Teaching of 21st century skills needs to be informed by psychological research

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The technological advancements and globalization of the 21st century require a broad set of skills beyond traditional subjects such as mathematics, reading, and science. Research in psychological science should inform best practice and evidence-based recommendations for teaching these skills.

Introduction

Skills such as problem solving, collaboration, creativity and critical thinking are paramount for meeting the demands of a rapidly changing, increasingly dynamic and unpredictable environment. Together, these skills are known as 21st century skills. Although these skills have always been important in labour markets and everyday life, their relevance has increased markedly in the past two decades and is projected to increase further.

Technological advancements, digitization and globalization have transformed the skills needed for workforce readiness and social and personal well-being in the 21st century[1] . For instance, familiarity with digital devices such as computers and smartphones has become a prerequisite for accessing the labour market and basic public services. Current technologies (for instance, machine learning algorithms) now outperform humans on many non-routine tasks. The use of technology increases the need for expertise in highly technological, complex and specialized occupations. Coupled with the interconnectedness of labour markets and international trade, these changes have profound implications for the skillsets needed to develop, manage and work alongside such technologies.

Mastering a broad set of cognitive skills (including mathematics, reading and science) during childhood must be accompanied by investments in building 21st century skills[2]. Educational systems need to ensure that 21st century skills are acquired during primary and secondary education, when developmental changes and sensitivity to interventions are highest, to enable individuals to master the fundamentals and participate successfully in society.

National curricula worldwide and curricular frameworks developed by international organizations have increasingly emphasized problem solving, cognitive flexibility, collaboration, creative thinking and digital learning. For example, the Programme for International Student Assessment (PISA), a global assessment of the achievement of 15-year-old students in more than 80 countries — which has provided international benchmarks for reading, mathematics and science since 2000 — measured collaborative problem solving in its 2015 edition and will measure creative thinking in 2022 and digital learning in 2025. The 2022 Survey of Adult Skills (PIAAC) includes the first worldwide measurement of adaptive problem solving. These studies and resulting analyses have far-reaching implications and a measurable impact on education systems by informing policies. For example, the results have been used to compare the quality and effectiveness of school curricula and the quality of adult education and training programs. Despite the high value and demand associated with

teamwork and collaboration in the labour market, more than 35% of students across OECD (Organisation for Economic Co-operation and Development) member countries in 2015 performed at or below the lowest proficiency level when solving problems collaboratively[3] .

Social science research is key to ensuring that individuals and societies reap the benefits of technological advances and globalization. Disciplines such as economics and sociology have shaped policy-making and the public discourse around the role of skills such as literacy and numeracy in economic development, globalization and inequality[4] . By contrast, whereas psychological science has developed a substantial body of empirical research on these skills, it has been much less effective at providing sound evidence and relevant information about 21st century skills. Furthermore, this information has not been broadly translated to policy-makers and society.

Opportunities for psychology

Existing psychological research on 21st century skills has been restricted in several ways. Research has often focused on overly narrow definitions of 21st century skills, used measures that have not been validated, investigated non-representative samples and/or involved experiments far removed from real-world implications. However, psychological science has spearheaded the development of comprehensive process models used for the learning and instruction of other skills that support evidence-based policy recommendations. The field of 21st century skills would profit from such advances, focusing on three key research priorities.

The first priority is to provide conceptual clarity regarding what 21st century skills are, including their underlying cognitive processes and their relations to personality traits, attitudes, self-beliefs and values. The core goal is to develop frameworks that identify the content, relevance and expression of 21st century skills in different contexts to facilitate buy-in and policy action among policymakers, educators and the general public. Cognitive psychology is well-equipped to answer questions about the nature of 21st century skills, such as problem solving or digital learning, by building on existing research that ranges from psychometric research on human intellect to the neurocognitive foundations of the brain. Developmental psychology can provide guidance on the typical development of 21st century skills, atypical trajectories and developmental delays, and sensitive developmental windows for skill development.

The second priority is to develop evidence of the best ways to teach and learn 21st century skills in formal and informal learning contexts. Knowing which skills matter and when they develop is of little use if we do not know how best to develop them. Psychological science is also critical for identifying the principles that underpin the acquisition of 21st century skills across diverse populations. These skills can contribute to reducing social inequities by, for example, reducing the gender pay gap and promoting social mobility by expanding access to jobs with high wages and good contractual conditions. A wealth of research has identified the principles that drive the development of reading and mathematics[5] . Educational psychologists are well placed to explore similar concepts for 21st century skills. These include transferable principles that underpin the learning and instruction unique to 21st century skills, specific classroom interventions for diverse student populations, and the use of technology to develop skills across the lifespan. For example, a particular focus on migrant and disadvantaged children has already revealed the hidden potential of these populations in exploring new problem situations[6] . Furthermore, evidence from educational psychology could highlight how different classroom interventions and teacher variables influence student learning. From this research basis, psychologists could promote national curricula and learning goals that focus on 21st century skills[7].

The third priority is to develop measurement instruments and assessment frameworks to assess these skills over the life course and across diverse populations of learners. The research fields of differential and personality psychology and psychological assessment are accustomed to tackling challenges related to understanding the antecedents and consequences of individual differences. These fields provide psychometric models, scoring mechanisms and guidance on validity and measurement across groups, which are key for developing instruments with broad construct coverage and clearly defined guidelines for use in practical settings. The inherently cross-domain nature of 21st century skills poses particular challenges, but international assessments, such as PISA and PIAAC, show that these skills can be efficiently assessed. Psychological research focused on assessment and evaluation is critical for ensuring that 21st century skills are integrated into educational improvement efforts as well as school-level and system-level accountability processes[8].

Outlook

Learning and skill-acquisition have fundamentally changed the nature of societies and workplaces. The relevance of skills changes along with societal changes, and students' acquisition of key skills shapes a country's economic growth. At the same time, the unequal distribution of skills is an important driver of inequalities in income and wealth because of the intergenerational transmission of skills and the high job market returns associated with certain skills[4,9] . Psychological science needs to advance knowledge about 21st century skills and provide guidance to policy-makers so that key labour market demands are met. Crucially, psychological research should ensure that the increasing labour market returns associated with these skills do not contribute to a widening of societal inequalities. Research can identify how to best teach these skills in early education, as well as providing concrete advice on targeted and differentiated approaches for addressing the needs of children across backgrounds. For example, children living in families with economic, social, cultural or educational disadvantages might rely on formal education settings for specific forms of support that other children find at home. The fields of psychology and education are only beginning to tackle 21st century skills, but can make these skills understandable and teachable to a wide audience, thereby benefiting individuals and society.

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