment with product guidelines; it is his or her duty to conduct tests of prototypes and existing products, thus the job requires extensive experience in the domain as well as problem-solving skills that allow the designer to react to unforeseen challenges.

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Although building on the foundation of specific knowledge, the designer, within most of these activities, continuously acquires and applies knowledge and collaborates on interdisciplinary teams with other designers, engineers, and industrial psychologists. CPS and ColPS allow for the targeting of skills required to successfully deal with situations when prior knowledge and experience are either scarce or not sufficient for dealing with problems on a routine level. As a consequence, they are a valuable tool for HR departments in assessing their employees' HC beyond measures of education or experience, such as tenure. Further, CPS and ColPS are considered to be indispensable assets when one is acquiring and consolidating specific knowledge and experience in terms of lifelong learning (OECD, 2013c). This initial picture of how CPS and ColPS might benefit HR practices can serve only as a point of departure, and specific connections and insights into the interplay of the multitude of related factors are a rich field of inquiry for both future research and practical application.

Organizational change and the complex and collaborative problem-solving side of leadership. It is unlikely that solutions to nonroutine problems will be accomplished without a large degree of support from organizations. Representing one pathway by which this organizational support can be provided, leadership is thought to be a critical resource for developing appropriate problem-solving skills (Reiter-Palmon & Illies, 2004). In fact, Reiter-Palmon and Illies (2004) suggested avenues by which organizational leaders can facilitate early stage cognitive processes in an effort to enhance the problem solving of their employees. For instance, leaders would do well to encourage their subordinates to take more time, communicate with their team, and regard different perspectives for the definition and construction of a problem. Taking a similar approach to examining the possibilities and effects of facilitating the CPS and ColPS of employees through various organizational processes (e.g., leadership) certainly promises to lead to interesting, practical, and highly relevant insights.

Shifting the focus from the leader's organizational role in facilitating the problem solving of subordinates to the leader's own problem-solving ability, we invite leadership researchers to follow our emphasis on the cognitive side of leadership, where CPS and ColPS could spice up existing research directions. In times of organizational change, leaders have to be prepared for the unexpected to be able to provide adequate guidance to their subordinates. With their emphasis on knowledge acquisition, knowledge application, and shared understanding in groups, CPS and ColPS contribute to a comprehensive assessment of leadership skills. Well-established theories of organizational leadership employ a range of classic qualitative measures, including the Multifactor Leadership Questionnaire (Bass & Avolio, 1990) or the Leader Opinion Questionnaire (Fleishman, 1989), to shed light on a leader's interaction style with subordinates.

Several authors have argued that the focus of research on organizational leadership and assessment ought to incorporate the (cognitive) substance of leadership and should not focus exclusively on leadership styles (e.g., Day & Lord, 1988; Jacobs & Jaques, 1987). This view suggests that organizational leadership should be perceived as a form of skilled performance grounded in the leader's ability to solve complex and ill-defined organizational problems (Mumford, Mobley, Reiter-Palmon, Uhlman, & Doares, 1991; Mumford, Zaccaro, Harding, Jacobs, & Fleishman, 2000; Zaccaro et al., 1997).

Apparently, qualitative leadership style measures do not account for the cognitive side of leadership, and hence, different leader assessment strategies involving tools explicitly designed to assess CPS skills are required. For instance, CPS subskills such as problem construction, information encoding, and solution implementation and monitoring skills (e.g., Fischer et al., 2012) have been identified by Mumford et al. (1991) as important parts of leadership purely on the cognitive side. Further, Zaccaro, Mumford, Connelly, Marks, and Gilbert (2000) extended leaders' problem solving to collaborative aspects by acknowledging that leadership is embedded in a social context and by emphasizing social skills that reflect an understanding of people and social systems, especially during organizational change.

Whereas these authors used complex organizational scenarios with open questions in a paper-and-pencil format that relied on the raters' own interpretations, Marshall-Mies et al. (2000) had already introduced an online computer-based leader assessment strategy by building on a predetermined set of choices across comparable scenarios. However, neither approach can account for the procedural, dynamic, and complexity-related aspects of interacting with leadership problems.

By contrast, microworlds as exploited by Greiff and colleagues (Greiff & Wüstenberg, 2014; Greiff et al. 2012) in educational settings are able to account for such aspects by requiring the active gathering, integration, and application of knowledge. Consequently, the measures can be seen as reliable proxies for the assessment of at least some of the prerequisites for successful leadership, incorporating the skills to acquire and apply knowledge across situations and problem solving in groups. The CPS and ColPS abilities of leaders have been identified as key factors in producing organizational transformations (e.g., Bruch, Spychala, & Wiegel, 2013). With the help of CPS and ColPS assessment, researchers and practitioners have the tools available to incorporate these abilities into empirical research and practical application.

Conclusion

Coming back to the notion of a world of increasing complexity and the increasing importance of nonroutine and interactive tasks in the daily working lives of individuals, we must ask whether the proposed integration of CPS and ColPS will be able to overcome the lack of satisfactory approaches to the assessment of 21st century skills in I-O psychology. In contrast to (a) basic psychological constructs, which are missing connections to application; (b) job-and-work-analysis-based approaches, which require huge efforts specific to a job or occupation; and (c) application-oriented constructs, which suffer from a lack of integration and viable ways of assessment, we indeed believe that CPS and ColPS have the potential to serve as a point of departure for future development.

Clearly, if we as researchers and practitioners do not strive for an integration of the various components that influence the interaction of individuals and groups with problem situations characterized by complexity and dynamic and interactive features, we may as well stick with a separate assessment of different basic constructs and analyze their influences separately on an abstract level. If we are not interested in developing an encompassing perspective that integrates concepts beyond our specific line of inquiry, and if we do not mind problems of assessment hampering scientific and applied progress, we may also be satisfied with application-oriented constructs without a path to theoretical integration and sound empirical application. If we look at highly standardized production jobs, stable work environments, or occupations that will remain the same across the years, we may be inclined to continue to put our efforts toward job and work analysis.

However, if researchers and practitioners pursue the route of bringing I-O psychology forward, both theoretically and practically, CPS and ColPS are two lines of inquiry worth considering. Combining a focus on ill-defined and complex problems with rigorous empirical research and clear paths for application, these constructs naturally fit the developments of the 21st century and provide the necessary components for the field of I-O psychology. We believe the field of I-O psychology would benefit from practitioners and researchers incorporating advances in the definitions of these 21st century skills and the tools used to assess these skills that are currently part of the OECD and PISA programs. Furthermore, an incorporation of these advances would also facilitate international collaboration between I-O psychologists in the United States and researchers and practitioners in Europe and Asia, where the PISA assessments and OECD programs are already having a visible impact on educational and school-to-work policies.

Following the example of the PISA assessments and the OECD, including CPS and ColPS in the arena of I-O psychology might lead to interesting developments: CPS and ColPS might offer ways to preserve the benefits of classical constructs (e.g., intelligence) in terms of well-connected nomological networks, empirically scrutinized links to the broader scientific context, and reliable and valid assessment instruments and might offer ways to combine these benefits with clear routes for application and practice-oriented advice. Ultimately, this could lead to the replacement of assessment instruments that target basic constructs with instruments that are more closely aligned with the developments in the working world of the 21st century. As the time and money available for assessment is almost always limited, a direct assessment of 21st century skills could actually be the preferable option compared with basic constructs that lack clear connections to practice. Integrating insights from a range of classical domains while acknowledging the fact that the complex problems we encounter on an everyday basis need more than the sum of basic (non)cognitive processes (cf. Funke, 2010) also raises questions related to the overcoming of the scientist–practitioner gap (Cascio & Aguinis, 2008).

Analyzing current trends in practice and research, Cascio and Aguinis (2008) indicated a serious disconnect between the knowledge that I-O psychologists are producing and the knowledge that practitioners are consuming (e.g., Rynes, Colbert, & Brown, 2002). Consequently, a scientist–practitioner gap persists (Aguinis & Pierce, 2008; Anderson, 2007), and I-O psychology has yet failed to provide sufficient answers to public policy or to management practices about HC trends in a changing world of work in the 21st century. The current state of affairs is certainly something with which we cannot be satisfied, and the examples we presented of application-oriented constructs clearly indicate the drawbacks of discourses that do not manage to connect scientific rigor and practical relevance for both practitioners and researchers alike. Constructing a bridge across this gap might indeed build on the insights presented here for the direct assessment of practically relevant 21st century skills such as CPS and ColPS. We are eager to find out whether application-oriented researchers and colleagues dedicated to classical constructs (e.g., intelligence) agree with this opinion.

We are unsure whether the detailed analyses of requirements resulting from task-specific characteristics as identified by job and work analysis might be a good starting point for such endeavors, but the question remains as to whether I-O psychology really needs to base each and every instance of assessment and intervention on such costly grounds. If we can identify larger trends, such as the ones identified for nonroutine and interactive tasks, we might actually be better off with broader categories of skills that are applicable across specific contexts and jobs. To be fair, domain-specific knowledge and tenure will always be relevant predictors of job performance in specific situations, but the question remains as to whether I-O psychologists, HR professionals, and organizations can take the development of these factors into account and base their reasoning on broader 21st century skills that make detailed analyses of narrow job tasks superfluous.

We discuss approaches currently available to I-O researchers and practitioners, highlighting their benefits and drawbacks in terms of theoretical, empirical, and practical integration, and present an alternative: a direct assessment of 21st century skills such as CPS and ColPS. Tushman and O'Reilly (2007) reasoned that the gap between actual research and practical concerns in I-O psychology reduces the impact of the field's research and undermines the external validity of its theories. Even further, Anderson, Herriot, and Hodgkinson (2001) perceived the separation process between academics and practitioners as a threat to the core values of the discipline, which as Anderson et al. (2001) warned could seriously impede the field. To advance the discussion in I-O psychology, we presented CPS and ColPS, two 21st century skills that might provide an answer for overcoming the scientist–practitioner gap with their theoretical line of inquiry, their focus on reliable and valid assessment, and their routes to application in I-O psychology. Furthermore, as the examples from several areas of application in I-O psychology should have made clear, the possibilities of combining CPS and ColPS with domain-specific questions in I-O psychology—targeting, for example, HR development and leadership—offer promising opportunities for application-oriented conclusions and interventions as well as further research and scientific inquiry.

In closing, CPS and ColPS are two approaches to 21st century skill assessment that will contribute to the development and prosperity of I-O psychology by combining the strengths of basic and well-validated constructs with the richness and palpable value of application-oriented concepts for progress in insights and innovation. Let's get started!

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