

## What We Educators Get Wrong About 21st-Century Learning: Results of a Survey

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To cite this article: Punya Mishra & Rohit Mehta (2017) What We Educators Get Wrong About 21st-Century Learning: Results of a Survey, Journal of Digital Learning in Teacher Education, 33:1, 6-19

To link to this article: <http://dx.doi.org/10.1080/21532974.2016.1242392>



Published online: 09 Dec 2016.



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# What We Educators Get Wrong About 21st-Century Learning: Results of a Survey

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## Abstract

*Twenty-first-century learning and how it differs from prior conceptions of learning have received significant attention lately. Kereluik, Mishra, Fahnoe, and Terry (2013) offered a synthesis of multiple expert frameworks and perspectives on 21st-century learning, summarizing them in nine forms of knowledge (under three broad categories: foundational, humanistic, and meta). Using this framework, in this study, 518 practicing educators completed a survey on their beliefs about 21st-century learning, allowing us to compare practitioners' perspectives to that of the experts. Our analyses indicate that, in contrast to the expert view as Kereluik et al. synthesized, which equally valued all the categories, survey participants ranked creativity, collaboration, communication, and critical thinking (meta-knowledge) and digital/information and communication technology (ICT) literacy (one component of foundational knowledge) as being most important. Life/job skills, ethical/emotional awareness, and cultural competence (humanistic knowledge) were ranked lower, while disciplinary and cross-disciplinary knowledge (two components of foundational knowledge) were regarded as being least important. Though these results are consistent with some popular views about 21st-century learning, we argue*

*that this reduced emphasis on foundational and humanistic knowledge is misguided. It is, we suggest, the consequence of an unreflective emphasis on the power of technology to access information and a fundamental misunderstanding of the very nature of learning and the broader goals and purposes of education. Finally, we highlight three myths about learning in the 21st century and offer recommendations to address these myths.*

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“Knowledge is obsolete.” — Sugata Mitra

“It is one thing for students to accumulate plenty of factual knowledge, but they may have not learned to think in a disciplined manner.” — Howard Gardner

**M**ore than 100 years ago, Herbert Spencer, an English philosopher and political theorist, wrote an essay in answer to the question, “What knowledge is of most worth?” (Spencer, 1884). A great deal has changed since then, and the answers we come up with today will be different from what were deemed appropriate for those times. That said, the question of “what knowledge is of most worth” is one that is worthy of being revisited by every generation, since the kinds of knowledge and the contexts within which knowledge is accessed, learned, and applied evolve and change, often dramatically, over time.

In today's context, this discussion of “what knowledge is of most worth” is often framed within the broad label of “21st-century learning.” Here, the underlying motivation for suggesting new approaches is that the world we live in today—transformed as it is by the forces of globalization and rapid advances in technology—requires new kinds of learning and new forms of knowledge (21st Century Schools, n.d.). Some scholars who work in this area suggest that current approaches toward educating our youth have been largely unsuccessful (Cuban, 2001; Keengwe, 2007; Keengwe, Onchwari, & Wachira, 2008; Kozma, 2003; Zhao & Frank, 2003), because existing practices do not prepare students for the changes and challenges of the new millennium (Robinson, 2001). Schooling, according to this perspective, has remained impervious in many ways to the changes that have occurred in the world due to the knowledge economy. In addition, new technologies, such as the Internet, offer dramatically and potentially transformational opportunities for teaching and learning. As Joel Rose (2012), co-founder and chief executive officer (CEO) of New Classrooms Innovation Partners, wrote in an article in *The Atlantic*:

The Information Age has facilitated a reinvention of nearly every industry except for education. It is time to unhinge ourselves from many of the assumptions that undergird how we deliver instruction and begin to design new models that are better able to leverage talent, time, and technology to best

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meet the unique needs of each student.

In keeping aligned with this idea of unhooking ourselves from the “assumptions that undergird how we deliver instruction,” a range of approaches, models, and projects in education has been offered to the world. Projects such as the Hole in the Wall (Mitra et al., 2005), One Laptop Per Child (Negroponte, 1996; Sorondo, Malinvaud, & Léna, 2007), or Massively Open Online Courses (MOOCs) (McAuley, Stewart, Siemens, & Cormier, 2010; Siemens, 2013) have been offered as solutions to the problems faced by education today. At the core of many of these initiatives are two key ideas. First, learning will happen when students and learners are provided direct access to information, specifically via information and communication technologies (ICTs). This is seen as a move from “just-in-case” learning (the old way of doing things) to “just-in-time” learning (Bolton, 1999), where easy access to information means that it is more important that learners be able to have the skills to access knowledge as and when needed. Second, and related to the first, is the idea that the development of broader skills like creativity, critical thinking, collaboration, and communication (the 4 Cs) is more important than developing foundational or disciplinary knowledge.

### Can Knowledge Be Obsolete?

Sugata Mitra, winner of the TED prize for his idea of Self Organized Learning Environments (“Sugata Mitra creates a school in the cloud,” n.d.), stated that “knowledge is obsolete.” Mitra, known for his experiments with what he calls “minimally invasive learning,” such as the Hole in the Wall project (Mitra et al., 2005), suggests that in an age of immediate access to information, standard forms of knowledge are no longer essential. This perspective, if correct, has significant repercussions for how educators perceive learning in the 21st century.

Support for this perspective also comes from other groups and organizations, such as the 21st Century Schools website (21stcenturyschools.com), which

argue that today’s students are “digital natives” and are fundamentally different from students in the past, mainly due to their immersion in technologies and media such as video games, YouTube, and action films (Prensky, 2012). As a result, students in the 21st century should have different learning goals and therefore require different teaching approaches. There is also an assertion that education has failed to prepare students for the demands of the 21st century, which has driven the call for new 21st-century knowledge frameworks (Jerald, 2009; Pink, 2005).

It would be incorrect to suggest that the perspectives (such as that of Mitra or Rose) that we have just described are the only approaches to 21st-century learning. They may reflect a view that has received much media attention, but there is a wide range of perspectives and frameworks that have been proposed under the broad heading of 21st-century learning. In addition, the approaches just described are not without their critics, who argue that advocates for these new technology-driven approaches fundamentally misunderstand what it is to know and learn (Bransford et al., 2005; Gardner, 2006; Greeno, Collins, & Resnick, 1996; Mishra, Koehler, & Greenhow, 2015). These scholars argue that learning is more than being able to look up facts on the Internet and that learning in the disciplines is difficult work and requires the guidance of a knowledgeable “other” (Gardner, 2006). Kereluik et al. (2013) have previously expressed concern about such claims by asking whether educational demands of the 21st century actually require new ways of thinking and learning. The skepticism of these claims stems partly from prior research that shows that specific technologies do not necessarily demand specific ways of teaching and structuring content (Mishra & Koehler, 2006); neither do they determine how they are to be used. Weighing both these perspectives on the supposed changing face of education with evolution in technology, we come back to our original question: “What knowledge is of most worth?”

### What Knowledge Is of Most Worth: A Synthesis

A few years ago, to provide a better understanding of these differing perspectives, Kereluik et al. (2013) published the results of an analysis in which they synthesized a range of “expert” views of learning in the 21st century. They analyzed 15 key documents<sup>1</sup> from the literature on 21st-century knowledge frameworks, and—through that analysis—developed a set of overarching categories to offer a coherent integrative framework that would bolster our understanding of what teaching and learning mean in the 21st century.

The synthesis of these 15 key frameworks (Kereluik et al., 2013) showed a far more balanced and nuanced approach than the one that merely emphasized the more commonly labeled 21st-century skills (i.e., the 4 Cs). Their analysis also indicated a paradox in how we think about knowledge in the 21st century. On the one hand, these authors argued that this synthesis is consistent with past approaches toward teaching and learning, suggesting that, at some level, nothing really has changed. That is, not all the knowledge and skills represented in these 21st-century frameworks are unique to this century. On the other hand, they also argued that though the overarching knowledge bases that are required may not have changed, the specifics of how these ideas are reified and instantiated in learning contexts have changed.

<sup>1</sup>The 15 frameworks analyzed by Kereluik et al. (2013) include reports from educational organizations (such as the American Association of Colleges and Universities, Cisco, Microsoft and Intel, the Educational Testing Service, the Center for Public Education, the International Society for Technology in Education, WestEd, The Partnership for 21st Century Skills, the MacArthur Foundation, Center for Public Education, the National Academy of Engineering); international bodies (such as the European Union); business interests (such as the Organization for Economic Cooperation and Development and the Metiri Group); and individual scholars (such as Howard Gardner and Yong Zhao) and popular writers (such as Daniel Pink). A complete, annotated list of the documents analyzed, as well as the method of coding and analysis can be found in Kereluik et al (2013).

Starting from where Kereluik et al. left off, the structure of this article is straightforward., we describe their synthesized framework (what we call the  $3 \times 3$  model of 21st-century learning) based on their analysis of 15 existing 21st-century learning frameworks. We follow this by a description of the survey instrument we designed (targeted at practicing educators) based on this framework and describe our methods of data collection. We then report our survey results and how they compare to the experts' view. We end with a discussion of what our findings mean for understanding teaching and learning in the 21st century.

### The $3 \times 3$ Model of 21st-Century Learning

The Kereluik et al. (2013) analysis of 15 key documents related to 21st-century learning indicated a convergence onto nine key domains—which in turn could be seen as falling under three broad categories (see Figure 1). A complete description of the documents selected and methodology can be found in Kereluik et al. (2013).

The  $3 \times 3$  (three times three) model of 21st-century learning is as follows:

- Foundational knowledge (*what we need to know*) consists of core disciplinary knowledge, cross-disciplinary knowledge, and digital/ICT literacy.
- Meta knowledge (*how we act on the knowledge we have*) consists of creativity and innovation, problem solving/critical thinking, and communication/collaboration.
- Humanistic knowledge (*the values we bring to knowledge and action*) consists of life/job skills, ethical/emotional awareness, and cultural competence.

We should note that this  $3 \times 3$  synthesis aligns well with what cognitive psychologists have traditionally defined as *declarative, procedural, and conditional* knowledge (Winnie & Azevedo, 2014, p. 64). Given this synthesis of existing 21st-century learning frameworks, an important question that emerges is, how does it compare with the practitioners' view on the ground? This

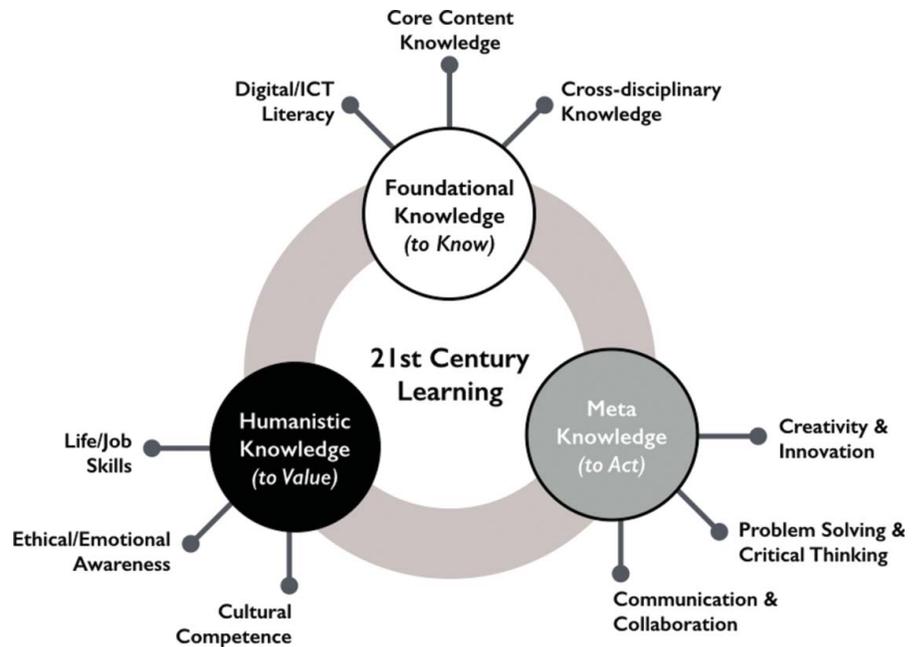


Figure 1. The  $3 \times 3$  model of 21st-century learning, based on the Kereluik et al. (2013) framework.

is an important question because despite what the experts say and believe, the actual implementation of new approaches to teaching and learning in today's schools and classrooms will be determined by the beliefs and knowledge of the practitioners themselves. There is ample research to suggest that beliefs are a critical filter for how educators acquire new knowledge and apply it in their classroom. For instance, as Richardson (1996) noted, "The beliefs that practicing teachers hold about subject matter, learning, and teaching [will] influence the way they approach staff development, what they learn from it, and how they change" (p. 105). Along similar lines, Borko and Putnam (1995) shared these thoughts:

Teachers' thinking is directly influenced by their knowledge. Their thinking, in turn, determines their actions in the classroom. Thus, to understand teaching, we must study teachers' knowledge systems; their thoughts, judgments, and decisions; the relationships between teachers' knowledge systems and their cognitions; and how

these cognitions are translated into action. (p. 37)

Therefore, this study seeks to understand how the synthesis of 21st-century learning (as developed by Kereluik et al., 2013) compares with how actual educators think about 21st-century learning. Are they similar to the balanced  $3 \times 3$  approach laid out by Kereluik et al. or do they lean more toward the stereotypical perspective of focusing on the 4 Cs over other forms of knowledge? Answering this question could lead us to a better understanding of what teachers and educators think are important 21st-century skills and knowledge, in contrast to what emerges from a synthesis of the current literature. To answer this question, we developed and implemented a survey to compare the practitioner mind set with that of the experts. We now report the results of this survey.

## Methods

### Data Collection

We took a mixed-methods approach to data collection and analysis. We conducted an online survey (see the appendix) targeting educators. Educators in our

study were broadly defined to include K12 teachers, administrators, higher education faculty, corporate trainers, and other professionals working in education. This survey had three major sections: (a) general and professional demographic questions; (b) open-ended questions about the challenges that teachers and educators face in teaching and learning in the 21st century and the skills that they find important to face these challenges; and (c) ratings of the nine kinds of knowledge in the 21st century that emerged from the Kereluik et al. (2013) analysis.

### *The Instrument*

The first part of the survey consisted of a series of demographic questions that covered basic information such as age and gender, as well as questions on participants' education, experience, and their field of expertise. Analysis of responses to these questions allowed us to develop a broad profile of the people who had completed the survey.

The next section consisted of two open-ended questions. The first question was to list three to five challenges faced by educators in the 21st century, and the second was to list three to five skills needed to face those challenges. Our intention in this section was to get unfiltered responses from our participants (i.e., without revealing or providing them any information about the nine themes that had emerged from the Kereluik et al. (2013) synthesis of expert views on the subject). Coding these open-ended responses allowed us to get a sense of how the educators in this sample were thinking of the significant challenges and skills required to face these challenges for 21st-century learning.

In the last survey section, participants were asked to rate the nine kinds of knowledge outlined as essential to teaching and learning in the 21st century from Kereluik et al. (2013). They were asked to rank each of them from most to least important, using a nine-item survey matrix where 1 being the least important and 9 being the most important. As mentioned above (and as shown in Figure 1), these nine kinds of knowledge are core content knowledge, cross-

disciplinary knowledge, and digital/ICT literacy (that constitute foundational knowledge); problem solving and critical thinking, communication and collaboration, and creativity and innovation (that constitute meta knowledge); and life/job skills, cultural competence, and ethical/emotional awareness (that constitute humanistic knowledge). This allowed us to quantitatively investigate how people valued each of these components and thus compare it to the experts' view of 21st-century learning.

### *Collecting Responses*

We emailed a link to the online survey, along with a brief description of the study, to our contacts in different universities and schools across the United States and internationally. We also shared a link to this online survey on social media platforms, such as Facebook and Twitter, which our acquaintances and friends often re-shared. We drafted the email and social media posts to call for educators to share their views on the challenges and skills in 21st-century learning. The survey started with a consent form, only upon agreement to which further questions were shared with the participants. The participants were made aware of their voluntary involvement in the study and their right to withdraw at any time.

The survey was kept open for participants to complete for 3 weeks. After the survey was closed, data was statistically analyzed for demographic questions to generate descriptive statistics. Following this, the responses to challenges and skills questions were coded to identify the emerging themes. These themes were then linked to the nine categories of knowledge to highlight which of these knowledge are considered as most challenging or most useful in the 21st century. Finally, the ratings of the 21st-century knowledge groups were compared with each other for importance and across categories of knowledge to underscore which knowledge educators value the most.

### *Participants*

A total of 738 participants started the survey, out of which 518 answered all the

questions on the survey, with a completion rate of just above 70%. About 62% of the final 518 participants were within the age group of 31 to 50 years, and nearly 72% of the total participants were identified as female. 39% of the participants were enrolled in a program at a college or university at the time of the study, and 81% of them had at least a Master's degree. Out of the 518 participants, nearly 41% had been out of a college or university for more than at least 8 years, and 82% had over 6 years of experience in their respective fields. Finally, 40% of our participants were teachers.

## **Results**

The broad details of the demographic portion of the survey have been reported above and this section will focus on the results of the other two segments: the open-ended questions on challenges and skills and the ranking of the nine kinds of knowledge essential for the 21st century.

### ***Challenges and Skills in 21st Century***

All the participants were asked to list, in two separate questions, three or more challenges and skills that they found important to teaching and learning in the 21st century. Respondents listed a total of 2,126 challenges and 2,104 skills. These open-ended responses were then coded for emerging themes using a top-down approach, where emerging themes or participant responses were further categorized using the nine kinds of knowledge that emerged from the Kereluik et al. (2013) study as categories for coding (Saldana, 2015). This allowed us to study how, if at all, the challenges and skills that the participants considered as important aligned with their and the experts' perspectives of what knowledge is of most worth in the 21st century. The following sections cover the details of how the coding was done for each of the two questions.

### ***Challenges***

The first open-ended question we analyzed was regarding identifying three or more challenges that the respondents

found to be important to teaching and learning in the 21st century. We Two raters separately coded the data using a top-down approach to see which of the nine themes of knowledge they could be associated with, if at all. However, to have clean data to code, we had to first do a bottom-up coding of code raw data to look for general patterns (Saldana, 2015), which were then coded for the nine themes of knowledge (see Table 1 for examples). Two coders went over 2,126 responses to put the emerging themes in ten overarching categories of the nine kinds of knowledge and a tenth miscellaneous category with an interrater reliability of 88% after the first round. They coded the remaining 12% together to come to an agreement.

Multiple coding was allowed, meaning responses could be coded as belonging to more than one category. Upon coding, we found that nearly 37% of challenges were associated with life/job skills (humanistic knowledge) and 25% were linked with digital/ICT literacy (foundational knowledge). The third largest category was miscellaneous (15%). The least challenging kinds of knowledge categories were found to be cross-disciplinary knowledge (0.3%), creativity/innovation (1%) (foundational knowledge), and problem solving (1.2%) (meta knowledge) (see Figure 2 for more details). Overall, most challenges were found to be associated with humanistic knowledge (44%), followed by foundational knowledge (32%) and meta knowledge (9%), where miscellaneous accounted for 15% of the challenges.

**Skills**

Another open-ended question that the respondents completed had to do with identifying three or more skills that they found to be important to teaching and learning in the 21st century. A total of 518 participants responded with three to five skills each, resulting in a total of 2,104 skills being listed. Two raters separately coded used a top-down approach to the skills under ten categories (see Table 2 for examples), including the nine knowledge sets in the 21st-century framework with an addition of a

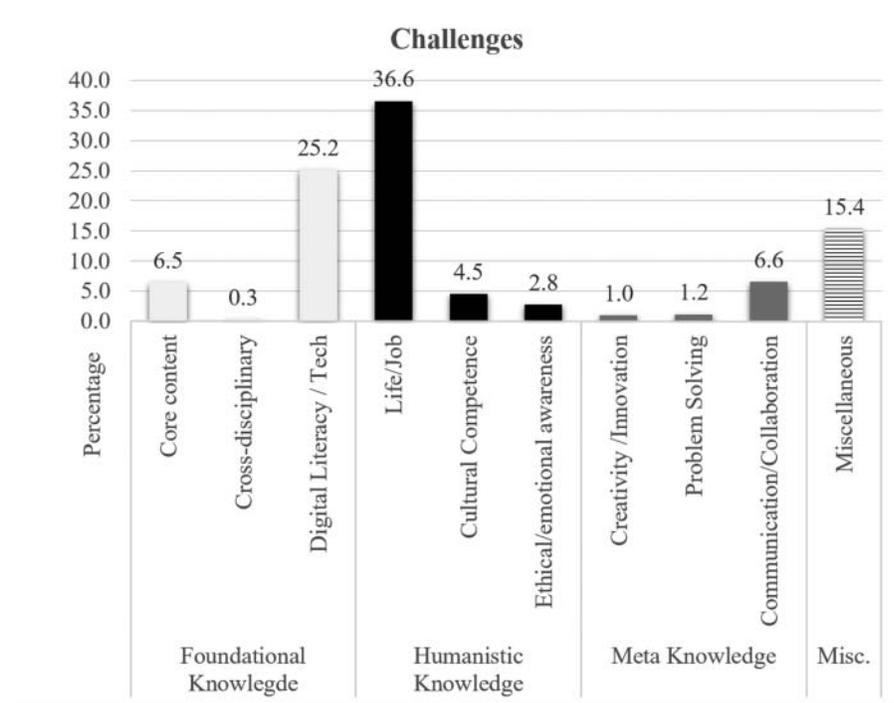
**Table 1.** Examples of Challenges From the Survey That Teachers and Educators Stated They Face in the 21st Century

Challenges	Broader code	Knowledge category
Understanding rather than memorizing what is taught in schools today	Developing human ability, knowledge	Core content
Must be experts in ALL areas, not a generalist	Information, knowledge	Cross-disciplinary
Trusting all information found on the Internet (yes, this still happens no matter how much you teach them to be critical thinkers)	Information	Digital/ICT literacy
Need creative, innovative thinkers	Creativity	Creativity/innovation
Learning to assess and act on problems quickly	Developing human ability	Problem solving
Less personal people to people interaction	Communication	Communication/collaboration
Uncertain future/job market	Work and employment	Life/job
Transphobia	Equality issues	Cultural competence
Maintaining intellectual property	Information	Ethical/emotional awareness
Maintaining intellectual property	Information	Digital/ICT literacy
Changes to state and federal standards	Change	Miscellaneous

Source: Survey data.

miscellaneous category for skills that did not fall under the nine knowledge sets (Saldana, 2015). An interrater reliability of 92% was reached. They coded the remaining 8% together to reach an agreement. Multiple coding was allowed, which resulted into 2,644 codes total.

Out of these, we found almost 21% of the important skills to have in the 21st century to be focused on Digital/ICT literacy (foundational knowledge). The second highest set of skills—not including miscellaneous—was focused on communication and collaboration (meta



**Figure 2.** Teachers and educators' ratings of the most and the least challenging knowledge domains in the 21st century.

**Table 2.** Examples of Skills From the Survey That Teachers and Educators Stated as Needed in the 21st Century

Skills	Knowledge category
Basic statistical knowledge	Core content
Be an expert in something that has nothing to do with your career	Cross-disciplinary
Basic tech literacy	Digital/ICT literacy
Being innovative and creative	Creativity/innovation
Bullshit detecting, creative problem solving	Creativity/innovation
Bullshit detecting, creative problem solving	Problem solving
Flexibility in communication and working methods	Communication/collaboration
How to be professional	Life/job
How to think in a global perspective	Cultural competence
Empathy	Cultural competence
Empathy	Ethical/emotional awareness
Energy	Miscellaneous

Source: Survey data.

knowledge) at 12%, closely followed by problem solving (meta) at 11%. The least frequently occurring skills were creativity/innovation (3.3%) (meta) and life and job skills (4%) (humanistic knowledge) (see Figure 3). We can see here that one of the nine kinds of knowledge, life and job skills, that was found to be the most challenging was also found to be among the least required skill in the 21st century. Creativity/innovation was among the least challenging and also the least frequently occurring skill. Speaking in

terms of the overarching three categories of knowledge, most skills were found to be associated with foundational knowledge (36.5%), where digital/ICT literacy pulled most weight, followed by meta knowledge (26%) and humanistic knowledge (17%), and miscellaneous accounted for 16.7% of skills.

In the next section of this article, we discuss the quantitative analysis where we looked at how the educators rated the relative importance of the nine categories of knowledge. In

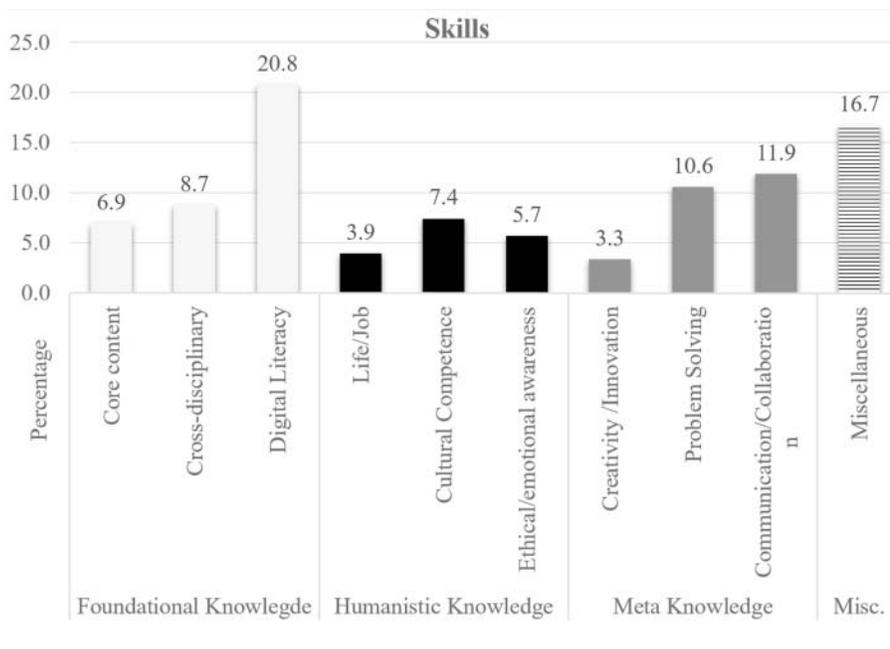
contrast to the previous two questions, which required open-ended answers, this question in the survey was framed tightly within the Kereluik et al. (2013) framework.

**The Practitioner Perspective on 21st-Century Learning**

All participants ( $n = 518$ ) ranked the nine knowledge sets based on their level of importance. Friedman’s omnibus test was used to see if there was an overall difference between their mean rankings (Friedman, 1937). There was a statistically significant difference in the mean ranking of importance of the nine knowledge sets,  $\chi^2(8) = 724.90, p < .001$ . We then organized the nine sets into the three overarching categories (foundational, humanistic, and meta) and performed the same test. There was, once again, a statistically significant difference between their mean ranking,  $\chi^2(2) = 321.37, p < .001$ . To examine where the difference actually occurs, Wilcoxon signed-rank tests were performed by first pairing the three overarching sets of knowledge: foundational, humanistic, and meta (Field, Miles, & Field, 2012).

Overall, on a scale of 1 (*least important*) to 9 (*most important*), meta knowledge ( $M = 6.21, SD = 1.19$ ) was rated to be the most important in 21st-century learning by the participants, followed by humanistic knowledge ( $M = 4.82, SD = 1.38$ ), and finally foundational knowledge, which was rated the least important ( $M = 3.97, SD = 1.33$ ) (see Figure 4). Using the Wilcoxon signed-rank test, the foundational knowledge was found to be statistically significantly different from humanistic knowledge ( $t = 7.65, p < .001$ ), and meta knowledge ( $t = 16.48, p < .001$ ). Humanistic knowledge was also statistically significantly different from meta knowledge ( $t = -12.15, p < .001$ ). When comparing the three knowledge sets for statistical significance, we made the Bonferroni adjustment and used the  $p$  value of  $.05/3 (.016)$  to reduce the chances of making a Type I error.

If we zoom in, going from the overarching categories to the nine



**Figure 3.** Teachers and educators’ ratings of the most and the least important skills to have in the 21st century.

subcategories, we find that problem solving/critical thinking were rated as the most important ( $M = 6.87, SD = 2.13$ ), closely followed by communication and collaboration ( $M = 6.36, SD = 2.03$ ), with creativity/innovation ( $M = 5.39, SD = 2.43$ ) as the third most important knowledge in the 21st century (see Figure 5). Together, these three constituted the meta knowledge. Core content knowledge ( $M = 3.77, SD = 2.54$ ) and cross-disciplinary knowledge ( $M = 3.24, SD = 2.11$ ) were considered to be the two least important categories. These two subcategories of knowledge, along with digital/ICT literacy, constituted foundational knowledge, which participants rated the least important knowledge overall. Digital/ICT literacy, however, was statistically significantly higher than its two counterparts, core content knowledge ( $t = -7.01, p < .001$ ) and cross-disciplinary knowledge ( $t = -10.12, p < .001$ ). Despite its higher average, digital/ICT literacy could not bring the overall average importance of foundational knowledge high enough to compare with meta or humanistic knowledge. When comparing the nine knowledge sets for statistical significance, once again, we made the Bonferroni adjustment and used the  $p$  value of .05/9 (.006) to reduce the chances of making a Type I error.

**Findings**

The key focus of this study was to compare what practicing educators believe is important for 21st-century learning with the experts' perspectives on the same issue. To recap, the experts' view (as laid out in Kereluik et al., 2013) was that the nine categories of knowledge, further collapsed into three overarching categories (foundational, humanistic, and meta), are of equal importance in the 21st century. The results of our survey clearly indicate that our survey respondents have a significantly different viewpoint on this matter. Based on responses from 518 participants, the qualitative and quantitative results clearly indicate that our respondents value some forms of knowledge as being more important

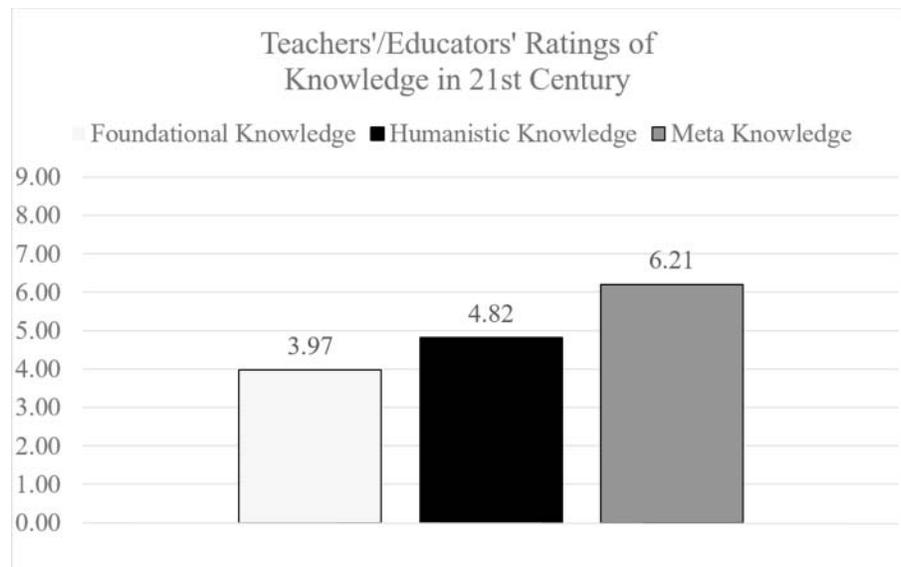


Figure 4. Teachers' and educators' ratings of the three broad domains of knowledge in the 21st century.

than others at a statistically significant level. Specifically, our respondents indicate that in terms of the overarching

categories, meta knowledge was of greater importance (in a statistically significant manner) for 21st-century learning than either humanistic knowledge or

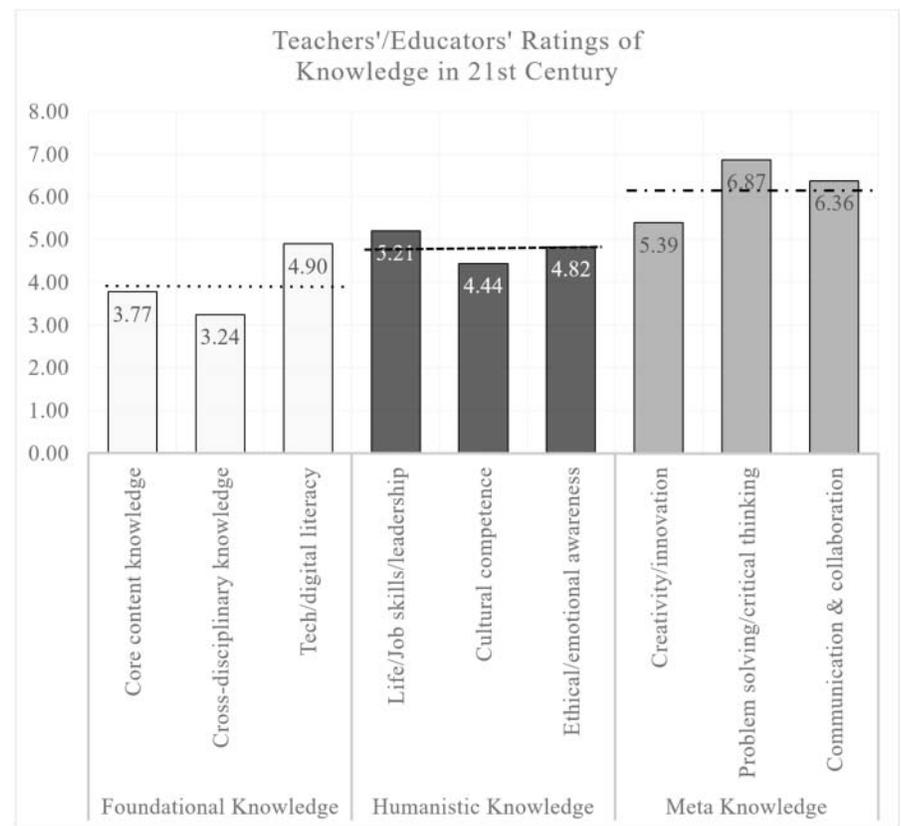


Figure 5. Teachers and educators' ratings of the nine knowledge domains in the 21st century. (Dashed lines indicate category-wide averages).

foundational knowledge. Meta knowledge had the highest average when comparing across the three overarching categories (see Figure 4), and its subcategories (creativity/innovation; problem solving/critical thinking; communication/collaboration) also had the three highest means across all nine categories. The next highest value was placed on humanistic knowledge, and two of the three subcategories within it (life/job skills/leadership and ethical emotional awareness) received the fourth and fifth highest means. Cultural competence was valued slightly lower than digital/ICT literacy (a subcategory of foundational knowledge) but had the seventh highest mean overall.

Our respondents placed the least value on foundational knowledge. Two of the subcategories within foundational knowledge (core content knowledge and cross-disciplinary knowledge) received the lowest means (eighth and ninth, respectively). Foundational knowledge would have been valued even lower if not for the subcategory of digital/ICT literacy (which came sixth within the nine categories). In fact, within the broader category of foundational knowledge, digital/ICT literacy was valued statistically significantly higher than the other two sub-categories (core disciplinary and cross-disciplinary knowledge) (see Figure 5).

To summarize, we found that teachers and educators consider meta knowledge, like problem solving, critical thinking, creativity, innovation, communication, and collaboration, as the most important form of knowledge in the 21st century. We also found that teachers and educators considered foundational knowledge, such as core content knowledge and cross-disciplinary knowledge, as the least important among all possible forms of knowledge, with the exception of digital and technological literacy as more important than the other two. Humanistic knowledge, like life and job skills, leadership, cultural competence, and ethical and emotional awareness, ending up in the middle of the pack, and was considered to be of less importance than meta

knowledge, and of more importance than foundational knowledge.

From the qualitative open-ended questions, we also found that teachers and educators considered dealing with life/job skills and information, change, and technology (digital/ICT literacy) as their biggest challenges in 21st century and deemed skills like digital literacy and communication and collaboration important to dealing with these challenges. Paradoxically, even though humanistic skills were found to be the most challenging, they were considered the least important skill set (17%) to have to cope with challenges in the 21st century. Meta knowledge, on the other hand, was found to be the least challenging category (9%), but an important skill set to have (26%), in addition to being rated the most important set of knowledge. Foundational skills were considered the second most challenging (32%) and also deemed an important skill set (36%) to have in the 21st century. However, in both cases, digital/ICT literacy took the majority share (25% and 21%, respectively), which gave foundational knowledge a higher share than expected. Thus, the undervaluing of disciplinary knowledge can be seen even in the qualitative results as well, where core content knowledge and cross-disciplinary knowledge received relatively little attention compared to other categories (see Figures 2 and 3).

### **Implications**

Based on the results, it is clear that the meta knowledge categories (which broadly align with the 4 Cs) are regarded as being the most important for 21st-century learning. Basic knowledge of content (either core disciplinary knowledge or cross-disciplinary knowledge) is regarded as being of least importance for learning in the 21st century. This is in stark contrast to the experts' view of what knowledge is of most worth for 21st-century learning, as laid out in the 3 × 3 model from the Kereluik et al. analysis, where each of these broad categories was seen as being of equal importance. Thus, practicing educators have quite a different view from that of the

experts of what knowledge is important to learners and are consistent with what has become a dominant viewpoint regarding 21st-century learning. This viewpoint values meta and humanistic knowledge over disciplinary learning (as captured by Mitra's statement that "Knowledge is obsolete"). These beliefs will clearly have consequences for learners—since the research shows that educators' beliefs often have significant influence on how curricula are designed and enacted (Borko & Putnam, 1995; Richardson, 1996).

We believe that this difference in viewpoint is deeply problematic, devaluing as it does the importance of core disciplinary learning (and cross-disciplinary learning). This way of thinking (see Stinson, 2015) emerges, we believe, from an impoverished view of the process, meaning, and value of disciplinary (and cross-disciplinary) learning. The implication that in a world saturated with information (via ICT) facts and memorization are no longer important is narrow, and in fact, an incorrect understanding of what it means to learn. By conflating disciplinary knowledge with facts and memorization, the proponents of this viewpoint deeply misunderstand or misrepresent what it means to learn a discipline. Furthermore, the lower emphasis placed on humanistic knowledge also indicates a narrow perspective about the values that we bring to the educational enterprise. Therefore, we end this article by answering the question that surfaces from these results: What is it that we educators get wrong about 21st-century learning?

### **What We Educators Get Wrong About 21st-Century Learning**

When Kereluik et al. (2013) studied the literature around 21st-century learning, they found nine kinds of knowledge that experts considered to be important. However, in this study, we found educators to be favoring meta knowledge ("to act") (that aligns more with the 4 Cs) and humanistic knowledge ("to value") over foundational knowledge ("to know") (like core disciplinary and cross-disciplinary knowledge). This shift away

from foundational and humanistic knowledge, which highlights a difference between what experts consider as important versus what teachers and educators view as important, reflects a more popular mind set that favors tool or technology over knowledge, thus putting more emphasis on softer, interpersonal skills than on content (e.g., Mitra et al., 2005).

Contrary to this popular belief, there is a range of arguments that can be made for the value of disciplinary and cross-disciplinary learning for the 21st century. For instance, disciplines instantiate specific and unique ways of thinking about (and understanding) the world around us. As Mansilla and Gardner (2008) write:

Scientists hold theories about the natural world that guide their observations. They make hypotheses, design experiments to test them, revise their views in light of their findings, and make fresh observations. Artists, on the other hand, seek to shed novel light on the object of their attention, depict it with masterful technique, and stretch and provoke themselves and their audiences through deliberate ambiguities in their work. (p. 17)

We argue that the reason behind the shift away from foundational knowledge in educators' opinion can be defined in terms of educational myths that influence some of the educational discourse today. More specifically, we frame three key myths that can be considered problematic in the present scenario to help understand the results of this study. We use these myths as a tool to propose resolutions for valuing a balance in the three sets of knowledge.

**Myth 1: Disciplinary Learning Is Easy and Is About Memorizing/Retrieving Facts**

There are three critical points to consider when resolving this myth. First, imagine designing a computer chip or a new cure for cancer; developing solutions for reducing carbon emissions or creating the latest holographic art exhibition; researching a new way to study the

origin of exo-planets or conducting a historical analysis of the origin of the Cold War; or composing a new symphony or writing a novel. Each of these activities requires deep knowledge of the domain under question, be it engineering, material science, chemistry, astronomy, history, art, and more. It is truly naive to think that just reading articles on the Internet when you need to can help you pick up deep knowledge of a domain. Such a perspective is deeply insulting to the years of effort and hard work that scientists, artists, engineers, authors, historians, social scientists, or psychologists need to undergo in order to become experts in their respective domains. Humans are not born with an instinct to do calculus or compose symphonies. These accomplishments are based on complex skills that have to be learned. In fact, one can argue that success in the future will require more disciplinary knowledge rather than less, since the world is more complicated than ever before.

Second, disciplinary knowledge is more than facts or equations that need to be merely looked up. As Gardner (2006) has suggested, the invention of the discipline is maybe one of the greatest inventions of the human mind. It gives structure to the world, and is far more than just a collection of facts. Different disciplines have different kinds of knowledge, purposes for existing, and methods of developing new knowledge, and different forms for representing that knowledge. These aspects go far beyond knowing facts to developing knowledge structures, ways of thinking, forms or representations of that knowledge—and these are hard and not easy to come by. Janet Donald in her book *Learning to Think: Disciplinary Perspectives* (2002) develops a framework for learning that goes beyond the acquisition of knowledge and describes ways of constructing and utilizing knowledge within disciplines and how learning is different in different disciplines. This is a stark contrast to the “look it up on the Internet” approach to learning.

Third, problems in the real world do not respect disciplinary boundaries. In

fact, one could argue that the problems we face today are fundamentally interdisciplinary in nature. Whether it be global warming, or terrorism, or issues of equity or sustainability—no single discipline has “ownership” over the issues. Similarly, solutions, if any, are going to cut across disciplines. This emphasizes the importance of both disciplinary and cross-disciplinary learning.

*Implications for Educators*

Thinking specifically of what implications this myth has on educators, we can summarize it as the following: Information does not equate to knowledge. Also, as teachers and teacher educators, we need to be careful when we start considering technology as a replacement for experts in the classroom. We need teachers in classrooms as experts, not just of content but also of pedagogy and technology, thus becoming facilitators and designers of experiences that allow for the transformation of information into knowledge. The emphasis on disciplines means that teachers need to go beyond facts toward helping develop broader disciplinary lenses with which students learn to be and act in the world. Technology (whether analog or digital) will, of course, play an important role in this process, but it is not the learning objective in and of itself. Finally, it is critical for teachers to make explicit transdisciplinary real-world connections. Making explicit connections that jump across disciplinary boundaries makes students realize that disciplinary knowledge needs more cross-disciplinary knowledge than is often portrayed.

**Myth 2: Creativity, Collaboration, Critical Thinking, and Communication Are Content Neutral**

What is ironic is that those who are emphasizing the 4 Cs (creativity, collaboration, critical thinking, communication—or what we are calling meta knowledge) do not realize that being successful in each of these requires disciplinary and cross-disciplinary knowledge. An example of this misguided sentiment can be seen in a quote by Mitra where he suggested that “If

knowing becomes obsolete I think it'll leave us with space for something that is perhaps more important, which is creating" (Stinson, 2015). This fundamentally misunderstands the significance of disciplinary and cross-disciplinary knowledge for creativity. Being creative in any field, be it mathematics or music, art or archeology, education or engineering, requires a sound foundation in the domain. It is a mistake to think that creativity or collaboration or communication can happen in a vacuum. What will one be creative about? What is it that one seeks to communicate or collaborate on? Research indicates that creativity, in particular, often requires more than the knowledge of one discipline (Mishra, Koehler, & Henriksen, 2010). It requires deep knowledge of a discipline and at the same time the ability to break out of the disciplinary structures (often through the application or combinatorial "remixing" of knowledge from other disciplines), once again emphasizing the dual importance of disciplinary and cross-disciplinary learning, what we (Mishra & Henriksen, 2012) have previously called (in)disciplined learning. By this we mean learning that is deeply grounded in the discipline and yet has a bit of in-discipline in it as well, cutting across disciplinary limits to emphasize divergent thinking and imagination. As Mishra, Henriksen, and the Deep-Play Research (2012) group write:

We need to break away from the current approaches to incorporating creativity in the classroom (which are often too generic, and do not take the notion of content or disciplines into account). Education today requires a more action-oriented view, where we consider creativity and thinking in ways that great creative minds actually do. Our notion of being in-disciplined suggests that it is important to work within a discipline, and also be able to learn and gather ideas by crossing over into others. (p. 20)

#### *Implications for Educators*

Specific implications of this myth for teachers and teacher educators can be

summarized by stressing on the importance of how we define and understand creativity, critical thinking, collaboration, and communication (the 4 Cs). We need to remember that creativity needs disciplinary knowledge. It is not content neutral. What it means to be a creative mathematician may not necessarily be the same thing as being a creative musician. Fostering creativity in each discipline may require different roles on teachers' parts. The same can be said for critical thinking, collaboration, and communication. These skills may be considered as transferable, but cannot be seen as being applied similarly across disciplines. This means that if we are to encourage the 4 Cs we have to take a more nuanced and content-driven approach toward both teacher training and student learning.

#### ***Myth 3: There Is a Simple Answer to Learning in the 21st Century***

In the previous two points, we emphasize the significance of foundational knowledge. However, this does not undermine the importance of humanistic knowledge and meta knowledge in the 21st century. As mentioned earlier, we argue for a more balanced approach that affords students the opportunity to learn at the intersection of the three knowledge domains, where each set of knowledge has its own unique role to play in the 21st century, none of which should be more or less significant than the other.

Starting with the importance of humanistic knowledge, researchers like Shirley Brice Heath (1983) and Gloria Ladson-Billings (1995) have repeatedly stressed the significance of a more culturally competent approach in classrooms that affords students with life and job skills and makes them more ethically and emotionally aware of other cultures and people. In addition, they also underscored the impact of culturally relevant teaching on academic success and learning content. Humanistic knowledge, in all its forms, has been found to be relevant when used to create a dynamic, culturally competent environment for learning. Given the diversity in classrooms, or a need for increasing diversity, in the 21st century, it is becoming even more

critical to find a balance between foundational knowledge and humanistic knowledge to help students prepare for their future jobs and life and identify the relevance of their disciplinary understanding. On one hand, humanistic knowledge provides a rich lens to look at the world more empathetically. It provides us with a sense of value—providing meaning and context for what we need to know (foundational knowledge) and how we act on that knowledge (meta knowledge). On the other hand, foundational knowledge provides a unique disciplinary lens of looking at the regular, everyday life in new, creative ways (Henriksen, Mehta, & Mishra, 2014).

Similarly, as mentioned in the second myth, meta knowledge, which is often addressed as the 4 Cs (creativity, critical thinking, collaboration, and communication), is also purposeless without foundational application. We argue that the 4 Cs—against the commonly held notion—are not content neutral. On one hand, creativity and innovation, along with collaboration and communication, and critical thinking cannot happen in a vacuum. In order for these skills to flourish, a foundational knowledge is needed that provides the raw material to build upon. On the other hand, foundational knowledge without creativity, critical thinking, and communication comes at a risk of banality and stagnation. In order for a discipline to flourish and engage people, it needs to have room for creative and critical thinking, and should support innovative ideas, collaboration, and communication.

#### *Implications for Educators*

Specific implications for this myth are built on the previous two myths. As mentioned already, first, disciplinary and cross-disciplinary knowledge are important. Second, creativity, critical thinking, communication, and collaboration should not be considered as content neutral. This means that, as teachers and educators, we need to avoid generalizing solutions to educational issues. There is no magic bullet for solving the real issues that face us as educators. Real life is messy and so is teaching. It is therefore important to balance these skills and knowledge categories instead of looking

for one miracle cure. There is a need for nuance and sensitivity to better understand the context and the dynamics of the classroom, the discipline being taught, the pedagogical approaches that are used, and the affordances of technological tools. This is what makes teaching a wicked problem, but it is also this that makes it such a rich and engaging activity.

### Limitations

Like any study, our design and instruments have a few limitations as well. First, sending the survey via e-mail and social media to reach a wider participant sample created a nonrepresentative sample. To counter this limitation, we added demographic questions to get a better sense of representation of the population, though, to be clear, that does not fundamentally mitigate the limitation. Second, we based the instrument on one meta-framework of 21st-century learning, as proposed by Kereluik et al. (2013). Clearly this analysis is not the last word on the subject and there are other frameworks out there that we could have used. Finally, in the last question in our survey, we created a question for our participants to rank the nine types of knowledge. The nature of this instrument could have influenced participants to choose one type of knowledge over the others even if they considered two or more as being equal. Methodologically, we also addressed this by using the Wilcoxon signed-rank test, which is a nonparametric hypothesis test for samples of ordinal data. The fact that our participants' responses show statistically significant trends of valuing certain types of knowledge over others is an indication of some key patterns by which they thought about learning in the 21st century.

### Conclusion

These three myths suggest that the idea that content knowledge is of less importance is deeply misguided, driven by an ignorance of the true nature of learning in the disciplines and the important role it plays in creativity, communication, and

collaboration. Such perspectives to teaching and learning are often reflected in statements like "Sit children in rows and pour facts into their brains" (Mitra, as quoted in Stinson, 2015, ¶ 19), which can be misleading, and therefore quite problematic, ignoring as it does all that we have learned over the years about how learning actually happens. We do not deny that there is much to criticize about current educational practices and schooling approaches. We must, however, be careful not to throw out the proverbial baby with the bathwater. Our purpose should not be to drop algebra or art for courses on creativity and innovative thinking, but rather to ensure that these foundations are taught in a way that dig deeply into their disciplinary perspectives, while affording a creative and innovative space for students to think critically and collaboratively in ways that are conducive to the development of valuable skills transferable to life beyond school. In order to achieve this harmony, we cannot undermine the significance of "disciplining the mind"—or, in the words of Mansilla and Gardner (2009), the true goal of education is the inculcation of disciplinary thinking, and to

instill in the young the disposition to interpret the world in the distinctive ways that characterize the thinking of experienced disciplinarians—historians, scientists, mathematicians, and artists. This view entrusts education institutions with the responsibility of disciplining the young mind. (p. 1)

In conclusion, the perspective we are arguing for values all aspects of 21st-century learning—foundational, humanistic, and meta. To achieve a harmony between these three, especially in this technology-driven 21st-century learning, it is critical to remind ourselves that while creativity and innovation needs to be supported in classrooms, this should not undermine the importance of disciplinary and cross-disciplinary knowledge. In fact, creativity, collaboration and critical thinking cannot happen without

disciplinary or cross-disciplinary foundations. Finally, the humanistic perspective provides a lens and a set of broader values that allow us to be purposeful as we decide what foundational knowledge is to be emphasized and how we act on that knowledge. For example, disciplinary knowledge of science can tell us how to influence genetic selection; creativity, ingenuity, and collaboration among scientists allow us to do that, but it is only humanistic knowledge that can educate us on when and why such approaches are advisable. And this is not a solitary example. The challenges that face us in the 21st century, from climate change to the migrant crisis, from biotechnology to the demands of economic inequity, require us, as educators, to bring all that we have in our muster, to develop the next generation of citizens, who will have the right, knowledge, skills, and values to tackle these challenges. It cannot be done merely through a vacuous, ungrounded form of creativity and collaboration (though clearly these skills will be essential). It will require deep knowledge of the disciplines and ways of thinking that cut across disciplines, skills and approaches of acting on that knowledge, and, most importantly a set of humanistic values that they will bring to the task.

It is clear to us that as 21st-century educators, we need to first step away from the hype surrounding new technologies and Internet resources to understand that in some ways the goal of schooling and education has not changed. It is still about instilling in learners ways of thinking that are tightly connected to disciplinary ways of knowing embedded within a humanistic worldview. The mere presence of information and communication technology (ICT) and the immediate availability of information do not mean that these forms of knowledge are obsolete. New tools and technologies do provide us with new and innovative ways of acquiring and transmitting such knowledge, but they do not fundamentally change

the goals and purposes of education. We ignore or simplify these goals at our peril (and the peril of the learners under our care). Learning is hard, and simplifications that ignore its challenges and realities do more harm than good. This is not to undervalue the importance of the 4 Cs, but rather to place that importance within a frame that respects the value of foundational and humanistic perspectives. To quote Noam Chomsky:

You cannot pursue any kind of inquiry without a relatively clear framework that is directing your search and helping you choose what is significant and what is not . . . If you do not have some sort of a framework for what matters—always, of course, with the proviso that you are willing to question it if it seems to be going in the wrong direction—if you do not have that, exploring the Internet is just picking out the random factoids that don't mean anything . . . You have to know how to evaluate, interpret, and understand . . . The person who wins the Nobel Prize is not the person who read the most journal articles and took the most notes on them. It is the person who knew what to look for. And cultivating that capacity to seek what is significant, always willing to question whether you are on the right track—that is what education is going to be about, whether it is using computers and the Internet, or pencil and paper, or books. (Learning Without Frontiers, 2012)

### Acknowledgments

The authors thank the members of the Deep-Play research group at Michigan State University and Dr. Matthew J. Koehler for their help with all aspects of the design, implementation, and writing of this research study.

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## Appendix: Survey

### Demographic Questions.

- How old are you?
  - Less than 20
  - 20–30
  - 31–40
  - 41–50
  - 51–60
  - 60+
- What is your gender?
  - Male
  - Female
  - Other
- Are you currently in a program of study at a college/university?
  - Yes
  - No
- What is the highest degree you’ve obtained?
  - High school graduate
  - Associate’s degree
  - Bachelor’s degree
  - Master’s degree
  - Doctoral degree
- How many years since your last degree?
  - 1–3 years
  - 4–7 years
  - 8–11 years
  - 12–15 years
  - 15–20 years
  - 20+ years
- Do you work in a field related to education? If you do, please select the profession closest to yours from the options below. If you don’t work in education, please select “other” and specify your profession in the space below.
  - School administrator
  - Director/coordinator
  - Teacher
  - Preservice teacher
  - Technology support staff
  - Library/media specialist
  - Other support staff (school psychologist, social worker, etc.)
  - Graduate student
  - Higher ed. faculty
  - Board of education member
  - Education consultant
  - Education publisher
  - Other school staff
  - Other. If “other,” please specify.
- If you work in education, how long have you worked in the field?
  - 1–3 years
  - 4–6 years
  - 6–10 years
  - 11–15 years
  - 16–20 years
  - 20+ years
  - N/A
- If you work at the K12 level, what type of district do you work in?
  - Not a K12 teacher
  - Urban
  - Rural
  - Suburban
  - Other (please specify)
- If you are a K12 classroom teacher what subject(s) do you teach?
  - Not a K12 teacher
  - Art
  - Business and computer education
  - Counseling
  - Driver education
  - English
  - Family and consumer education
  - Foreign languages
  - Gifted
  - Library media
  - Literacy (reading, writing, language arts)
  - Math
  - Music
  - Physical education/health
  - Science
  - Social studies
  - Special education
  - Technology and engineering
  - K–5

### Challenges and Skill.

- In the space below, list three to five challenges faced by people in the 21st century, as a result of our changing modern world.
- In the space below, list three to five types of knowledge/skills that you feel are needed by people to deal with the

21st century challenges that you listed above.

**Knowledge in 21st century.** Please rate each of the subcategories of 21st century knowledge individually in order of importance. (9-point scale. Displayed in random order in survey.)

- |  |   |  |
|--|---|--|
| <ol style="list-style-type: none"> <li>1. Ethical/emotional awareness: Knowledge to identify, understand, and handle one's own feelings and emotions as well as those of other people.</li> <li>2. Digital/ICT literacy: Knowledge about how to learn and work with technology.</li> </ol> | <ol style="list-style-type: none"> <li>3. Problem solving/critical thinking: Knowledge or skills to reason effectively, analyze information, use good judgment, make decisions, and problem solve.</li> <li>4. Core content knowledge: Knowledge of basic subject matters such as math, science, reading, writing, language, arts, history, etc.</li> <li>5. Cultural competence: Knowledge or ability to understand, communicate and interact effectively with people from varied cultures or socioeconomic backgrounds.</li> <li>6. Creativity/innovation: Knowledge and ability to think and work creatively,</li> </ol> | <p>individually or with others. Being able to create and act on new and worthwhile ideas.</p> <ol style="list-style-type: none"> <li>7. Cross-disciplinary knowledge: Knowledge that connects one field or subject matter to another, such as math and music; literature and psychology.</li> <li>8. Life/job skills/leadership: Knowledge that promotes success in work and life (flexibility/adaptability, self-direction and initiative, responsibility, and social skills).</li> <li>9. Communication and collaboration: Knowledge and skills to communicate clearly, and to work well with others.</li> </ol> |
|--|---|--|
-