

21st Century Competencies – What are they and are we teaching them?

Summary

This last issue of Volume 4 of the Digest continues to look at teachers in the Singapore classroom and analyses the skills that they are required to have in order that their students develop the beliefs, attitudes and skills they will need in the world beyond school. This issue focuses on 21st century competencies (and other related frameworks such as 21st century skills and 21st century literacies) which it is forecast will be the essential competencies for the future workforce.

The first section of the issue compares the frameworks (21st century competencies, 21st century skills and 21st century literacies) and the areas of overlap and differences. The second section looks at what these competencies (skills, literacies) are, the third looks at whether these are currently taught, the fourth section looks at approaches to teaching them and the fifth section examines whether teachers already have the required teaching skills and how they could develop those skills if they have not yet developed them. A sixth section considers assessment that is appropriate to the 21st century competencies that students are being asked to develop.

Introduction

In 2006, Bruett (2006) reported that Dell, one of the major electronic companies in the US, was looking for people with ‘twenty-first century skills such as self-direction, problem solving, communication and collaboration, and technology proficiency’ (p. 25). Dell was seeking to employ people who thought and acted globally and had ‘a commitment to learn how to work with cultures other than their own’ (p. 25).

Singapore began early on its focus on enhancing students’ thinking skills, an integral part of the 21st century skills described by Bruett (2006) above, but the defining moment came with the launch of Thinking Schools, Learning Nation (TSLN) in 1997 when Singapore began in earnest to focus on the preparation of the teachers, infrastructure and technology needed to prepare students for the demands of the 21st century (Tan, Choo, Kang, & Liem, 2017). The intent of the policy was the development of creative and critical thinking students with a reduction in curriculum content, a revision of assessment and a focus on process.

In 2011, the Singapore Ministry of Education pub-

lished online a Framework for 21st Century Competencies and Student Outcomes (Ministry of Education, 2011). It began:

Globalisation, changing demographics and technological advancements are some of the key driving forces of the future. Our students will have to be prepared to face these challenges and seize the opportunities brought about by these forces. (p. 1)

A quick scan of the Framework establishes that it covers a range from values, to communication and collaboration skills, to thinking skills. This issue of the Digest, however, will generally focus on those 21st competencies that in some way involve the use of language, specifically the English language, in and across school. Most obviously, language is generally involved in collaboration and communication no matter what subject is being taught, no matter what activity is taking place.

In the following pages, we will attempt to define what is meant by 21st century competencies focusing on aspects related to language and communication, taking note along the way of possible approaches to developing those language related aspects not only in the English Language classroom

but across all subjects and, finally, considering what skills teachers will need to help students develop those competencies.

It is worth noting that, as clarified by Tan et al. (2017), the competencies and related dispositions being discussed are not actually particular to the 21st century. Humans have always found it important to think creatively and critically, to communicate and to collaborate. However, particularly in the industrial ages, these competencies tended to be developed only among an elite that managed the economy. However, as machinery takes over the more mundane functions that employed people in the industrial age, the knowledge age of the 21st century will require these competencies for the creative demands of much future employment.

Skills, competencies or literacies

In this section, we will look at what is meant by three different terms, 21st century skills, competencies and literacies, addressing such issues as whether they mean the same thing and whether it matters which term we use?

Bruett (2006) noted:

Today's students need to know how to apply their knowledge in a real-world environment by thinking critically, analyzing information, comprehending new ideas, communicating, collaborating in teams, and solving problems—all in the context of modern life. We call these competencies twenty-first century skills. (p. 27)

The last sentence seems to indicate that, for Bruett (2006) at least, 'competencies' and 'skills' are the same thing.

In their report of a study of American employers' views regarding the readiness of school graduates for employment in the 21st century, Casner-Lotto and Barrington (2006) did not give a definition of 'skill', but they did define two skill subsets. They referred to the first set as *Basic Knowledge/Skills*, the fundamentals learnt in school such as grammar and spelling in English. The second set, *Applied Skills*, were necessary for success at work, enabling employees to use the Basic Skills they had learnt in oral and written communication, teamwork and collaboration.

Casner-Lotto and Barrington (2006) also gave a formal definition of what they referred to as 'core competencies'. For them, these included knowledge, skills, abilities and behaviours necessary for job success. In their view, then, competencies were a much broader category that included not only skills but also knowledge and abilities.

Like Casner-Lotto and Barrington (2006), Ananiadou and Claro (2009) defined 21st century competencies as broader than skills suggesting that, while competencies included skills, they also included knowledge and attitudes. For an individual to be competent, he or she needed the relevant knowledge and skills as well as the appropriate attitude. However, the writers noted that 'skills' and 'competencies' were often used as equivalent terms. They also noted that there was no unanimous definition of 21st century skills and competencies and so they deliberately adopted the open-ended definition that they were whatever skills and competencies young people would need to be effective citizens and workers in the 21st century knowledge economy.

The Singapore Ministry of Education's *Framework for 21st Century Competencies and Student Outcomes* (Ministry of Education, 2011) stated that, in a graphic of two concentric circles representing its concept of 21st century competencies, the 'middle ring signifies the Social and Emotional Competencies – skills necessary for children to recognise and manage their emotions...' (p. 1) suggesting that, for the Ministry as well, the words 'competency' and 'skill' could be used as equivalents. Similarly, Carnevale and Smith (2013) defined 21st century skills as 'the competencies required for the jobs of the future' (p. 497) suggesting that 'skills' and 'competencies' were equivalents.

In view of the overlapping definitions of 'skills' and 'competencies' in the literature (see, for example, Fong & Koh, 2017; Low, Hui, & Cai, 2017 on defining 21st century competencies), this issue of the Digest will adopt the approach of Ananiadou and Claro (2009) and use the two terms largely as equivalents while recognizing that they are used differently by different writers. However, for the purposes of this issue of the Digest, we will generally use the term 'competency' preferred by the Ministry.

Ananiadou and Claro (2009) noted that not all sectors welcomed this focus on 21st century competencies or skills. Some people argued that promoting these skills was part of a purely economist approach to education supported by big business, and moved education away from preparing students for a broader humanist view of life. Moreover, while not all students in developed countries would become knowledge-intensive workers, the economist approach was even less relevant in non-developed countries. There were thus fears that an emphasis on these competencies and skills in education would increase already existing wealth disparities. Weninger (2017) expressed similar concerns, while Tan et al. (2017) suggested that the next phase in the development of 21st century competencies might question the ethics and values informing 21st century schooling.

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Before leaving this section, it would be useful to consider a third term that is also used in this context – 21st century literacies. The NCTE framework (National Council of Teachers of English, 2013) pointed out that literacy had always been defined by the cultural and communicative practices shared by members of a particular community. As society changed, those shared practices changed. In the 21st century, as information and communications technology (ICT) grew in influence, new communicative competencies and literacies would become important. NCTE's 21st Century Literacies Framework listed competencies the successful individual must have and gave ways in which these could be assessed. The students should learn how to access and evaluate multiple sources of information through different modes, collaborate across groups sharing different views and ideas and together come up with innovative ideas, which they could then share with others.

We now need to go on to finalize what the constituents of these competencies, skills or literacies are. We can then look at what can or should be taught in school and, important for this issue of the Digest, how teachers can develop the skills necessary to teach these areas.

21st century competencies

The *Framework for 21st Century Competencies and*

Student Outcomes of the Singapore Ministry of Education (2011) was presented as a set of two concentric circles as mentioned earlier. The outer circle included three sets of skills:

- Civic Literacy, Global Awareness and Cross-Cultural Skills;
- Critical and Inventive Thinking; and
- Information and Communication Skills.

For each of these sets, the Ministry of Education (2011) listed four components, for which the Ministry drew up standards and benchmarks to 'provide a common point of reference for all teachers to plan, teach, and assess the 21st Century Competencies in the total curriculum' (p. 4). (See Bruett, 2006 for a similar listing skills.)

A number of those standards related directly, although not exclusively, to language and its use in school, inside and outside the classroom. These are listed below with the aspect of the skill involving language underlined:

- For Civic Literacy, Global Awareness and Cross-Cultural Skills – The student can:
 - discuss various aspects (social, economic) of Singapore;
 - work with others from different socio-cultural groups in Singapore and beyond.
- Information and Communication Skills – The student can:
 - explain complex ideas to create an impact;
 - use information collectively developed with others to build new information, products or solutions;
 - use a variety of ICT tools to communicate and collaborate effectively with others;
 - synthesize information from various sources to draw conclusions;
 - explain the rationale of choices made regarding the ethical use of information;
 - use ICT tools to locate information and confirm its reliability.

No language related skills were found under *Critical and Inventive Thinking*.

As indicated in the previous section, Casner-Lotto and Barrington (2006) divided the 21st century skills

required into Basic and Applied. The Basic Skills encompassed those already learnt in school including grammar, spelling, writing and reading comprehension. However, while necessary, these skills were not sufficient for success in today's workplace. The school graduates needed to know how to apply these skills (or knowledge): that is, they needed to have the applied oral and written communication skills to collaborate and work in teams. When all skills were rated by employers, the applied skills consistently rated as the most important, the top three being *professionalism*, *collaboration* and *oral communication* skills.

Ananiadou and Claro (2009) summarized 21st century competencies into three dimensions of skills: *information*, *communication* and *ethics and social impact*.

In the information dimension, students needed to learn where to get information, how to assess it for reliability and how to organize and process it further, thus developing new knowledge. Clearly, in this dimension, students would need to have advanced reading, viewing, writing and representation skills relevant to the subject areas they were involved in to be able to do this. They would need to have creativity, innovation, problem solving and decision making skills. Ananiadou and Claro (2009) suggested that these skills, once reserved for a small management group, were now needed by ever growing numbers.

In the communication dimension, students needed to receive and share information and knowledge. As well as basic language knowledge, this meant students needed to learn the relevance of purpose, audience and context, including, subject. The students also had to learn to collaborate and to have the flexibility and adaptability to work in teams. Ananiadou and Claro (2009) believed the importance of these skills had been heightened in the 21st century because of the use of ICT.

In the ethics and social impact dimension, students needed to learn to take into consideration the consequences of their action or inaction. The speed and spread of the Internet meant that anything that was written there could be quickly shared with a wide range of people and any social damages could be that much greater.

The writers noted that, in most cases, these 21st century competencies were taught as part of the

individual subjects and not in sessions especially set aside for such instruction.

Trilling and Fadel (2009) also used three categories but organized them differently:

- Learning and innovation skills that included critical thinking, communication, collaboration and creativity. Trilling and Fadel (2009) proposed that these skills, though not new, had increased in importance because ICT had added new dimensions in terms of communicating and collaborating with others, gathering information and gaining access to expert others.
- Digital Literacy skills that covered information literacy, and media literacy as well as ICT literacy. Trilling and Fadel (2009) proposed that, although students today learnt the basics of using digital tools at an early age, they did not know how to use these skills for learning, how to find and evaluate the reliability of information on the Internet, how to process that information from numerous sources and then, from that, how to produce something new.
- Career and life skills that encompassed social and cross-cultural interaction. Trilling and Fadel (2009) submitted that the life and career skills they listed were not new skills peculiar to the 21st century. However, they believed they had taken on a new significance as technology made the world smaller. Students today needed to develop adaptability, initiative, social (including cross-cultural) and productivity skills as businesses moved to a flatter structure of teams brought together from across the different sections or even countries to complete specific projects. On completion of the projects, the teams broke up and new teams were formed. This form of organization demanded flexibility as well as good communication and cross-cultural skills.

They pointed to the importance of students learning these workplace related skills that had quickly and quietly transformed the culture of the 'Industrial Age' to that of the 'Knowledge Age'.

Trilling and Fadel (2009) believed that four forces were leading to pressure to change learning approaches. The first of these was the increasing demand for knowledge workers. Instead of the need for teams of workers with basic education skills to work on assembly lines, large corporations needed

to recruit staff who could work in teams to synthesize knowledge into new approaches (see also Pellegrino, 2014). Second, the last few decades had seen the rapid growth of digital tools resulting in the amount of information available to everyone being far greater than what could be learned in school. Third, the current generation had grown up in a world with a full range of digital tools that provided choice of access. They thus expected to have choice and individualization as well as the opportunity to go beyond what was given to find out ‘the real story’ behind what they learnt. Finally, learning research had indicated that several factors facilitated learning. These included learning in authentic situations or simulated realities rather than learning principles in isolation, the need for learners to accommodate new knowledge into their already existing mental models, the importance of intrinsic motivation and the variation in learner responses to different teaching approaches. Research had also shown that people learnt better in social situations where they could share and discuss what they were learning either face-to-face or online.

Greenhill (2010) also accepted that the list of competencies such as critical thinking, communication, technology literacy, and collaboration, known as 21st century competencies, were not actually new. However, she pointed out that, in the 21st century, they were no longer simply considered useful skills for the few to have but were now essential to the non-routine work that was becoming the norm for employment in the 21st century. When students graduated from high school, no matter where they intended to go from there, they needed ‘to be able to think critically, solve problems, communicate, collaborate, find good information quickly, and use technology effectively. These [were] today’s survival skills – not only for career success, but for personal and civic quality of life as well’ (p. 7). These skills were not to be taught as separate areas but had to be woven into all subjects across the board, including English Language, Mathematics, Science, Social Studies, History, Art and Music.

While the list of competencies from Greenhill (2010) largely matched those from other sources, critical thinking and problem solving, communication, collaboration, creativity and innovation, to

these, she added information literacy, media literacy and ICT literacy – an ability to access and evaluate information, an understanding of how media stories were constructed and the tools that were used, and an ability to use technology as a tool to find, evaluate and reprocess information. For her, it was important to note that competencies such as reasoning, critical thinking and problem solving were important across all subjects.

Carnevale and Smith (2013) suggested that the growing need for 21st century competencies went across all industries, not just the knowledge industries. The skills important everywhere included active listening (as the most important), reading comprehension, speaking and critical thinking. The authors pointed out that five of the top 12 skills required by employers were communicative. Listening, interpreting and following instructions and communicating these to

colleagues in oral and written forms had been found to be requirements across the board including in quite low-level jobs. Communication skills were essential to collaborating with colleagues and dealing with customers. They included an awareness of different personal and cultural communication styles and adapting accordingly. As more employers recruited staff globally, this ability to adapt styles to cultural differences increased in importance.

The consortium of the Partnership for 21st Century Learning (2015, 2016) drew up a list of the necessary skills for the 21st century. The first requirement was that students had a strong academic background in several areas, including their main language plus one other as well as Arts, Maths, Economics, Science, Geography, History, and Government and Civics. However, these formed the base only. There was also a need to include 21st century interdisciplinary themes that went across these subjects and included global awareness and financial, civic, health and environmental literacies. Those students that were ready for the more complex life of the 21st century would also have four important innovation and learning skills: creativity, critical thinking, communication and collaboration.

These skills needed to be combined with an ability to use modern technology to access information

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and to communicate with others. Thus, the students needed to be literate in information, media and technology (Fong & Koh, 2017). Critical and creative thinking, and problem-solving skills prepared students for work in the 21st century through using ICT as a visualization and thinking tool to help them learn to solve authentic problems.

Low et al. (2017) pointed out that skills such as critical thinking were not a set of fixed strategies or procedures. It was important to understand that they also involved certain dispositions such as being inquisitive, open- and fair-minded, and interested in finding evidence. The critical thinker had developed lifelong values of fairness.

Weninger (2017) noted that media literacy had come to mean the ability to access and create as a member of a community media texts that met the norms, values and ethics of that community. At the school level, the emphasis was on access as well as higher order skills of analysis and evaluation. The latter included the understanding of digital media as a form of representation, the rhetoric of that representation, the commercial interests behind the digital production and the ethics of participation. A further aspect of media literacy involved the actual production of such texts allowing for personal empowerment. This production could be in the form of remixing what was already available or it could be something completely new.

Do we teach 21st century competencies?

In a survey of American employers, Casner-Lotto and Barrington (2006) found that the employers thought school graduates were deficient in a number of Basic Skills, including writing in English and reading comprehension, and lacked Applied Skills such as communication skills and critical thinking that built on the Basic Skills. Even college graduates were regarded as being deficient in writing in English and written communication. The graduates did, however, have sufficient collaboration and ICT skills. Casner-Lotto and Barrington (2006) pointed out that the employers generally believed it was the schools' responsibility to ensure that students graduated from school with the requisite Basic and Applied Skills although some believed it was the responsibility of the students themselves.

In a survey of 400 major corporations reported by Trilling and Fadel (2009), the results also showed

that the hiring staff responding believed that students graduating from secondary school, technical college and university lacked basic skills in a number of important areas. These included areas involving language skills such as oral and written communications, teamwork and collaboration, and working in diverse teams.

According to Trilling and Fadel (2009), there were a number of forces of resistance to the adoption of 21st century approaches in schools. One such force was the continuation of policies first designed to deliver mass education during the industrialization period. Others included the use of standardized tests designed to assess only what were basic skills such as reading and maths, the difficulty of changing decades old transmitting modes of teaching, the vested interests of publishers of textbooks, the fear of putting into practice new approaches that might jeopardize hard won advances and the preferences of parents to see their children taught in the way they themselves had been taught.

Towndrow and Vaish (2009) looked at the use of wireless laptops in English classrooms in a Singapore school and reported a similar reticence towards incorporating computers fully into the work of the students. The computers were rarely used other than as tools to send information to students and the focus remained on hand-written texts with no attempt to use the computers to develop communication skills, increase opportunities for inventive thinking or develop cross-cultural/global awareness and literacy.

In a study by The Economist Intelligence Unit (EIU), ("Education systems not arming students with 21st-century skills," 2015), the students, teachers and business executives surveyed around the world thought that problem-solving was the most critical skill in the modern world along with communication and collaboration skills. While most of the students surveyed agreed that these skills were covered in school, less than half of them thought that they left school with sufficient skills for today's workplace. Only a quarter of the students felt that their school systems were effective with technology while more than half the teachers felt their students were better at technology than they were.

Weninger (2017) pointed out that the current Sin-

gapore English Language Syllabus 2010 (Curriculum Planning & Development Division, 2008) included media literacy, defined as ‘the ability to access, analyse, evaluate and *create information in a variety of forms and media*’ (p. 128; italics inserted by Weninger, 2017). However, none of the key outcomes used to guide what was taught or assessed mentioned the production of digital texts. Instead, the focus was on digital media ethics and cyber wellness. This could reduce the likelihood that the production of digital texts would appear in the enacted syllabus, and a survey of 202 Singapore teachers indicated that their teaching regarding media texts focused on the functional and critical elements and did not look at the aesthetics and production of such texts. Assessment of student knowledge and skills regarding media texts was usually done through written tests rather than the actual production of such resources, reflecting the probability that the production of media texts was largely ignored in teaching periods.

In the same study, Weninger (2017) analysed logs kept by 32 students from two Singapore schools that showed that the average 34 to 35 hours a week spent on media-related activities in and out of school were generally solitary and consumption oriented. This fitted in with other research that showed the digital natives worldwide were mainly consumers. This, combined with the lack of creative activities at school, meant that school students were not being involved in the creation of digital texts and were thus not developing this targeted 21st century skill.

Unfortunately, as Fong and Koh (2017) pointed out, studies of the effects of 21st century learning experiences on students were rare so it was difficult to state if such learning was effective. In their study of 385 Secondary 2 students, they found that students were interested in the use of ICT tools in school the least. The students were more interested in working collaboratively and Fong and Koh (2017) suggested that teachers might use this to introduce authentic problems that the students could then work on together with the aid of ICT.

Approaches to teaching 21st century competencies

If, as suggested in the previous section, schools are not preparing students with the basic and applied skills that they need for their future as workers and citizens, what can be done to improve the situation? Several writers have offered possibilities.

White (2005) reported on a discussion on the future of English organized by the Qualifications and Curriculum Authority (QCA) of the UK. The discussion, involving some 5,000 people including students, parents and employers, concerned how English should be taught and learnt in school to meet the

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needs of the 21st century. The conclusion was that the curriculum needed to be refreshed rather than radically changed. Two areas were noted. First, students needed to be given more opportunities to be creative and imaginative and meet creative people: local writers, script writers or web designers. Second, the school needed to be open to working with employers and the local community so as to better meet their needs such as the growing importance of English as a global and intercultural language noted by employers and the resulting need for clarity and precision in the use of spoken language.

Three important messages came out from the discussion:

- While reading and writing were important, more focus on the listening and speaking skills was needed for the future.
- The use of informational texts was important but stories had to remain an important part of the English curriculum.
- The literary heritage had to be recognized. While the canonical literature was important, current literature needed to be read as well, including that from various English language cultures across the world along with translations of important literature from other languages.

The discussion led to suggestions that teachers should be able to spend less time preparing the students for tests and more time for talk. Also, the time spent on some of the canonical texts should be reduced to allow for the introduction of texts

from a range of cultures, times and genres. White (2005) emphasized the links between competence, creativity, critical skills and cultural understanding. For students to be creative, it was necessary for them to be competent with a critical understanding of how language could work to change meaning as an important part of cultural understanding. Moreover, the computer, with its combination of text and graphics and used every day outside school, needed to be brought into school so that it could become a part of students' learning. The notion of literacy needed to expand to include these activities.

Casner-Lotto and Barrington (2006) suggested that one successful approach to preparing students for employment in the 21st century was project-based learning in which students worked individually, in pairs or in groups on a given project and then presented their results to the whole class by a given date. This put the students into a practical situation where they had to read to collect and process information, collaborate with others and then communicate their results to the larger group within a given schedule. In the process of completing the project, they practised their oral and written communication, collaboration and ICT skills.

In her discussion regarding the teaching of English in the 21st century, Webb (2007) suggested that the starting point always had to be an understanding of the lives, cultures, identities and interests of the students so as to enable them to use contexts they knew to draw on their existing knowledge before moving on into new contexts. English teachers could start by looking at what the students already knew something about, such as music clips or text messages, and then move on to related forms of literature (canonical texts) or communicative texts (emails, letters and summaries).

The second strategy that Webb (2007) recommended was to provide choice. Choice gave a sense of control to students and thus a sense of commitment to what they were doing, an important part of education. This choice should not end with what to learn but should include how learning was to be done and assessed. This would result in a highly differentiated classroom but one of engaged students.

Webb (2007) insisted that this was not a case of the teachers abdicating authority. They remained

the experts in the classroom regarding learning. However, they needed to be ready to accept that their students might be better able to help others in other areas. Group learning provided the opportunity for individual students to assume leadership in the areas in which they were competent.

Further, in the 21st century, meaning had to be negotiated through the filters of culture, gender and social class. Teachers could not force students to accept a set of traditional texts they found irrelevant. Instead, teachers needed to make a link between what they introduced and the experiences of the students. The example that Webb (2007) gave related to Shakespeare's *Romeo and Juliet*. She suggested links could be made to modern films with the same or similar themes.

The traditional form of constant assessment through essays killed enthusiasm for learning according to Webb (2007). She suggested that it was important to have students reading and writing a variety of genres. In fact, it should go beyond that to teachers recognizing the importance of the oral and visual in the 21st century. Not everything needed to be tested through writing.

Webb (2007) concluded that '[a]bove all, we need to listen to our students, and strive to engage and enthuse them in learning. From enthusiasm comes motivation, and from motivation comes success. From success comes joy!' (p. 9).

The correct approach according to Trilling and Fadel (2009) was not to throw out past approaches to teaching and learning but to adjust the balance between approaches. They offered a set of 15 continua such as Teacher-directed/ Learner-centred, Basic skills/ Applied skills and Competitive/ Collaborative. They suggested each continuum was not a yes or no choice. It was a question of adjusting the balance. Generally, they felt the balance should be shifted to more learner-centred work but they emphasized that this did not mean that teacher-centred activities should be completely abandoned. They suggested that a reasonable goal was for 50% of curriculum time to be devoted to inquiry, design and collaborative learning projects and 50% to be used for more traditional, direct methods of instruction.

For the classroom of the 21st century, Trilling and Fadel (2009) believed that the most appropriate approach was project based. The project would

have four phases: define, plan, do and review. The four phases would involve both the teacher and the students in varying ways. The amount of challenge for the students would vary from low (projects with a lot of guided instruction) to high (projects constructed collaboratively). In working on these projects, students would be practising the 21st century skills they would need beyond school – problem solving, communication, collaboration, information and ICT literacy, creativity and innovation. Trilling and Fadel (2009) felt that such approaches had proved superior in terms of student learning and development. Project-based approaches included, they suggested, collaborative small-group learning, project learning methods, problem-based learning and design-based learning. For these approaches to be successful, it was important to create teams of compatible members with rules that supported collaboration, to select activities that could draw on the skills of the different members in the group and to use discussion to support deeper learning.

Richardson (2010) pointed to the contradictions between traditional and innovative programmes sometimes occurring together in the same education system. He pointed to the two American programmes, ‘Race to the Top’ (RTTT), with its emphasis on standardization, and the innovative National Education Technology Plan (NETP), which talked of every student and teacher having their own Internet device through which they could access information in and out of class with individual students developing their own specific talents with the teacher’s help. (See Tomlinson, Little, Tomlinson, & Bower, 2000 for a similar review of the problems of the education system in England and Wales.)

One neglected school resource is often the school library. Morris (2012) called on school librarians and teachers to work together to provide the support students needed to prepare informational skills that would prepare them for college and employment in the 21st century. She pointed to the need to provide more informational texts either in physical form or online, especially for the upper grades, and then to help students develop the skills and dispositions to mine the resources to develop their own

text based on reliable resources.

Carnevale and Smith (2013) reported that the shift to preparing students for their future life and career had been relatively new and involved looking for ways of helping students learn the basic skills and then transforming these into deeper capabilities so that students could become adaptable learners that could thrive in the 21st century. However, these were still early days in the search for the appropriate approaches although research had already shown that learning the 21st century competencies was easiest when it took place in a practical and realistic context.

Lee, Hung, and Teh (2013) discussed how the Singapore education system could move to the level of ‘excellent’ from the ‘great’ classification given by the McKinsey report (Mourshed, Chijioke, & Barber, 2010). They noted that, along with several East

Teachers needed to have the right knowledge, skills and beliefs in order to put student-centred learning into practice. It was important to make a move in that direction while keeping a balance between teacher-centred and student-centred activities.

Asian education systems, Singapore had a tradition of an emphasis on academic achievement and exam scores. This had resulted in excellent results overall but had not provided an ideal education for all students. Singapore now aspired to develop 21st century skills

among its students and, in 2012, announced a student-centred, values-driven education. While academic proficiency remained important, this was to be balanced with more emphasis on students developing appropriate ethical and character development along with dispositions such as resilience and adaptability. However, Lee et al. (2013) felt that there were few policies at the system level that would encourage collaborative or self-directed learning, something that they admitted would take time to develop. Even with policies in place, it was possible that teacher implementation of the policies might not fully reflect the original intention. Teachers tended to continue to teach mainly towards the tests and it was thus difficult to change their approaches.

The review by Lee et al. (2013) concluded that teachers needed to have the right knowledge, skills and beliefs in order to put student-centred learning into practice. It was important to make a move in that direction while keeping a balance be-

tween teacher-centred and student-centred activities. Through student-centred activities, students would learn the disciplinary knowledge and enquiry processes that would prepare them for the changing demands of the 21st century, combining established theory and personal experience to inform new knowledge. Lee et al. (2013) indicated that there was clear evidence that a change in approach would help the students with lower academic results to achieve more. The changes would include making the content more real world oriented and open-ended with increased technological resources and more student-initiated collaborative activities. They suggested that exams had an important function but putting too much emphasis on exams could lead to attitudes of intellectual snobbery and less interest in the lifelong learning that was expected to be important in the 21st century. It was important to build a learning environment that allowed all students to develop.

In terms of developing students' ability to use technology in the communication of ideas with others, Conner-Zachocki (2015) suggested getting them to transmediate (turn) a story or idea from one medium into another. For example, a poem could be transmediated into a digital story. Conner-Zachocki (2015) warned that, to do this, students needed to be given time to 'mess around' and to try different approaches to developing their stories but this was an essential part of the learning. In the process, they would learn to be discerning and to collaborate with others, both online and face to face. They could also learn the dangers and ethics of the digital world – the need to respect the rights of others including copyright and the right to privacy and the importance of the maxim, 'Do no harm'.

According to Hutchison, Nadolny, and Estapa (2016), a further 21st century skill that would be useful for students to learn was coding literacy. They described coding apps that had been devised for use with students. The apps allowed the students to create stories using simplified code and pre-supplied scenes and characters, to which the students could add their own recorded dialogue. Hutchison et al. (2016) believed this gave the students practice in their English language skills as well as some basic understanding of coding language such as 'if...then' routines. They advised teachers to prepare for such lessons carefully by understanding

that technology should not be the sole instructional goal of such lessons, by planning the lesson sequence and student groupings, by being clear how the students would benefit, by knowing how the apps worked before the lesson, by checking the instructional implications of using the apps and by providing time afterwards to reflect on how well the objectives had been achieved and what changes would be needed.

Developing teacher skills

The focus of this section is on teachers and their preparation for the teaching of 21st century competencies as the quality of teacher training is the key to quality student learning as noted by Singapore's National Institute of Education (2009).

Luterbach and Brown (2006) raised the question of how teachers should be prepared for an education system affected by advances in technology in ways discussed in the previous section. These advances affected people's definitions of communication, socializing, accessing information and learning. The writers worked with a panel of four professors and two teachers who considered what they thought would be necessary. Sets of skills that the panel felt that 21st century students would need to learn and that were relevant to language skills covered literacy skills (reading, writing as well as arithmetic and information skills) and the social skills of communication and collaboration.

The panel noted that 21st century teachers would need to be competent in these same skills to be able to pass the skills onto their students. They too would need to be able to communicate meaningfully face-to-face, by email, by SMS and to present to larger audiences. Luterbach and Brown (2006) suggested that teachers would need to introduce activities and assignments that introduced students to the use of software and materials that encouraged thinking, evaluating, reasoning, reflecting, and synthesizing, and that brought in tools that helped the students to communicate. This was particularly important as research had shown that, although students were familiar with ICT tools, they did not use those beyond social communication applications. Similarly, while students were very capable at finding information on the Internet, they were not always good at evaluating its accuracy. Teachers needed to be able to help students learn how to use social media such as blogs

and wikis to collaborate and learn. Real life experiences such as investigating actual local issues that involved collecting information and opinions from others to prepare recommendations could be a positive and engaging way for students to learn these skills.

The panel also believed that education in the 21st century would focus on developing the individual talents of students rather than the mass transmission of the same information to all. Thus, teachers would need to have a wide range of skills to help individuals appropriately.

Ananiadou and Claro (2009) looked at how teachers might be helped to develop those skills through a survey of education systems. They reported that many of the 17 education systems (just over half of OECD members at that time) that responded to their survey reported that there was training on ICT skills for their trainee teachers. However, the systems did not generally include training in 21st century competencies apart from a few that had courses on such aspects as cooperative learning or pedagogical uses of ICT.

For teachers to help students with collaborative projects, Trilling and Fadel (2009) also suggested they would need to learn the same skill set themselves. They needed programmes that engaged them in the task of developing, implementing and evaluating collaborative projects while watching other teachers carrying out such projects. The programmes should deal with the teachers' own concerns and problems. They should be collaborative, deal with the teachers' own areas of work with students and be integrated with other areas of their work and the use of technology. Moreover, the support should be sustained, using the collaboration with other teachers and administrators as a model of what they were expected to model for their own students.

The National Institute of Education (2009) indicated that, in preparing teachers for 21st century learners, there was a need to shift the emphasis from an over-preoccupation with content onto 21st century skills such as lifelong learning, managing ambiguity and novelty, and communicating new

ideas. There was also a need to develop new pedagogical skills that would help them involve students in independent learning, act as mediators of learning and co-learn with their students while accessing the mass of material on the Internet. In this way, they could help their students learn the same lifelong learning skills. The student learning should involve meaningful tasks that had a basis in reality. The report added that the National Institute of Education (NIE) should model this approach as a 'lead learner' in their preparation of student teachers.

It was important that, for the 21st century, the focus for Singapore's schools had to be on the development of the whole child morally, intellectually, physically, socially and aesthetically to prepare them as individuals, as members of the community and as citizens (National Institute of Education, 2009). Students needed to learn several skills: learning and innovation skills (such as critical thinking and problem solving); knowledge and media literacy skills (such as content mastery and information literacy); life skills (such as flexibility and adaptability, leadership and responsibility); and citizenship skills (such as global awareness, and values and ethics). To help students, teachers needed to develop the same 21st century literacies (such as media and multicultural literacies), a 21st century learning environment (in which students could collaborate and share their learning), and a 21st century curriculum (that allowed students to access, evaluate and synthesize information).

The American Association of Colleges for Teacher Education (AACTE) advisory group and the strategic council of the Partnership for 21st Century Skills prepared a similar set of principles to be followed by educator preparation programmes in the United States (Greenhill, 2010). First, the principles recognized that school education systems would need to prepare students with 21st century knowledge and skills. To ensure that, their teachers would need to have, and be able to teach and assess those same 21st century knowledge and skills. Thus, educator preparation programmes would have to ensure that teachers had and were able to teach and assess the knowledge and skills. With these skills, new teachers would become the change agents that would help to embed those 21st century knowledge and skills into all subjects.

The panel also believed that education in the 21st century would focus on developing the individual talents of students rather than the mass transmission of the same information to all.

As well as critical thinking, problem-solving, collaborative, innovative and communicative skills, all teachers would be expected to integrate technology into their teaching through an understanding of technological pedagogical content knowledge (TPCK) or the relationship between technology, pedagogy, and content knowledge. Greenhill (2010) thus argued that all educator programmes had to incorporate training towards 21st century standards in a coherent and comprehensive way. The programmes needed to integrate inquiry-based models into educator preparation, bringing together practice and theory. She recommended flexible programmes that allowed for cross-disciplinary project-based learning that made full use of available technology integrated with the appropriate pedagogy and content.

Greenhill (2010) argued that educator preparation programmes needed to work with four instructional models. First, they needed to help teacher candidates include ‘teaching for understanding’ in their approach to delivering lessons, connecting the main concepts and skills students needed with the appropriate integration of technologies. In this way, skills such as critical thinking and problem solving would be integral to the lessons.

Second, the teacher candidates should be provided with rich in-school experiences that allowed them to connect theory to practice.

Third, the teacher candidates needed to be given opportunities to take part in technology supported ‘personal learning communities’ (PLCs) that would give them the opportunities to share their reflections on what they were learning and thus deepen their understanding.

Fourth, the programmes needed to examine the relationship between technology, pedagogy and content and 21st century skills. While these areas needed development across the whole curriculum, there would be differences. For example, teaching critical thinking in an English Language lesson was quite likely to be different from teaching the same skill in a Mathematics lesson.

Also important according to Greenhill (2010) was that teacher candidates saw the ‘learning environment’ as constituting more than simply the ‘brick and mortar’ of the school. It also included the full range of opportunities afforded including the availability of technology in support of teaching and

learning. The technology must not be seen as separate from everything else. It had to be incorporated seamlessly into subjects across the board. Greenhill (2010) reported that, unfortunately, in a survey of teacher candidates, only one quarter indicated that they were learning how to integrate Internet-based tools such as wikis and blogs into their lessons to promote student collaboration. In contrast, just over half indicated they were being trained in the use of productivity tools such as word-processing, spreadsheets and database tools.

Based on her experience of working with student teachers, Cancienne (2011) pointed out that few teachers of English felt comfortable teaching the combinations of print and non-print texts that they needed to prepare students for the 21st century. She believed that non-print texts included not only multi-media texts but also art, music, movement and drama, all of which could be used to inform the study of language. She gave examples such as music being used to help interpret a poem and to introduce multiculturalism, another important strand of 21st century competencies.

The Partnership for 21st Century Learning (2015, 2016) recommended that teachers should be helped to see opportunities for integrating 21st century skills, tools and teaching strategies into their classroom practice and to see what other activities they could replace. As recommended by Trilling and Fadel (2009), it was noted that teachers needed to balance direct instruction with project-oriented teaching methods so that students could have a deeper understanding of subject matter. This could be done through professional learning communities of teachers that could model the kinds of classroom learning that helped students develop 21st century skills tuned to specific learning styles, strengths and weaknesses.

Conner-Zachocki (2015) emphasized the need to develop pedagogies to teach these 21st century competencies. For example, teachers must know and help students understand and apply the required ethical standards when using digital media, including the Internet. For this to happen, the teachers themselves must know the relevant standards and be seen to apply them.

She believed that the old pedagogies of teacher-controlled lessons failed to meet the requirement

for students to learn communication, collaboration and critical thinking skills. She felt teachers needed to use pedagogies that placed learners in the centre of the learning process by personalizing the learning of each, by enabling their development, by emphasizing collaborative aspects of learning and by contributing to the more general learning community.

She reported inviting her teacher trainees to develop digital transmediated magazines, digital magazines drawing on non-digital material. This was partly to help them develop the 21st century skills required to carry out the project but also to get them to appreciate the growing importance of this form of writing globally and to give them a model of how this could be done with their own students. The exercise introduced the teacher trainees to digital literacy and the culture that went with it.

In a study of rural schools in Malaysia, Garba, Yusuf, and Busthami (2015) were surprised that a growing trend for teachers to use ICT in lesson preparation was matched by a decreasing trend in the use of ICT in lessons. They felt that ICT was an important tool in the creation of 21st century classrooms where teachers were no longer the source of all information but were learning facilitators. They recognized that part of the problem related to a lack of ICT equipment in some classrooms and ICT access for all students, as well as a lack of technology support staff. However, more importantly, they felt the focus in pre-service training was on separate courses on pedagogy, content and technology and there was not enough emphasis on how these could be integrated. As well as the technical knowledge, teachers needed to understand the interplay between technology and pedagogy (technological pedagogical knowledge) as well as between technology, pedagogy and content knowledge (TPCK).

Hung et al. (2017) indicated that research at Singapore's National Institute of Education was focusing on balancing content mastery and 21st century pedagogy in particular in three categories: (1) cognitive competencies, such as creativity and inventiveness, critical thinking, and digital and new media literacies; (2) interpersonal competencies, such as

collaboration, communication and cross-cultural skills; and (3) intra-personal competencies, such as self-directed learning that included goal-setting, self-regulation, persistence, and resilience. They noted that technology had created a platform that teachers and students could use to communicate and collaborate with each other.

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Low et al. (2017) reported research that indicated that higher education, including teacher education programmes, had paid lip service to the preparation of students to learn about learning for life.

of students to learn about learning for life. This would have a negative impact on the preparation of teachers expected to promote holistic education with their own students once

they entered school. It was important that teacher educators were seen to live by the values that they promoted to their student teachers. It was the values they demonstrated that the student teachers would internalize rather than the ideas they presented. In their own teaching, teacher educators needed to model what they espoused while also explaining the rationale behind what they were doing. The teacher educators' passion for teaching and their caring attitude towards their student teachers would have a lasting effect on the student teachers' future approach to teaching.

The researchers found that student teachers were looking for models of good teaching and would attempt to copy approaches that they saw successfully used by their teacher educators. This was not something that could be faked. Student teachers were more likely to respond to teacher behaviour that was authentic, natural and constant. The importance of encouraging critical/creative thinking at every step was underlined by evidence that student teachers did not apply the critical thinking they had learnt across the board and were often uncritical of anything they were 'taught' or told by the teacher educator they trusted.

Low et al. (2017) suggested that the best teacher educator was demanding but caring and was keen to share and help the student teachers prepare for the role of teacher that they would be assuming once they entered school.

Assessment

The six member panel of professors and teachers in the Luterbach and Brown (2006) study believed that assessment in the 21st century would need to be more diverse in order to assess each student's range of skills and knowledge and their ability to think creatively in solving problems.

Ananiadou and Claro (2009) reported that, of the 17 education systems that responded to their survey on 21st century competencies mentioned earlier, most claimed to have assessment guidelines in place. However, Ananiadou and Claro (2009) found, when examining these guidelines, that, in most systems, 21st century competencies were assessed implicitly as part of relevant subject areas. The writers felt this was likely due to two reasons. First, these competencies cut across subject areas and were generally taught within their contexts. Second, the competencies were still not defined well enough and were thus difficult to assess. Generally, what assessment was done was carried out by inspectors as part of their general assessment of a school.

Ananiadou and Claro (2009) felt that the lack of clear assessment guidelines could be a cause for concern. They pointed to the suggestions of many that, without clear system-level assessment, teachers and students would give 21st century competencies a low priority.

The current emphasis on discrete point testing encouraged an education system that focused on the transmission of knowledge according to Trilling and Fadel (2009). To cover as broad a range of knowledge as possible, teachers the world over focused on worksheets and practice tests, students completing the same tasks at the same time. Giving Singapore's 'Teach less, learn more' as an example, they suggested that the focus on knowledge accrual could be reduced and that topics with real-world relevance to students could be learnt in greater depth. They further recommended that more formative assessment approaches could be adopted so that teachers and students could adjust the learning programme in response to the students' progress. Moreover, students could then develop cross-disciplinary projects that had practical applications.

As the 21st century would see a continuous growth

in the preparation of multimodal texts, Wyatt-Smith and Kimber (2009) argued that assessment focused only on the final product left out important developmental stages and that assessment had to become more dynamic. They thus urged the development of a formative approach that included the shared development of the language and meta-language for multimodal assessment using dynamic assessment tools covering the whole process from the conception of the text to the final product. In other words, the assessment should be formative and concerned with the process of learning.

Greenhill (2010) similarly argued that current discrete point testing might well test the content of given subjects. However, there was a growing concern that it did not prepare students for the 21st century workplace, where critical thinking, collaboration, communication and the use of technology were in demand.

Darling-Hammond (2014) reported that there was already a movement in the US away from the narrow tests that had been used to sanction poorly performing schools and that a growing number of parents and educators were uncomfortable with. Instead, they needed to move towards systems that assessed 21st century education goals that emphasized higher order thinking skills. She suggested that such assessment systems should have three features:

- Broader focus: They should include assessments of important education outcomes such as critical thinking, communication and collaboration.
- Multiple measures: They needed to include varied measures that could be used to assess the progress and needs not just of students but also of teachers, principals and their schools.
- New accountability system: The system should assess, support and help improve rather than test and punish.

However, one-off tests could not, suggested Darling-Hammond (2014), test all the required skills. Some of the skills required could only be assessed by long-term research and investigative projects that required students to communicate orally, visually and in writing. The projects required them to collaborate, to investigate, to come to conclusions based on the evidence they had collected and to

defend their reasoning.

Darling-Hammond (2014) listed four types of assessment that she believed assessed 21st century skills:

- Classroom performance tasks such as research papers and science investigations;
- Portfolios of learning products such as writing or art samples;
- Oral presentations and discussions; and
- Teacher ratings of student learning skills such as note-taking, persistence and collaboration skills.

The assessments should involve students in higher order thinking as well as performance skills, should help students become independent learners, should help teachers check if they were achieving their goals and then improve their practice, and should cover the range of skills that were of greatest concern in schools.

An added benefit of this approach to having multiple-measures of student skills was that teachers had to develop the assessment measures and criteria together. In the process, they had to define together what was to be assessed and thus what they should teach. This led to collaborative inquiry, the co-creation of lesson plans and tasks and mutual feedback – a collaborative learning by the teachers. Darling-Hammond (2014) felt that modern assessment should provide educators with information on their own practice as well as insight into individual students' progress. The result would be that both teachers and students could benefit.

Pellegrino (2014) argued that the important skill for today's students wasn't simply the acquisition of information. Rather it was an ability to take what they had learnt, analyse it and apply it to new problems to come up with new solutions. For this, they needed to collaborate effectively and communicate persuasively. To help students develop these skills, there was a need to put in place new standards and assessment approaches. Pellegrino (2014) reported this was already happening in many education systems, quoting from a speech of

As well as basic skills and procedural knowledge, students should learn and be assessed on higher order skills such as transfer-ring what they have learnt to solve issues in new contexts.

Mr Tharman Shanmugaratnam, then the Singapore Minister for Education (Tharman, 2005), who suggested that there should be less 'one size fits all' education and, instead, more engaged learning, based on discovery and experience, that led to the learning of life-long skills and values that equipped students for future success. Pellegrino (2014) noted that, in the US, the Common Core standards for English included the need to develop critical reading, writing, speaking, and listening skills not only in English Language classes but also in other subject areas such as History, Science, and Mathematics. That is the standards emphasized the importance of language

across the curriculum. He suggested that the best assessment designs would help the teacher and students assess the progress being made. To do that, the assessment tasks should be designed to engage the students and have the following five elements:

1. Higher order cognitive skills: As well as basic skills and procedural knowledge, students should learn and be assessed on higher order skills such as transferring what they have learnt to solve issues in new contexts.
2. Critical abilities: Pellegrino (2014) suggested that abilities such as listening, speaking, reading and writing in multimedia forms, collaboration and problem-solving were critical abilities and thus should be assessed directly and not through proxies.
3. International benchmarks: The standards should be as rigorous as those used in international assessments and those in leading nations.
4. Instructionally sensitive and educationally valuable items: The assessments should identify those who have been taught well rather than identify those with socio-economic advantages. Assessment preparation should encourage useful, engaging activities, i.e. the backwash should be positive.
5. Valid, reliable and fair assessments: The assessments should assess what they claimed to assess and do so with accuracy across examiners and contexts.

Unfortunately, most funding in the US still went into tests that assessed students in mass rather

than through classroom-based assessment. There was evidence that this kind of testing had a negative backwash on student learning as they generally did not assess the targeted skills well but teachers tended to teach 'to the tests' as they wanted to give their students the greatest advantage possible. The result was teachers teaching the test rather than the target skills.

The aim of the assessment system should be to educate as well as monitor student learning. To do this, it needed to be comprehensive, coherent and continuous, that is it should use multiple measures, be based on theories that were compatible with each other and be used on a continual basis to monitor student progress. There was no system that had all these features although Pellegrino (2014) suggested that there had been some progress in this direction. Pellegrino (2014) expected that a growing use of digital technology would facilitate the development of the type of assessment forms required and might even be used to assess persistence, creativity and teamwork.

Conclusion

The literature is clear that the 21st competencies discussed here, apart from those relating to ICT, are not new. However, the world is changing and there is an increasing need for schools to help develop in students the thinking, communication and collaboration skills that were once seen as the specialities of a limited few. It has been suggested that these skills cannot be developed in classrooms that use the transmission of facts approach common in the industrial age. In the new 'knowledge age', students need to be given the opportunity to use the basic skills they have learnt to solve real world problems in collaborative groups so that they learn

related higher order skills such as creative and critical thinking skills.

However, teachers cannot pass on skills they do not have. It is thus important that student-teachers be given the same skill training that they will pass on to their students – the skills and dispositions to think creatively, critically and collaboratively to solve real world problems using the required ICT tools appropriately. In other words, they, in their turn, need to experience appropriate teaching models demonstrated and explained to them as part of their teacher preparation.

Finally, no skill set will be seriously practised in the schools unless parents, teachers and students are able to see it is taken seriously in the competition for qualifications. It is thus necessary to revise assessment models so that they include the skills that are important – creative and critical thinking, communication, collaboration, global awareness, and the ability to use ICT tools. Many of those skills cannot be measured successfully by mass examination systems and alternative formative assessments will need to be developed.

Tan et al. (2017) pointed out that major new developments such as that of the teaching of 21st century competencies did not always develop in a straight line. A complex of factors was usually involved and this caused the development to move in different directions at different times. In such situations, policy reforms could take two or three decades to complete and this could well be true for the introduction of 21st century competencies. However, this was not a reason to discontinue the effort to develop the teaching and teachers that can, in turn, help develop the appropriate skills in our students.

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