



21st Century Skills: evidence of issues in definition, demand and delivery for development contexts

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About this report

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1. Executive summary

The purpose of this study is to provide a summary of the evidence related to issues associated with the definition, demand and delivery of 21st Century Skills, with a particular focus on low- and middle-income countries (LMICs).

In looking at definitions of ‘21st Century Skills’, Section 2 of this study finds that there is a broad range of available literature discussing 21st Century Skills, including a number of key synthesis studies. Within the examined literature, there is general agreement across the commentators on the need for new forms of learning to tackle global challenges. **However, despite this consensus, there is no unique and single approach to the definition of ‘21st Century Skills’.** Multiple sources identify a variety of competencies and skills and a broad range of attempts to synthesise these according to analytical frameworks. Key examples include the ‘4Cs’ promoted by the Partnership for 21st Century Learning (P21) initiative, the ‘3Rs’ as variously defined by Stenberg and Subotnik (2006) and Wagner et al. (2006), the ‘3Ps’ promoted by Prensky (2012), and ATC21S conceived by Griffin and Care (2012) (all cited in Scott, 2015).

The literature also reveals that other terminologies associated with 21st Century Skills – most particularly, ‘life skills’, but also including ‘soft skills’, ‘transversal skills’, ‘critical skills’ and ‘digital skills’ – are often regarded as synonymous with 21st Century Skills, despite some significant diversity across a range of personal, professional and practical attributes. Most significantly, the definitions under ‘life skills’ as framed in a development context (WHO, 1997; Kennedy et al., 2014) reference current and future challenges, but prioritise the anticipated challenges faced by the majority of emerging populations operating in LMICs and in other development settings. This contrasts significantly with the range of attributes cited under ‘21st Century Skills’ in other frameworks, which indicate the prioritisation of skill sets for operating within in a highly connected, highly resourced and globally diverse knowledge-based economy.

The existing literature also examines the extent to which specific technology-driven skills are regarded as a core element of 21st Century Skills. Terms such as ‘digital skills’, ‘ICT skills’ or ‘digital literacy’ have attracted the attention of many (Voogt & Roblin, 2010, 2012; Van Laar et al., 2017; Lewin & McNicol, 2015). However, while the literature sees ICT skills regarded as crucial by the majority of 21st Century Skills frameworks, it also sees them having varied emphases or roles within those frameworks.

Despite this diversity in terminologies, the analysis of a number of key synthesis studies (Voogt & Roblin, 2010, 2012; Scott, 2015; Chalkiadaki, 2018) demonstrates a relatively clear set of skills, competencies and attributes that are referenced in some form by the majority of literature commenting on 21st Century Skills. These can be consolidated into five key areas associated with primarily professional attributes:

1. **Communication skills**, including language and presentation of ideas.
2. **Collaborative skills**, including management of group activities and social interaction.
3. **Individual learning approaches**, including critical thinking, metacognition and new skills acquisition.
4. **Individual autonomy**, including flexibility, adaptability and entrepreneurship.
5. **ICT and digital literacy**, including use of technology as tools for learning, communication and collaboration.

Further to this, a number of core knowledge areas are also featured, including:

- Literacy,
- Numeracy, and
- STEM-associated fields of knowledge.

Finally, additional personal attributes seen by the majority of commentators as necessary to a fulfilling life in the 21st century include:

- Physical well-being and personal health;
- Social and emotional skills;
- Social citizenship; and
- Cultural and creative expression.

In looking at the levels of demand for 21st Century Skills, evidence gathered in Section 3 suggests that the need for 21st Century Skills at the global level is dictated by a combination of factors including: the change in societies resulting from the rapid spread of technology; increasing globalisation and internationalisation; and the shift from industrial social economies to information and knowledge-based social economies (Voogt & Roblin, 2010). **Accordingly, evidence of demand at regional rather than the global level suggests a significant diversity in demand based on differences in developmental context.** The need for 21st Century Skills seems to be clear in contexts of rapid development, such as East Asian countries (Rolleston, 2018; Kattan, 2017), where labour markets are increasingly demanding a workforce with non-routine cognitive skills and interpersonal skills (Kattan, 2017; Suatra et al., 2017).

This diversity of current demand for 21st Century Skills based on context is also echoed in future predictions of need. Demographic projections show that the labour force will decrease in Central Asia, China, Europe and North America and in high-income countries in East Asia (Dunbar, 2015). Oppositely, the workforce will increase in sub-Saharan Africa (UNESCO, 2012; Dunbar, 2015), implying an anticipated global shortage of high-skilled workers and a surplus of low-skilled workers concentrated mainly in developing countries. This situation highlights a tension in current discussions highlighting the ‘urgency’ of need for 21st Century Skills at an international level. **While it is acknowledged that there are extensive projected demands at the global level, discussions should also recognise the level of diversity of demand across regions (e.g. East Asia vs sub-Saharan Africa), as well as the ways in which contextual and economic circumstances of underdevelopment can inform practical skills needs and priorities at national and sub-national levels.**

Findings presented in Section 4 suggest that approaches to the delivery of 21st Century Skills are currently impacted by ongoing discussions over the definition and understanding of 21st Century Skills (Care, Anderson & Kim, 2016). **On this basis, while there is a broad range of documented interventions from around the world, many commentators conclude that there is currently little or no substantial evidence available on the most effective tools and approaches to delivering those skills.** Brown et al. (2015) also note that more than half of the available evidence is drawn from studies of pilot interventions or experimental projects rather than full programmes, and there are no available impact evaluation studies looking at the effectiveness of policies on outcomes related to 21st Century Skills.

The examined literature recognises the potential of ICT for enhancing 21st Century Skills, primarily through functionalities that enhance the capacities for communication, collaboration, critical analysis and creative use of knowledge and information-finding (Lewin & McNicol, 2015; McNulty 2016, 2017, 2018). However, a number of further commentators point towards the large-scale systemic barriers that impact on the use of ICTs for the development of 21st Century Skills in such settings, most particularly the limitations in teacher and school-level capabilities (Ananiadou 2009, Binkley et al. 2012, Voogt & Roblin 2012, cited in Lewin & McNicol, 2015; UNESCO, 2015b).

Although a number of cases outline steps that can be undertaken to address these barriers, much of the literature concludes that the use of educational technology (edtech) does not address what many see as the fundamental underlying issues associated with the teaching of 21st Century Skills (Care et al., 2019). This points towards the need to focus instead on other elements of the education system. Most specifically, this involves gaining a clear understanding of how progression and attainment of individual 21st Century Skills can be defined (ibid.), and then reflecting this in an alignment between curriculum, assessment and teacher training for classroom practices (Kim, Care & Ruscelli, 2019a; Kim, Care & Vista, 2019b; Vista, Kim & Care, 2018b), which may or may not include the use of edtech.

The lack of evidence associated with the effective delivery of 21st Century Skills also points towards a need to develop clear models for mapping progression in the acquisition of 21st Century Skills, and based on that, to gather evidence on the impact of the range of system-wide interventions associated with their delivery.

Section 5 concludes with a number of recommendations for proposed action in the development of regional and national programming for 21st Century Skills, and future research designed to strengthen the evidence base associated with levels of demand and approaches to delivery of 21st Century Skills, particularly in LMICs.

In terms of limitations to this study, while there is substantial literature available on the definition of '21st Century Skills' in the global context, **findings suggest that evidence related to the definition of demand and delivery of 21st Century Skills in development contexts is generally regarded as limited.** For example, in their review of the evidence for impact of transferable skills training for youth in LMICs, Brown et al. (2015) found only eight studies with sufficient information on impact, and only four completed systematic reviews, two of which focused on programmes for youth employment. Brown et al. (2015) also note that more than half of the available evidence is drawn from studies of pilot or experimental projects rather than programmes, and there are no impact evaluation studies looking at the effectiveness of policies. In terms of the literature analysing approaches to the design and delivery of 21st Century Skills in a global educational context, it is notable that the majority of recent leading thought has been generated by Care, Kim, Vista and Anderson, all published by Brookings and operating in loose affiliation with the ATC21S analytical framework.

2. What are 21st Century Skills? Challenges in definition

2.1 Introduction

This section starts by providing an overview of the literature associated with the definition of '21st Century Skills'. In doing so, it draws on three key systematic studies (Voogt & Roblin, 2010, 2012; Scott, 2015; Chalkiadaki, 2018) as well as a number of other studies to help summarise the diversity in definitions across a range of analysts and frameworks.

Next, the section provides overviews of the ways in which the broad range of skills, attributes and competencies included under '21st Century Skills' are also categorised and grouped by commentators and analysts under a variety of terminologies including 'life skills', 'soft skills', 'transitional skills', the '4Cs' and others. Within this, the study seeks to identify the range of key priorities that these different terminologies reveal. There is also a summary analysis of the unique position of ICT-driven technical skills, knowledge and practices within definitions and conceptions of 21st Century Skills.

The section concludes by highlighting the general areas of consensus across the broad range of frameworks associated with 21st Century Skills, which exist despite the diversity of terminologies used by commentators across the field.

2.2 An overview of definitions

The examined literature shows that no clear and unique definition of '21st Century Skills' is provided and adopted internationally. Multiple skills are attributed and listed as 21st Century Skills and, given the lack of clarity on what 21st Century Skills are, the literature is also not conclusive on the difference between 21st Century Skills and other related skills (e.g. soft skills). Indeed, analysts generally use the term '21st Century Skills' as a broadly encompassing concept referring to multiple skills or subcategories of skills.

In reviewing a broad range of analytical discussions, Voogt and Roblin (2010, 2012) define 21st Century Skills as 'new competencies' which society is increasingly demanding of the existing workforce and, in educational terms, of the youth who need to be trained today for future jobs and careers. **They state that the term '21st Century Skills' – or '21st century competences' – is 'an overarching concept for the knowledge, skills and dispositions that citizens need to be able to contribute to the knowledge society'** (Voogt & Roblin, 2010, p.16). Voogt and Roblin (2010, 2012) provide a summary that succinctly gathers the names and types of 21st Century Skills adopted by a range of different frameworks (see Table 1, Annex 1), and in doing so, highlight the ambiguity in the terminologies used to describe 21st Century Skills. They note that existing frameworks analysing 21st Century Skills frequently refer to different skill sets and skill types, making comparison difficult. **They conclude that the ambiguity in terminology and definitions is hindering the ways in which such skills are taught.**

Scott (2015, p.8) defines '21st Century Skills' as 'the knowledge, skills and attitudes necessary to be competitive in the twenty-first century workforce, participate appropriately in an increasingly

diverse society, use new technologies and cope with rapidly changing workplaces'. Scott provides a summary of 'essential competencies and skills for 21st century learning' by analysing several 21st Century Skills frameworks, a number of which work to synthesise the broad range of skills and attributes such as those indicated by Lippmann et al. (2014), Wagner (2010, cited in Scott, 2015) and Barry (2012, cited in Scott, 2015) within a more conceptual and manageable setting (see Table 2, Annex 1).

Finally, in her systematic review of studies on 21st Century Skills, Chalkiadaki (2018, p.5) defines 21st Century Skills as encompassing a broad range of skill sets and professional attributes, including:

creativity, divergent thinking, critical thinking, team working (especially in heterogeneous groups), work autonomy, developed cognitive and interpersonal skills, social and civic competences, responsible national and global citizenship, consciousness of interdependence, acceptance and understanding of diversity, recognition and development of personal attributes, interactive use of tools, communication in mother tongue and foreign languages, mathematical and science competence, digital competence, sense of initiative and entrepreneurship, accountability, leadership, cultural awareness and expression, physical well-being.

More concisely, she cites the Asia–Pacific Economic Cooperation (APEC) definition of '21st century competencies' as the knowledge, skills and attitudes necessary to be competitive in the 21st century workforce, participate appropriately in an increasingly diverse society, use new technologies and cope with rapidly changing workplaces (APEC, 2008, cited in Scott, 2015).

Importantly, Chalkiadaki cites several 21st Century Skills frameworks, including the P21 (2007, cited in Chalkiadaki, 2018), OECD DeSeCo (2005, cited in Chalkiadaki, 2018), EnGauge (2003, cited in Chalkiadaki, 2018) and ATC21S (2012, cited in Chalkiadaki, 2018). Her report documents the various definitions of 21st Century Skills and the skills each framework focuses on (see Table 3, Annex 1).

2.3 Approaches to the categorisation of 21st Century Skills

2.3.1 Introduction

The systematic review conducted by Chalkiadaki (2018) groups the broad range of 21st Century Skills into four main categories, as follows:

- **Personal skills**
 - (i) *Self-development and autonomy* (self-management, self-organisation, self-regulation, self-direction, self-reflection, independent thought, autonomous acting, ability to form and conduct life plans and projects and to defend/assert rights, emotional intelligence);
 - (ii) *Creativity* (curiosity, imagination, playfulness, creative production, co-creativity, innovation);

- (iii) *Problem-solving and critical thinking* (in authentic learning environments, analytical thinking, analysis and evaluation of evidence, ability to provide solutions in given challenges, higher-order thinking, sound reasoning, informed decision-making, innovation); and
 - (iv) *'Presence in the globalised environment'* (adaptability, agility, managing complexity, risk-taking).
- **Social skills**
 - (i) *Communication and collaboration* (skilled oral and written communication in the mother tongue and foreign languages, team-working especially in heterogeneous environments, open-mindedness, conflict management);
 - (ii) *Cultural awareness and global awareness* (ability to appreciate the value of the varied cultures and to intentionally construct cross-cultural relationships and networks); and
 - (iii) *Leadership* (self-motivation, initiative taking, entrepreneurship, leading by influence).
 - **Information and knowledge**
 - (i) *Learning* (self-reflection, self-assessment, self-improvement, metacognition, e-learning, self-directed learning, independent learning, knowledge construction, social and collaborative learning, intellectual risks); and
 - (ii) *Information management* (information literacy, data access and analysis, managing multiple streams of simultaneous information, applying knowledge to new situations, creating new knowledge, content knowledge).
 - **Digital literacy**

Based on Chalkiadaki's analysis, digital literacy in the 21st century context indicates individual confidence in the use of media and ICT and proficiency in the use of digital tools, plus interactive digital skills, critical use of digital tools (analysis, critique, evaluation, creation), and the ability to attend to ethical responsibilities required in participatory culture in technology.

In general terms, Chalkiadaki's model draws on the cross-cutting approach to categorisation developed by APEC, which defined four 'overarching 21st century competencies' that should be integrated into existing educational systems: lifelong learning, problem-solving, self-management and teamwork (APEC, 2008, cited in Scott, 2015), and the Assessment and Teaching of 21st Century Skills project (ATC21S), which categorised international 21st Century Skills into four broad categories designed to be of value to both practitioners and policymakers: ways of thinking, ways of working, tools for working and skills for living in the world (Griffin, McGaw & Care, 2012, cited in Scott, 2015). The ATC21S approach to categorisation is also designed to be of value to both practitioners and policymakers. Finally, research carried out by OECD/CERI on 'New Millennium Learners' (Ananiadou & Claro, 2009, cited in Scott, 2015) describes three dimensions for learning in the 21st century: information, communication, and ethics and social impact.

Across the literature reviewed, both by Chalkiadaki (2018) and by this study, there is a broad range of further and differing approaches to the categorisation of 21st Century Skills as either attributes, competencies or skills. We will now provide an overview of a number of these.

2.3.2 'Critical skills'

A number of commentators frame 21st Century Skills within the context of 'critical skills', a range of personal and professional attributes, competencies and technical skills that are presented as central to the 21st century.

Lippman et al. (2014) identify five 'critical skills' which are most likely to increase success in the workplace, which include both specific skills and desirable behaviours. Below is reported the definition of those skills and their relationship within four workforce outcomes – employment, performance, income/wages and entrepreneurial success.

- **Social skills:** The ability to behave in context-appropriate ways, respecting others and being able to resolve conflict. Social skills are reported as a strong indicator of success internationally in both formal and informal work sectors, and able to predict all four workforce outcomes.
- **Communication skills:** Oral, written, nonverbal and listening skills. Communication skills are recognised as a gateway to developing other soft skills.
- **Higher-order thinking skills:** Problem-solving, critical thinking and decision-making. At a basic level, this includes an ability to identify an issue and take in information from multiple sources to evaluate options in order to reach a reasonable conclusion. These skills are not well researched in relation to their impact on successful employment.
- **Self-control:** An intrapersonal skill that enables successful decision-making, conflict resolution and coherent communication. Self-control is related to all four workforce outcomes, especially in literature specific to youth aged 15–29.
- **Positive self-concept:** Self-confidence, self-efficacy, self-awareness and beliefs, self-esteem, and a sense of well-being and pride. It is reported as an intrapersonal skill that is related to success across all four workforce outcomes.

Wagner (2010, cited in Scott, 2015) and the Change Leadership Group at Harvard University identified a complementary set of competencies and skills. Informed by several hundred interviews with business, non-profit and education leaders, Wagner stresses that students need seven survival skills to be prepared for 21st century life, work and citizenship:

- Critical thinking and problem-solving;
- Collaboration and leadership;
- Agility and adaptability;
- Initiative and entrepreneurialism;
- Effective oral and written communication;
- Accessing and analysing information; and

- Curiosity and imagination.

The US-based Apollo Education Group, a leading provider of higher education programmes for working adults, cited 10 skills needed by students to survive as 21st century workers (Barry, 2012, cited in Scott, 2015):

- critical thinking,
- communication,
- leadership,
- collaboration,
- adaptability,
- productivity and accountability,
- innovation,
- global citizenship,
- entrepreneurialism, and
- the ability to access, analyse and synthesise information.

2.3.3 The '4Cs': Critical thinking, Communication, Collaboration and Creativity

The 'Framework for 21st Century Learning' proposed by the US-based Partnership for 21st Century Learning (P21) highlights the '4Cs' (Critical thinking, Communication, Collaboration and Creativity), a range of attributes which it proposes should be developed within the context of teaching core subject areas. The '4Cs' model is based on the assertion that 21st century challenges will demand a broad set of skills emphasising the individual's capabilities in core subject skills, social and cross-cultural skills, proficiency in languages, and an understanding of the economic and political forces that affect societies.

Drawing on Scott's analysis, each of the '4Cs' skills are described below:

- **Communication**

Communication includes the ability to express thoughts clearly and persuasively both orally and in writing, articulate opinions, communicate coherent instructions and motivate others through speech. Communication skills are also embedded in information, media and ICT competencies. It is stated that communication skills are highly valued in the workplace and public life, and are also shaped by current and emerging technologies, taking into account the large proportion of messages that are mediated by one or more digital devices. In this context, effective communication skills can help to avoid misunderstandings and miscommunications.

- **Collaboration**

It is stated that, in the future workplace, workers can expect to engage in highly networked collaborations, separated from colleagues by distance and situated far from the physical location of information resources. People will need to be comfortable with collaborating at a distance, and simulating those interactions in education will have clear benefits on the skills of the workforce. In

this context, clear and effective communication skills and the use of technologies and social media are key to effective collaboration.

- **Critical thinking**

Critical thinking involves accessing, analysing and synthesising information, and is considered fundamental to 21st century learning (Ananiadou & Claro 2009, Gardner 2008, P21 2013, Redecker et al. 2011, Trilling & Fadel 2009, Tucker & Coddling 1998, all cited in Scott, 2015). Critical thinking draws on other skills such as communication, information literacy and the ability to examine, analyse, interpret and evaluate evidence. It is presented as relevant within the field of formal education, and also within business and responsible social citizenship (NEA, 2010, cited in Scott, 2015).

However, while critical thinking can be taught, practised and mastered (P21 2007a, Redecker et al. 2011, both cited in Scott, 2015), recent studies suggest that many secondary and university students lack the necessary competencies to navigate and select relevant sources from the overabundance of available information (Windham 2008, cited in Scott, 2015).

- **Creativity**

Creativity is defined in terms of the capacity to generate new ideas and solutions, 'break new ground', invoke fresh ways of thinking, pose unfamiliar questions, and arrive at unexpected answers (Gardner 2008, Sternberg 2007, both cited in Scott, 2015). In a context of global competition and task automation, individual capacity for innovativeness and creativity are increasingly seen as requirements for professional and personal success.

In support of P21's '4Cs' model for the categorisation of 21st Century Skills, Voogt and Roblin (2010, 2012) examined five 21st Century Skills frameworks – Partnership for 21st Century Learning (P21); EnGauge; Assessment and Teaching of 21st Century Skills (ATC21S); National Educational Technology Standards (NETS/ISTE); and National Assessment of Educational Progress (NAEP). They note that 'collaboration' and 'communication' are mentioned in all the analysed frameworks, while 'creativity' and 'critical thinking' are included in the majority of the frameworks. In addition, all the frameworks analysed by Voogt and Roblin (2010, 2012) also mentioned the importance of a number of skills that cut across these four categories – ICT literacy, social and/or cultural skills and citizenship.

2.3.4 Variations on the '4Cs' model

In addition to the P21 '4Cs' model, Scott (2015) analyses a number of similar approaches to the conceptualisation and categorisation of 21st Century Skills. These include models that focus on a limited number of personal and professional attributes that commentators argue might be developed within the context of teaching core subject areas.

For example, Sternberg and Subotnik (2006, cited in Scott, 2015) present the case for a curriculum focused on fostering learners' capabilities through 'The other 3 Rs', which cover: Reasoning ('analytical, critical thinking and problem-solving skills'); Resilience ('life skills such as flexibility, adaptability and self-reliance'); and Responsibility ('wisdom or the application of intelligence, creativity and knowledge for a common good').

Similarly, Wagner et al. (2006, cited in Scott, 2015) advocate for a curriculum founded on 3Rs skills which differ from those proposed by Sternberg and Subotnik (2006, cited in Scott, 2015). Wagner's model includes Rigour, Relevance and Respect. 'Rigour' refers to the academic abilities and capacities students acquire as a result of their learning; 'Relevance' refers to their understanding of how their learning connects to current real-world challenges and future work; and 'Respect' refers to the promotion of respectful relationships among teachers and students that foster academic and social competence.

Finally, Prensky (2012, cited in Scott, 2015) advocates a student-centric curriculum founded on the '3Ps', which consist of 'Passion (including character), Problem solving (including communication) and Producing what is required with creativity and skill'.

2.3.5 'Soft skills'

Moving away from a categorisation of skills in terms of attributes that are presented as of value in primarily a work-based context, Gates et al. (2016) explore and identify a range of largely personal attributes that are assumed to create broader positive outcomes across important areas of youth's lives, including in terms of workforce success, violence prevention, and sexual and reproductive health. Their definition of 'soft skills' is:

[S]oft skills refer to a broad set of skills, behaviours, and personal qualities that enable people to effectively navigate their environment, relate well with others, perform well, and achieve their goals. These skills are applicable across sectors and complement the acquisition of other skills such as technical and academic skills (ibid., p.16).

The report provides a detailed description of those skills:

- **Positive attitude:** An emotional aspect in which a youth is happy and enthusiastic; a social aspect of encouraging others; and a cognitive aspect of valuing work or school with a positive outlook (Lippman et al., 2015, cited in Gates et al., 2016).
- **Responsibility:** The ability to understand one's own role and reliably accomplish tasks associated with this role, and the belief that one's own choices and actions can influence the events in life and lead to positive outcomes (ibid.).
- **Goal orientation:** The motivation and ability to make viable plans and take action toward desired goals (Lippman et al., 2014a, cited in Gates et al., 2016).
- **Empathy:** The affective and cognitive ability to feel and understand what someone else is feeling (ibid.).
- **Communication:** The ability to effectively express and understand knowledge and ideas. Communication includes listening, as well as skills in verbal, nonverbal, and written communication. It includes the ability to negotiate, persuade, transmit and interpret knowledge (Lippman et al., 2015, cited in Gates et al., 2016).
- **Social skills:** A cluster of skills necessary to get along well with others, including: respecting and expressing appreciation for others, demonstrating context-appropriate behaviour and the ability to behave according to social norms, using a range of skills or processes aimed at resolving conflict.

In keeping with Gates et al. (2016), Youth Power (2019) states that the term 'soft skills' refers to a broad set of skills, behaviours, and personal qualities that enable people to effectively navigate their environment, relate well with others, perform well, and achieve their goals. **Other terminologies used for 'soft skills' include 'life skills', 'socio-emotional skills', and 'transferable skills' (Scott, 2015). Given the broad nature of soft skills, USAID launched a portal aimed at collecting different terminologies used for 'soft skills'.**

As well as the lack of clarity in defining 'soft skills', there is also a lack of clarity regarding which soft skills are most likely to deliver the greatest benefits. However, Gates et al. (2016) cite studies that have found evidence and practice supporting the theory that a common set of skills can lead to positive outcomes in multiple domains of youth's lives. These domains include sexual and reproductive health, violence prevention, and workforce success (Youth Power, 2019).

2.3.6 'Life skills'

The use of 'life skills' as a formal framework for defining key skills, competencies and capabilities has emerged almost exclusively from within the sphere of international development, and is currently reflected in the objectives and indicators across a number of areas featured within the Sustainable Development Goals (SDGs). In this context, it operates as a model of definition for '21st Century Skills' that is of particular note for those parties operating within that sphere.

Resulting from studies into public health in international development settings, and based predominantly on the observed net effects of malnutrition on individuals and communication, the phenomenon of *failure to thrive* is associated with a range of mental health and personal developmental issues (Schwartz, 2000, cited in Kennedy et al., 2014) including, for example, cognitive impairment, emotion and behaviour regulation difficulties, and neuropsychological abnormalities (MOSPI, Government of India 2012, Pearson 2013, Read & Bentall 2012, all cited in Kennedy et al., 2014). These cognitive deficits are seen to impact on areas such as attention, memory and information processing, relationship difficulties (e.g. being unable to assert oneself, and poor parenting skills in adulthood), emotion regulation difficulties (e.g. being highly sensitive/insensitive to stress, lack of self-soothing and calming abilities, and experiencing extreme and inappropriate emotion and perceiving this as uncontrollable), and behavioural problems (e.g. self-harm, aggression, social withdrawal, avoidance of challenging opportunities, and absconding). In addition, because of impoverished environments, different social norms and the deficits already described, young people can develop attitudes and beliefs that prevent them from participating in an achievement-oriented world (Kennedy et al., 2014).

In response to this phenomenon, the World Health Organization (WHO 1997, cited in Kennedy et al., 2014) produced guidance on life skills education for children and adolescents in schools, in which 'life skills' are described as promoting *psychosocial competence*. On the basis of an analysis of the life skills research field, WHO (ibid.) suggests 10 core life skills:

- Decision-making,
- Problem-solving,
- Creative thinking,

- Critical thinking,
- Effective communication,
- Interpersonal relationship skills,
- Self-awareness,
- Empathy,
- Coping with emotions, and
- Coping with stress.

Refining this list further, Kennedy et al. (2014) undertook a study considering those practical skills needed by disadvantaged children and young people throughout the developing world hoping to achieve in work environments such as retail work, service industries, small entrepreneurial businesses, and non-governmental organisations (NGOs). Five observable behavioural skills emerging from the WHO life skills list were assessed as appropriate and feasible in this context, namely:

- Interacting with others,
- Overcoming problems and finding solutions,
- Taking initiative,
- Managing conflict, and
- Understanding and following instructions.

In general terms, the selection of attributes outlined above are closely associated with the more personality-driven range of attributes presented under 'soft skills'. While Kennedy et al. (2014) have refined these to reflect a specific set of personal competencies required to succeed within the professional sphere anticipated in a development context, this process has also largely bypassed the globalised, highly connected and knowledge-driven contexts that are associated with other frameworks for the conceptualisation of 21st Century Skills.

However, Brown et al. (2015) group a range of transferable skill sets featured under 21st Century Skills according to the UNICEF's three 'life skills' categories: (1) personal skills (e.g. self-regulation, confidence, adaptability, resilience, etc.); (2) interpersonal skills (e.g. communication, negotiation, leadership, etc.); and (3) cognitive skills (e.g. decision-making, critical thinking, problem-solving, etc.).

Jaberian, Vista and Care (2018) draw attention to evidence of more specific intersections between 'life skills' and '21st Century Skills'. In reviewing the UN's priority for empowering learners to assume active roles and make informed decisions in 'building a more sustainable future through peaceful, tolerant, inclusive, and secure societies', they draw attention to SDG Target 4.7, which states:

By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development.

Jaberian et al. (2018) claim that responses to this question have focused on Education for Sustainable Development (ESD) and Global Citizenship Education (GCED), both of which fall under the broad umbrella of '21st Century Skills'. Within this, they argue that SDG Target 4.7 calls for the mainstreaming of key 21st Century Skills concepts – namely, ESD and GCED – in policy planning, curricular content, teaching practices and assessment.

2.4 ICT and 21st Century Skills

In reviewing several 21st Century Skills frameworks, Voogt and Roblin (2010) point out that all examined frameworks highlight the intersection between ICT and 21st Century Skills. Firstly, they offer a comparison between the various elements that ICT and information literacy encompass through these frameworks, including as means of communication and collaboration, and as providing the capacity to access information efficiently and effectively. Secondly, they highlight that the use of ICTs to this end requires the ability to evaluate information critically and competently, and to use information accurately and creatively (Information Literacy Standards for Student Learning, 1998, cited in Voogt & Roblin, 2010). Finally, they suggest that ICT holds the promise of supporting the acquisition and assessment of 21st Century Skills, thereby recognising the importance of ICT as a tool for the development of 21st Century Skills in the individual.

Van Laar et al.'s (2017) systematic literature review on the relation between 21st Century Skills and digital skills and/or literacy identifies a number of areas of crossover. While the results of their review show that the attributes associated with 21st Century Skills are generally broader than those associated with digital skills, digital skills and/or literacy cover a number of attributes also strongly associated with 21st Century Skills. These include information management; collaboration; communication and sharing; creation of content and knowledge; ethics and responsibility; evaluation and problem-solving; and technical operations (Ferrari, 2012, cited in Van Laar et al., 2017). **However, they also conclude that while digital skills are necessarily underpinned with ICT knowledge, this is not necessarily the case with 21st Century Skills.**

Although 21st Century Skills and digital skills are both seen by commentators as crucial attributes, and while there is some significant conceptual crossover between the two, Van Laar et al. (2017) conclude that the combination is not yet sufficiently defined. In this light, they introduce the concept of '21st century digital skills', defined as: (1) the mastery of ICT applications to solve cognitive tasks at work; (2) skills that are not technology-driven, as they do not refer to the use of any particular software program; (3) skills that support higher-order thinking processes; and (4) skills related to cognitive processes favouring employees' continuous learning. Detailed conceptual definitions of '21st century digital skills' including operational components are also provided. They present such skills as critical for both people and organisations for keeping up with developments and innovating products and processes.

Lewin and McNicol (2015) also examine the relation between ICT and 21st Century Skills and conclude that ICT is at the core of the majority of 21st Century Skills frameworks. While some frameworks emphasise ICT-related competences as separate domains (P21 and ATC21S), others call attention to more integrative approaches where the development of ICT skills is embedded within other 21st century competences, such as critical thinking, problem-solving, communication and collaboration (Voogt & Roblin, 2012).

When defining ICT-related competences in the context of 21st Century Skills, most frameworks reference three types of literacies:

- **Information literacy:** The capacity to access information efficiently and effectively, to evaluate information critically and competently, and to use information accurately and creatively (American Association of School Librarians and Association for Educational Communications and Technology, 1998, cited in Lewin & McNicol, 2015).
- **ICT literacy:** ICT literacy focuses mainly on how to make an effective and efficient use of digital technologies. The main difference between ICT literacy and technological literacy lies in their emphasis with regard to the competences needed to function in a knowledge society. Technological literacy emphasises the interplay between technology and society, as well as the importance of understanding the technological principles needed to solve complex problems and face the challenges of a knowledge society.
- **Technological literacy:** ICT literacy in its traditional form refers to the technical skills related to the use of technology (Anderson, 2008, cited in Lewin & McNicol, 2015). However, this term can also be conceptualised in a much broader way as the use of digital technology, communication tools, information literacy, and/or networks to access, manage, integrate, evaluate and create information in order to function in a knowledge society (Committee on Technological Literacy, 2002, cited in Lewin & McNicol, 2015).

2.5 Summary

In looking at definitions of 21st Century Skills, this study has found a broad range of available literature discussing 21st Century Skills, including a number of key synthesis studies. Within the examined literature, there is general agreement across the commentators on the need for new forms of learning to tackle global challenges. **However, despite this consensus, in the literature there is no unique and single approach to either the definition of '21st Century Skills', or models for framing these within the context of education of children for the 21st century.**

As this section has shown, multiple sources identify a variety of competencies and skills framed as '21st Century Skills'. Scott (2015), Voogt and Roblin (2010, 2012) and Chalkiadaki (2018) compared several frameworks, highlighting similarities and main differences. The reviews demonstrate the extensive range of different attributes, competencies and skills that have been considered in defining 21st Century Skills. Similarly, these reviews also highlight a broad range of attempts to synthesise these in categories and/or analytical frameworks. Examples include the '4Cs' promoted by the P21 initiative, the '3Rs' as variously defined by Stenberg and Subotnik (2006) and Wagner et al. (2006), the '3Ps' promoted by Prensky (2012), and ATC21S conceived by Griffin and Care (2012).

Further to this, the literature reviewed reveals that other terminologies associated with 21st Century Skills – most particularly, 'life skills', but also 'soft skills', 'transversal skills', 'critical skills', and 'digital skills' – can be frequently regarded as synonymous with 21st Century Skills, despite some significant diversity across a range of personal, professional and practical attributes. As an example of this, 'soft skills' are defined as 'a broad set of skills,

behaviours, and personal qualities that enable people to effectively navigate their environment, perform well and achieve their goals' (Gates et al., 2016, p.9). While this definition could be easily applicable to 21st Century Skills, the most remarkable difference relies on the lack of reference within 'soft skills' to current and future challenges associated with globalisation, the world labour market and the emerging knowledge economy.

More significantly, the definitions under 'life skills' (WHO, 1997; Kennedy et al., 2014) do reference current and future challenges, but in a way that prioritises the anticipated challenges to be faced by the majority of emerging populations operating in LMICs and in developmental settings. In particular, 'life skills' seek to highlight those attributes that ensure resilience in the face of poverty, conflict, and economic and environmental crisis. This contrasts significantly with the range of attributes cited under 21st Century Skills in other frameworks, which indicate the prioritisation of skill sets for operating within in a highly connected, highly resourced, globally diverse knowledge-based economy.

The existing literature also examines the extent to which specific technology-driven skills are regarded as a core element of 21st Century Skills. Terms such as 'digital skills', 'ICT skills' or 'digital literacy' have attracted the attention of many (Voogt & Roblin, 2010; Van Laar et al., 2017; Lewin & McNicol, 2015). However, while the literature sees ICT skills regarded as crucial by the majority of 21st Century Skills frameworks, their position within those frameworks remains unclear. In this direction, it is noted that some frameworks emphasise ICT-related competences as separate domains (P21 and ATC21S), while others call attention to more integrative approaches where the development of ICT skills is embedded within other cited 21st century competences such as critical thinking, problem-solving, communication and collaboration (NETS/ISTE framework) (Voogt & Roblin, 2012, cited in Lewin & McNicol, 2015).

Despite this diversity in terminologies and aspects, the analysis of a number of key synthesis studies (Voogt & Roblin, 2010, 2012; Scott, 2015; Chalkiadaki, 2018) demonstrates a relatively specific number of skills, competencies and attributes that are referenced in some form by the majority of literature commentating on 21st Century Skills. These themes, which cut across each of the studies cited above, cover five key areas associated with primarily professional attributes:

- Communication skills, including language and presentation of ideas;
- Collaborative skills, including management of group activities and social interaction;
- Individual learning approaches, including critical thinking, metacognition and new skills acquisition;
- Individual autonomy, including flexibility, adaptability and entrepreneurship; and
- ICT and digital literacy, including use of technology as tools for learning, communication and collaboration.

Also featured are a number of core knowledge areas, including:

- Literacy,
- Numeracy, and
- STEM-associated fields of knowledge.

Finally, additional personal attributes seen by the majority of commentators as necessary to fulfilling life in the 21st century include:

- Physical well-being and personal health;
- Social and emotional skills;
- Social citizenship; and
- Cultural and creative expression.

A summary overview of the findings from the syntheses undertaken by Voogt and Roblin (2010), Scott (2015) and Chalkiadaki (2018) is included as three tables presented in Annex 1.

In looking at the range of challenges associated with the broad range of definitions of 21st Century Skills, this study concludes that an analysis of the relationship between the contexts assumed by these various definitions is missing in the literature. It also points towards the need to ensure that the terminologies and definitions associated with 21st Century Skills are not used lightly when discussing regional or national priorities, and that the realities of national and sub-national socioeconomic status need to be taken into consideration when defining future skills needs for the workforce and the labour market. **Arguably, it also points towards a need for policymakers and programmers to actively critique any 21st Century Skills frameworks generated from the perspective of emerging globalised industry leaders, particularly when those frameworks are being referenced for application in an international development context.**

Finally, **these findings also suggest a need to research the development or adoption of a model of definition for 21st Century Skills that integrates existing and emerging globalised employment challenges with those other forms of resilience frequently required in an international development context and currently framed as life skills.** In addressing this, rather than generating another framework of definition in an already diverse and potentially crowded field, it is suggested that any institution seeking to engage with 21st Century Skills programming in a range of global settings should instead adopt whichever pre-existing model provides users with the most flexible and outputs-orientated framework.

In light of the above, a number of recommendations for future action and research emerging from the findings presented in this section are set out in Section 5.

3. The demand for 21st Century Skills

3.1 Introduction

This section provides a brief overview of the literature associated with the current and predicted future demand for 21st Century Skills, at both the global and regional levels. In doing so, it provides a summary overview of the identified drivers of demand for 21st Century Skills, as well as evidence of the differing levels of demand.

While much discussion of this issue is from a global perspective, published evidence covered by this section is particularly limited when discussing the demand for 21st Century Skills within LMIC settings. However, what evidence there is highlights a noted diversity in demand between regional contexts – for example, between East Asia and sub-Saharan Africa – based on national policy priorities and labour market capabilities.

This section also reveals similar patterns when looking at evidence related to future demand. In addition, a number of commentators highlight the need to bear in mind evidence from demographic predictions associated with the global workforce. Their conclusions point towards a need to look carefully at largely globalised discussions highlighting the urgency associated with the need for 21st Century Skills, particularly when looking at current national priorities among developing countries.

3.2 What is the current demand for 21st Century Skills?

3.2.1 Drivers of demand at the global level

In their discussion and synthesis study on 21st Century Skills, Voogt and Roblin (2010, 2012) draw attention to the range of drivers identified with the increased demand for 21st Century Skills. The reviewed frameworks cited in their study attribute this largely to changes in society, particularly in global terms. Firstly, globalisation and internationalisation are seen as key drivers of change within the economy and labour markets at national, regional and global levels. Secondly, Voogt and Roblin (2010) state that many commentators also draw attention in particular to the rapid development of technology and its impact on life, work and learning, including in an increasingly globalised context. Most specifically, ICT is seen as driving a shift from an industrialised society towards an information or knowledge-driven society.

Voogt and Roblin (2010) see these combined factors being regarded as central to the perceived need for (and definition of) 21st Century Skills at the global level. These factors are also reflected in the emerging demands placed upon educational content and delivery. Firstly, while industrial societies require factual or procedural models of knowledge, knowledge-based societies place a far greater emphasis on the need for metacognitive knowledge. Secondly, there is evidence of an increased need for individuals to develop capabilities to flexibly adapt to rapidly changing globalised social and economic models (see, for example, ATC21S and P21), as well as a need for states to cultivate a socially and democratically engaged citizenship (see, for example, OECD, 2017).

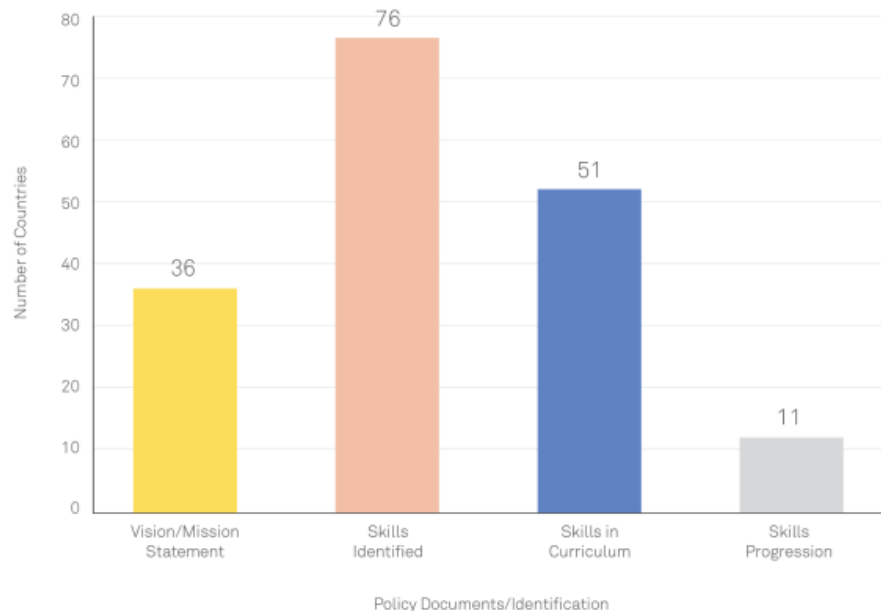
3.2.2 Evidence of demand at the global level

In assessing the levels of demand for 21st Century Skills, as well as the extent to which the above factors are explicitly reflected in educational change around the world, Care et al. (2016) explore the level of integration of 21st Century Skills within national documents related to education from 102 countries worldwide, assessed across four categories:

1. Whether national documents include either an explicit reference to 21st Century Skills as part of educational vision or mission statements, or an implicit reference by referring to a quality outcome that requires such skills;
2. Whether national documents identify particular skills commonly associated with 21st Century Skills (e.g. communication, collaboration, etc.), including as part of educational vision or mission statements;
3. Whether particular 21st Century Skills are featured as a part of the national curriculum; and
4. Whether particular skills associated with 21st Century Skills are taught and learnt in their own right at different stages and through different discipline areas.

Care et al.'s (2016) findings data demonstrated that, while most countries identify 21st Century Skills as part of their wider educational goals, fewer countries provide evidence of their practical integration either through the curriculum or through particular skills development progressions.

Figure 1: Inclusion of '21st Century Skills' in national documents



Source: Care et al., 2016, p.7. © 2019 The Brookings Institution. Reproduced with kind permission.

Firstly, in terms of frequency, of the 102 countries covered by Care et al. (2016), 36 mention '21st Century Skills' in their vision or mission statements, whilst 76 countries mention specific

skills as part of the same. However, only 51 countries mention those same skills in curriculum documents, and only 11 countries provide evidence of progression of these skills across multiple age groups and subjects (ibid.).

Only six countries (Australia, Canada (Ontario), Hong Kong, Mauritius, Scotland and Singapore) identify 21st Century Skills across all four categories (vision/mission statement, skills identified, skills in curriculum, and skills progression), while 22 countries identify specific skills in three of the four categories. Some countries (including Brazil, Mexico, Namibia, Rwanda and South Africa) include evidence of 21st Century Skills within educational skills progression, although such skills are not included as a feature of national vision/mission statements. Twenty-one countries do not feature 21st Century Skills in any of the four categories (Care et al., 2016).¹

Secondly, in terms of definition, Care et al. (2016) conclude that the specific skills identified in the national documentation vary widely from country to country, although some skills are more common than others. The 21st Century Skills most frequently identified were 'communication', which was mentioned by nearly 33% of countries, followed by 'creativity' (23%), 'critical thinking' (20%), and 'problem-solving' (19%) (ibid.).

3.2.3 Evidence of regional diversity in current demand

Looking at levels of demand among emerging economies and LMICs in particular, evidence suggests that there is also a broad diversity in current levels of demand between regions. For example, in discussing the demand for 21st Century Skills across East Asia, Kattan (2017) states that as a result of recent trends in automation and rapid technological advances, collectively dubbed the 'Fourth Industrial Revolution' (4IR), low-skilled and low-income countries become more exposed to automation. This is seen to be radically shifting the economic landscape at a regional level and changing the nature of jobs and the profile of skills required in the labour force across East Asia.

Kattan (2017) claims that, as a result of these changes, within the 4IR context, East Asian labour markets are beginning to demand a workforce that can adapt away from an industrialised mode of delivery towards modes of delivery based increasingly on a grasp of non-routine cognitive tasks and the interpersonal skills to carry them out. In this context, the new and emerging industries increasingly require individuals adept at transferring across cluster-based roles, rapid reskilling, and with attributes such as complex problem-solving, high-level technical skills, and social skills. In relation to this last attribute in particular, evidence suggests that the development of strong socio-emotional skills are associated with large income increases for women, less-educated workers, and those employed in the service sector.

In examining approaches taken by East Asian countries to address the demand for such 21st Century Skills created by the 4IR, Kattan (2017) highlights a number of cases of systemic change associated with national education and training systems and models for continuing and/or lifelong learning. For example, within basic education, the Philippines recently introduced a reform to K–12 education that emphasises cultural-responsiveness, flexibility, ICT-based

¹ A full map and list of the examined countries is accessible at <http://skills.brookings.edu/>

learning and globalisation in its curriculum. This reform also centres on strong community–industry partnerships to ensure relevancy of skills. Here, engagement with 21st Century Skills is presented within a framework for continuing national development building on existing priorities (Care et al., 2017a). The Philippines Development Plan 2011–2016 outlines the country’s need for growth based on further industrialisation (National Economic Development Authority, 2014, cited in Care et al., 2017a), and an associated need to ensure that human capabilities are improved through education. To address this, in May 2013, the Basic Education Act of 2013 was signed into law and resulted in the implementation of the K to 12 Basic Education Program.

Although the major goals of the K to 12 reform are to produce graduates who will (a) be recognised for their educational qualifications worldwide, (b) contribute to the Philippines’ economic growth, and (c) be educated in specialist areas, the primary recognition is that 21st Century Skills must be taught from elementary level onward for that goal to be achieved. Under K to 12, the curriculum mandates that key skills within three major groups be taught: learning and innovation, communication, and information media and technology. In turn, development of these skills is intended to build life and career skills (Care et al., 2017a). However, in reviewing the national demand for such skills, it is worth taking into account the existing labour market in the Philippines. Three sectors make up the formal labour force: agriculture (38.8%), industry (18.6%), and service 42.5%, although – importantly – the Philippine economy generates about 8.5% of the country’s GDP from its overseas Filipino workers (OFWs). In the period April–September 2015, the total number of OFWs was estimated at 2.5 million. A good proportion of OFWs (39%) are skilled workers in the professional, technical, clerical, and service industries. The ‘export’ of these workers is a major concern to the government and is not seen as in the best long-term interests of the country (Philippine Statistics Authority, 2016b, cited in Care et al., 2017a).

Also within the East Asian context, Malaysia has launched its Redesigning Higher Education strategy, which focuses on tertiary education reform in order to prepare students for the 4IR. Programmes include ‘2u2i’, which provides a mixture of academic and in-house industry training, and ‘CEO Faculty’, through which industry CEOs work with universities to provide lectures, curriculum development and mentoring as part of existing programming.

As another example, within sector-specific Technical and Vocational Education and Training (TVET) training, China’s Yunnan Province is currently remodelling its Agricultural Technical and Vocational Education sector to include training models that rotate students between different areas of farming based on the characteristics of regional agricultural economies, and includes a work-integrated learning model (in which students share time between classroom and hands-on farming) as well as a teacher-designed curriculum focused on student-driven learning.

Finally, in terms of ongoing professional development, South Korea has recently shifted to a competency-based social model, ensuring lifelong access to job training through recent policies such as the National Competency Standards (NCS) and the Work–Learning Dual System. Singapore has co-created a ‘Skills Framework’ for its workforce by involving industry leaders, unions and government. The framework provides information on a sector – including its future development – and maps out career progression pathways and resulting skills needs. These inform education and training institutions as well as individuals.

Suatra et al.'s (2017) discussion on the relevance of education skills in Asia–Pacific countries emphasises the importance of the employability skills to their labour market, but also recognises the variation in skill groups across Asian countries.

However, while the trend of responding to globalisation and increasing competition by upskilling youth and the current workforce for the ‘knowledge economy’ is generally clear in contexts of rapid development, such as East Asian countries, the demand remains far less obvious in other LMIC contexts (Rolleston, 2018). The effects of globalisation and technological change are not homogenous across contexts and, in many LMICs, much of the economy remains informal and ‘low-tech’ and largely reliant on agriculture and manufacturing industry. According to Rolleston (2018), in such contexts, no more than 20% of jobs currently require ‘non-routine’ skills and attributes such as those associated with 21st Century Skills. Additionally, in such contexts, where the quality of teaching and learning for the acquisition of basic skills (especially literacy, numeracy and STEM) is still very weak, the calibration of education systems for the provision of higher-level cognitive skills (e.g. problem-solving and critical thinking) can be particularly challenging. For example, an assessment conducted by Young Lives (2016, cited in Rolleston, 2018) demonstrated that in Ethiopia where literacy is weak, only a small number of students could demonstrate reading levels adequate to access assessments of critical thinking and problem-solving.

However, there are some signs of demand for transition to a ‘knowledge economy’ in countries with low levels of industrialisation, or where agriculture remains the main sector of employability. These signs are usually limited both geographically and socially, and supported only by a private sector with reduced capability. In approaching this, a number of countries have set a specific national objective of ‘leapfrogging’ traditional industries, shifting from a largely rural economy into the digital age, in part by stimulating development through the wholesale upskilling of the workforce. Although the skills identified in the associated national mission statements are described differently, they share common ground, including a trend aspiring towards the broadening of the educational curriculum (although the extent to which this is reflected in the implementation of education systems is less clear) (Care & Anderson, 2016). In other country contexts, the presence of an active and emerging private sector within specific industrial sub-sectors can also provide a source of demand for 21st Century Skills. A small number of regional cases from sub-Saharan Africa can be used to explore these issues.

Rwanda and the demand for 21st Century Skills

Berhuria and Goodfellow (2019) argue that the high-profile case of Rwanda had opted to bypass industrialisation and is continuing to prioritise investment in the service industry (most specifically, finance, tourism, and conferencing and events) rather than manufacturing as the main route away from an agrarian economy. Services were seen as becoming 'the most important engine of Rwanda's economy' and transforming Kigali into an international 'hub' of various kinds – transport, financial, tourism and information technology – was seen as integral to linking Rwanda to the fastest-growing sectors of the global economy. Evidence suggests that, on the basis of the government's national development strategy (Rwanda Vision 2020, developed in 2000), which first focused on the development of a knowledge-based economy, these and other service sectors have had healthy growth over the past 15 years.

However, Berhuria and Goodfellow (2019) also state that while this sectoral focus has contributed to economic growth in Rwanda, it has not contributed to equity and economic integration at a national level, and that the service industry 'remains somewhat dislocated from Rwanda's labour market context'. In this context, they point towards two major challenges.

First, in terms of the Rwandan workforce, the highly skilled and specialised nature of work in many service sectors poses challenges for creating the requisite forms and quality of labour, particularly for highly globalised international services sectors. Currently, despite significant investments in human capital and a focus on ICT literacy, the service industry reports a skills shortage of appropriately qualified staff across key sectors including finance and tourism. Such findings are supported in general terms by Byungura et al. (2018), whose study of tertiary students found that the majority of participants were not familiar with ICT, had never had any previous exposure to e-learning systems, and had rarely or never used accessible smartphone technology for learning activities. At the same time, due to the prioritisation of the service industry as the main source of employment, there is a reported shortcoming in the available workforce for lower-skilled but developmentally necessary sectors such as construction (Behuria & Goodfellow, 2019).

Second, in developmental terms, Behuria and Goodfellow (2019) argue that Rwanda's prioritised investment in the service industry has come at the cost of necessary investment in 'basic services' such as health, education, and forms of social protection. As a result, they question whether Rwanda's services-led strategy to development can generate the kinds of structural and societal transformation associated, for example, with the East Asian experience. In the East Asian experience, the combination of low wages with rapid increases in productivity was supported by social policies that ensured welfare and human development investments contributed directly towards economic goals. Rather, Behuria and Goodfellow (2019) see the Rwandan model of service-led national development as contributing to volatile economic growth limited to specific industrial sub-sectors, coupled with significant social and economic inequality.

In response, the Rwandan government has recognised that a better balance between services and manufacturing is required, alongside social redistribution to ensure a broader base of development. Arguably, this new approach is supported by two government actions. First, it is reflected by the revised mission of the Ministry of Education 'to transform the Rwandan citizen into skilled human capital for socio-economic development of the country by ensuring equitable access to quality education focusing on combating illiteracy, promotion of science and technology, critical thinking, and positive values' (Ministry of Education, 2016, cited in Care & Anderson, 2016). Second, it is reflected by the ongoing process of curriculum reform towards a 'competence-based curriculum' aligned with the knowledge-based economy but also designed to develop students' independent, lifelong learning habits, appropriate skills and knowledge, and applications to real life situations (Ngendahayo & Askell-Williams, 2016).

However, looking at other examples, commentators suggest that most African countries have seen a similar trend to India, involving substantial growth in the services sector at the same time as avoiding saturation of manufacturing demand. As of 2015, it is reported that service industries contributed to almost half of Africa's total output and about one third of formal employment (UNCTAD, 2015, cited in Behuria & Goodfellow, 2019).

Kenya and the demand for 21st Century Skills

In Kenya, the government has engaged with the prioritisation of 21st Century Skills, primarily in association with the objectives for Vision 2030, developed in 2008 to define a path toward middle-income status by 2030. Economic growth is at the core of Vision 2030, but it is supported by a variety of social governance projects, including several related to education and education infrastructure. Within this, the Ministry of Education, Science and Technology (MoEST) intends to equip citizens with 21st Century Skills required for the modern economy, at the same time as providing relevant knowledge, national values, and social competence values for contributing to Kenyan society (MoEST, 2015, cited in Care et al., 2017a).

In addressing this, Kenya's MoEST published a paper in 2012, 'Reforming Education and Training Sectors in Kenya', which focused on the need for non-routine tasks and complex problem-solving as a result of the labour market evolution (MoEST, 2012, cited in Care et al., 2017a), and in response, curriculum reform is currently being undertaken to enable students to better integrate into a competitive global economy. At the centre of reforms is the political drive to impart the skills that young people need to enhance their employability and economic productivity.

This curriculum reform is associated directly with the drivers for 21st Century Skills: globalisation, technological revolution, future unpredictability, and expanding needs of employers. However, the reform is also rooted in contemporary shifts in thinking around quality education, including the SDGs, the African Economic Outlook, and the OECD lifelong skills development strategy. Thus, the government acknowledges that 'global trends in education and training are shifting' and is looking to align its education system with the latest education movements (MoEST, 2015, cited in Care et al., 2017a).

However, in terms of actual demand for these skills, research suggests there are variations between government expectations, the labour market and the Kenyan population as a whole. Firstly, in terms of the labour market, recent estimates indicate that over 60% of the labour force is in the agriculture sector (UN Data, 2017, cited in Care et al., 2017a), and agriculture constitutes only 30% of the GDP (Kenya National Bureau of Statistics, 2014, cited in Care et al., 2017a). Furthermore, disparity between urban and rural employment and wages drives Kenya's relatively high rate of urbanisation, but the industries in urban areas do not have the capacity to employ the influx of rural migrants, even when they are educated (Care et al., 2017a).

Secondly, in terms of the population, research indicates there is agreement on the need for 21st Century Skills, with an emphasis on ICT skills as a tool for overcoming challenges to learning, including language barriers, environmental conditions, inequality and globalisation. However, attitudes and perceptions also highlighted the importance of contributing to the society as a whole. The skills cited as critical in school, life and the workplace include but are not limited to life skills, literacy, numeracy, communication, problem-solving, creativity, critical thinking, citizenship, science, entrepreneurialism and ICT (Care et al., 2017a).

South Africa and the demand for 21st Century Skills

The South African education system has engaged with 21st Century Skills through the development of the CAPS (Curriculum Assessment Policy Statement) curriculum – a single, comprehensive policy document that provides guidance for learning and teaching in South African schools (Department of Basic Education, 2016b, cited in Care et al., 2017a). The development of skills and values associated with 21st Century Skills is embedded within this curriculum, as its stated goals are to produce learners that can identify and solve problems, make decisions using critical and creative thinking, work effectively with others, critically evaluate information, communicate effectively, and show responsibility toward the environment and others. However, these skill sets and characteristics are also framed within a wider government prioritisation of the promotion of inclusion, diversity, equity, and life in the 21st century – issues that are seen of utmost importance in South Africa as a nation, given its historical background (Care et al., 2017a).

In terms of demand for these skills within South Africa, research across a broad range of stakeholder groups also reveals a similar framing emphasis on human characteristics associated with citizenship and nationalism, alongside factors seen as necessary for success such as ‘independence, confidence, self-motivation, and self-drive’. In the South African context, successful individuals are seen as being involved in their communities because, ultimately, community involvement benefits society as a whole. Within this, communication and technology skills are identified as being in demand, but only with a foundation of literacy and numeracy – these ‘basic education’ skills are highly valued in the South African context because they are seen as necessary for the 21st century (ibid.).

In contexts such as these, it is suggested that an ambitious government-led willingness to capture the benefits of globalisation, technological progress, and learning technology can accelerate or stimulate skills development in new ways, including through basic skills (Rolleston, 2018), provided any interventions are designed with appropriate cross-sectoral consideration. Such settings can be regarded as ‘pockets of demand’ that exist either at national state level within a wider regional context of lower demand, or as an active sub-sector of industry within a wider economic context of slower development. From a developmental perspective, such settings therefore offer potential as arenas for programmatic investment in 21st Century Skills development that may also benefit wider developmental goals.

The evidence points towards the need for such initiatives to be supported by an enabling policy and practitioner environment, as represented (1) by direct support from the state and key sectoral engagement such as on the part of education and employment services, and (2) by a wider labour market that would benefit from the presence of such skills. For example, Dewan and Sarkar (2017) highlight the relationship between the deficiency in preparing workers with necessary skills and slow economic growth and development in national contexts.

In the majority of low-resource settings, the relevance and applicability of the 21st Century Skills agenda and the urgency placed upon it as part of a global discussion, should be considered carefully in relation to the national context. It is suggested that any donor-led programming that encompasses 21st Century Skills should consider exploring the opportunities for highly targeted and context-specific investment in such settings, with a view to also enabling the wider beneficial impact identified above by Rolleston (2018). This should be guided in part through a process led by evidence across a range of criteria for regional and national state systemic engagement, as well as industry sector and local labour market demand.

3.2.4 Evidence of the demand for ‘life skills’

In general terms, ‘life skills’ as defined within the context of international development, are presented by the UN, WHO and the SDGs as a developmental need linked with social development, public health and quality of life. With this in mind, discussions surrounding the development of ‘life skills’ in these terms can appear to emerge largely from within the donor sphere, rather than from those national or regional stakeholders associated with decision-making over economic modernisation, global competitiveness, employment and the labour market.

In support of this perception, a number of commentators present evidence of tensions in the uptake of SDG-defined ‘life skills’ as part of nationally driven development agendas. For example, Jaberian et al. (2018), in discussing emerging solutions for the monitoring of 21st Century Skills adopted by the UN, conclude that most countries agree on the need for inclusion of 21st Century Skills in their education systems. However, they also highlight that, in relation to the strand of competencies and practices aligned with ‘life skills’ and the SDGs, there remains some resistance to including certain fundamental but contextually controversial concepts including human rights, gender equality, or climate change in education policies and teaching materials.

In addition to the above, discussion of ‘life skills’ in these terms also points towards issues of varying interpretations and prioritisation of these largely personal attributes according to cultural contexts. Concepts such as ‘independence’, ‘responsibility’ and ‘happiness’ are likely to mean different things within different cultural contexts. The interpretation of these concepts is societal insofar as they are values-based and instilled in children from a young age. From a developmental perspective, none of these concepts are necessarily associated with completion of basic education or being economically prosperous (Care et al., 2017a). In this setting, it is difficult to assess the levels of national-level ‘demand’ for the range of ‘life skills’ as defined in the SDGs.

Finally, in exploring such issues further, Care et al. (2017a) highlight tensions over priorities emerging at national level while looking at stakeholder perspectives on demand for 21st Century Skills across four countries (Mexico, Kenya, South Africa and the Philippines). Across all four countries, stakeholders at policy and state level emphasise communication, social skills, critical thinking, and technology and computer skills – attributes clearly associated with globalised definitions of 21st Century Skills. In contrast, beneficiary stakeholders instead endorse characteristics such as confidence, independence and responsibility, being productive members of society, happiness, and possessing appropriate morals and values as the most important – attributes that might be more generally associated with the measures of well-being related to ‘life skills’. In terms of demand, this demonstrates a tension between the agendas of the state, which we might assume are primarily economically driven, and the agendas of beneficiary stakeholders, who prioritise ‘life skills’ as being largely based on social drivers.

However, in terms of delivering on the demand for ‘life skills’, the cases of educational reform in South Africa, Kenya and the Philippines cited by Care et al. (2017a) provide examples of how characteristics associated with life skills – such as community, society and citizenship – are featured as prominent elements within wider recent educational programming and curriculum reforms seeking to address 21st Century Skills, and that such elements are valued by both state and beneficiary stakeholders at national level.

In Kenya and the Philippines, the current and emerging programmatic models described in Section 3.2.3 above see the values and attributes associated with 'life skills' integrated across educational delivery within the formal sector. In South Africa, however, the teaching and learning of such skills are made explicit within the CAPS curriculum: Life Skills and Life Orientation are specific subject areas within the senior secondary curriculum, and have allocated time and suggested pedagogical practices. Under Life Skills, there are four study areas – beginning knowledge, personal and social well-being, creative arts, and physical education – through which learners are exposed to a broad range of knowledge, skills and values such as communication, creativity, social and interpersonal skills, moral responsibility, self-confidence, self-discipline and cultural values. Life Orientation is intended to guide and equip learners for 'meaningful and successful living in a rapidly changing and transforming society' (Department of Education, 2002, cited in Care et al., 2017a) and targets four learning outcomes: personal well-being, citizenship education, recreation and physical well-being, and career choices. As such, these examples demonstrate evidence of demand for 'life skills' at a systematic level, but on the basis of definitions developed largely in line with expressed national and community-led priorities rather than donor priorities.

3.3 What will be the demand for 21st Century Skills in developing countries by 2030?

3.3.1 Predictions of future demand at the global level

In anticipating the demand for 21st Century Skills, Dunbar (2015) concludes that for most developing economies the labour market of 2030 will continue to be heavily influenced by global trends in technology, migration, urbanisation, demographics, foreign direct investment, education, agriculture and the environment. According to Dunbar, these trends will change the nature of work and access to it, and the skill sets required. In keeping with the findings presented above, it is also anticipated that technology will be a major driver, as will the demand for individual inter-social attributes associated with team- and project-based work, project management and problem-solving skills, and the ability to acquire and continuously update individual skills through self-directed or peer-to-peer learning and technology-enabled training opportunities.

Such findings are supported in general terms by Kenworthy and Kielstra (2015), whose global survey of company executives identifies 'problem-solving', 'team-working' and 'communication' as the top three skills currently required and expects their importance to grow. Looking to the future, 'digital literacy' and 'creativity' were also cited as anticipated essential skills, although they were not currently seen as vital.

However, when looking beyond the drivers of demand for 21st Century Skills, estimations show that the global labour market workforce of 2030 will comprise 3.5 billion workers (McKinsey Global Institute, 2012, cited in Dunbar, 2015), most of whom will be unskilled and based in developing countries. **Based on population change, it is anticipated that, regionally, the labour force will decrease in Central Asia, China, Europe, North America and high-income countries in East Asia, while the sub-Saharan Africa labour force is projected to increase by 328 million (OECD, 2009, cited in Dunbar, 2015). Based on this, there will be a predicted**

global shortage of 38–40 million high-skilled workers, with the greatest demand being for graduates in STEM disciplines; a shortage of nearly 45 million medium-skilled workers in developing countries, brought about by low rates of high school enrolment and completion; and a global surplus of 90 million low-skilled workers.

3.3.2 Implications for levels of anticipated demand at regional level

While these findings point towards a need for 21st Century Skills at the global level, they also highlight a greater predicted demand within developing contexts for a workforce with basic literacy, numeracy, STEM and cognitive skills; and also a continued diversity of need along largely regional socioeconomic lines. **While 21st Century Skills are, in global terms, at the centre of what a contemporary education system ‘ought’ to be providing, they are not universally seen as a high priority (Kenworthy & Kielstra, 2015).**

For example, in discussing the Asia–Pacific context, Suatra et al. (2017) state that ‘employability’ and fitness for entering the labour market will be dependent on what are loosely termed 21st Century Skills. In particular, the authors emphasise a series of named ‘employability skills’ (communication, problem-solving, decision-making, analytical and critical thinking, synthesising information, teamwork, interpersonal skills and continuous learning) that will be the ‘prerequisite’ for professional recognition. Their synthesis work highlighted ‘communication skills’, ‘problem-solving skills’, ‘teamwork skills’ and ‘personal qualities’ as the most employable attributes, and cited them as being the ‘missing link’ between education and the emerging regional and international labour markets.

However, in development contexts, the current trend of poor educational results in countries with growing populations suggests instead both the need for a skilled and educated workforce in order to enable economic development and move towards a ‘knowledge-based’ economy, and a need to address increasingly severe competition for low-skill jobs. In international development and low-resource contexts, an emphasis on foundational and cognitive skills rather than 21st Century Skills is seen to best lead to economically significant difference in a country’s economic growth (Dunbar, 2015; UNESCO, 2012). Compared with 21st Century Skills, in such settings literacy and numeracy are greater concerns (Kenworthy & Kielstra, 2015).

However, in addressing these concerns, the need to improve levels of basic skills does not exempt a country from the need to also foster soft or non-cognitive skills in students (Kenworthy & Kielstra, 2015). UNESCO (2012) also recognises the importance of ‘transferable skills’, such as communication and problem-solving, in changeable contexts. Transferable skills can play an important role in supporting young people to adapt to labour market changes, including new technologies and the demands of a ‘green economy’. Similarly, ‘soft skills’ associated with personal capabilities are also regarded as important to individual development. As evidence of this, a survey of school-aged children in Ethiopia, India, Peru and Viet Nam found that the degree of self-esteem at age 12 was positively associated with higher levels of schooling at age 15 in all four countries (Rolleston & James, 2012, cited in UNESCO, 2012), and another survey conducted by the World Bank demonstrated that socio-emotional skills were correlated with earnings (World Bank, 2011, cited in UNESCO, 2012).

3.4 Summary

The literature suggests that the need for 21st Century Skills at the global level is dictated by a combination of factors, including the change in societies resulting from the rapid spread of technology, increasing globalisation and internationalisation, and the shift from industrial social economies to information and knowledge-based social economies (Voogt & Roblin, 2010). This shift is reflected in the need for re-orienting education goals toward metacognitive skills which are becoming increasingly crucial for upskilling the workforce. According to Kenworthy and Kielstra (2015), problem-solving, teamwork and communication are the top three skills that companies require and will increasingly need in the next years. As a consequence of the changing requirement of labour markets, many countries already recognise the importance of 21st Century Skills by including them in their education goals (Care et al., 2016).

However, looking at evidence of demand at regional rather than the global level suggests a significant diversity in demand based on developmental context. The need for 21st Century Skills seems to be clear in contexts of rapid development, such as East Asian countries (Rolleston, 2018; Kattan, 2017), where labour markets are increasingly demanding a workforce with non-routine cognitive skills and interpersonal skills (Kattan, 2017; Suatra et al., 2017). Additionally, many developing countries are deeply affected by weak results in cognitive skills (particularly reading and mathematics), which are often recognised as a prerequisite for developing soft competencies such as critical thinking and problem-solving (Rolleston, 2018; Kattan, 2017; UNESCO, 2012).

This diversity of current demand for 21st Century Skills based on context is upheld by future predictions of need. Demographic projections show that the labour force will decrease in Central Asia, China, Europe and North America and in high-income countries in East Asia (Dunbar, 2015). Oppositely, the workforce will increase in sub-Saharan Africa (UNESCO, 2012; Dunbar, 2015). **These trends imply an anticipated global shortage of high-skilled workers and a surplus of low-skilled workers who will be concentrated mainly in developing countries.** Equipping low-skilled youth in developing countries with foundational literacy, numeracy and STEM skills would have the potential of stimulating the development of their countries (Rolleston, 2018; UNESCO, 2012). **While improving youth's cognitive skills (particularly literacy and numeracy) remains a priority in developing countries to foster economic growth, this does not exempt those countries from fostering non-cognitive skills in students and incorporating those skills into the national curriculum (Kenworthy & Kielstra, 2015).**

This situation highlights a tension in current discussions highlighting the 'urgency' of need for 21st Century Skills at an international level. While it is acknowledged that there are extensive projected demands at the global level, discussions should also recognise the level of diversity of demand across regions (e.g. East Asia vs sub-Saharan Africa), as well as the ways in which contextual and economic circumstances of underdevelopment can inform practical skills needs and priorities at national and sub-national levels. These same context-specific and cultural circumstances also inform the nature of local demand for 'life skills', when considered as a subset of 21st Century Skills. These findings point towards a need for a model of donor programming for LMICs that can address regional or national future priority needs in terms of 'life skills', basic education enhancement and STEM skills, at the same time as working to identify

and provide for targeted interventions on 21st Century Skills development in national or economic development contexts where there is evidence of a demonstrated sectoral or sub-sectoral demand.

A number of recommendations for future action and research emerging from these findings are set out in Section 5.

4. Pathways to the delivery of 21st Century Skills education

4.1 Introduction

This study has already established that 21st Century Skills are acknowledged at national and global levels as priority attributes required to help countries and their workforces adapt to the significant worldwide changes in social and market economies. However, Section 2 of this study revealed a current and significant diversity in terms of the definition and conceptualisation of those skills, and a lack of consensus over how to frame them.

In addition, despite a consensus in rhetoric surrounding the global demand for 21st Century Skills, Section 3 revealed a significant diversity in current and future demand for those skills at regional and national levels. In the context of this study, this diversity is particularly apparent between those regions with either rapidly developing or developmental socioeconomic profiles. Levels of demand for 21st Century Skills in these settings are also strongly influenced by contextual factors including existing industry, labour markets, and technological and communications infrastructure.

These findings point towards a number of practical challenges resulting from the issues outlined. The combination of a lack of clear definition of '21st Century Skills' together with variable levels of demand, particularly across developing countries, continues to present numerous practical challenges when it comes to the design and implementation of educational approaches for the teaching and learning of 21st Century Skills (Care et al., 2016).

In addition, supporting evidence from development contexts is generally regarded as limited, making it difficult to identify which approaches to skills delivery are most effective. For example, in their review of the evidence of impact of transferable skills training for youth in LMICs, Brown et al. (2015) found only eight studies with sufficient information on impact, and only four completed systematic reviews, two of which focused on programmes for youth employment. Across the additional body of literature they reviewed, the majority of evidence related to skills courses inserted in the formal education setting is health-related, and there was limited evidence on courses associated with, for example, skills training for work-readiness. Just over half the studies covered are from sub-Saharan Africa, with the remainder covering Latin America and the Caribbean, Asia–Pacific and the Middle East. Brown et al. (2015) also note that more than half of the available evidence is drawn from studies of pilot or experimental projects rather than programmes, and there are no impact evaluation studies looking at the effectiveness of policies.

Within this context, the following sections will provide a summary overview of a range of approaches that commentators argue may contribute to enabling the teaching and learning of 21st Century Skills within the formal education system, at the same time as acknowledging the limitations of evidence to support any claims resulting from the general challenges associated with the field at large. More detailed discussion and analysis on the role of ICT, edtech and systemic reform in the delivery of 21st Century Skills are included in Annexes 2 and 3.

4.2 Evidence on the potential of edtech to deliver 21st Century Skills

As noted in Section 2 of this report, ICT and the use of technology for educational ends are seen by many commentators as central to a number of frameworks for the definition of 21st Century Skills. These frameworks and commentators frequently present ICT and associated capabilities as either a distinct skill set within 21st Century Skills; a cross-cutting area of knowledge facilitating the development of specific competencies (e.g. communication, collaboration, etc.); or a holistic platform which, it is assumed, forms the default professional and educational working environment for the emerging global knowledge economy (Lewin & McNicol, 2015; UNESCO, 2015b).

The examined literature recognises the potential of ICT for enhancing 21st Century Skills through functionalities that enhance the capacities of students to effectively communicate at a distance, collaborate with geographically dispersed teams, develop the faculties to critically analyse digital information, and enable creative working (Lewin & McNicol, 2015; McNulty, 2016, 2017, 2018). Additionally, the use of technology also has a role in contributing to teacher development and improving assessment practices and tools (Voogt & Roblin, 2012). Commentators on the implications of edtech's assessment functionality for the education system highlight the potential of ICTs to make the delivery of assessment more effective and efficient (Voogt & Roblin, 2010).

These findings are supported by examples of the use of ICTs in education across a broad range of development contexts. Gaible, Mayanja and Michelazzi (2018) outline a variety of bespoke initiatives taken in seven DFID focal countries. Based on the cited examples, the primary uses of these technologies for learning in an educational context include: supporting the delivery of learning activities by using software and/or preloaded media; using applications for learning by young learners through gamification and animation; the transmission of teaching to pupils from another location; and supporting virtual learning (e.g. physics labs). At a subject-specific level, there are examples of the use of technology to develop skills for learning engineering, mathematics and the sciences, and to support the learning of languages. At the level of teacher development, there are examples of the use of technology to share resources for teaching and learning.

However, across the range of cases available, it is to be noted that there is frequently a huge diversity of projects in terms of scale, scope and application: much of the evidence related to ICT application is drawn from pilot programmes or from projects operating in a high-investment context with a small number of participating schools. In addition, the extent to which cited cases include specific objectives associated with 21st Century Skills rather than subject-specific outcomes is open to further analysis. Findings suggest that there is a limitation on available evidence – for example, a review conducted by Rutkowski, Rutkowski and Sparks (2011) found evidence of school-based support for ICT use specifically for the development of 21st Century Skills in only three out of 18 countries (South Africa, the Russian Federation and Thailand).

Evidence suggests that a number of systemic challenges impact on the use of ICTs for the development of 21st Century Skills, particularly in low-resource settings, namely the lack of capabilities among teachers, inadequate mechanisms for teacher professional development, and low levels of school-level support for innovative use of ICTs. A number of commentators discuss a range of systemic interventions that can work to address this through professional

development, school leadership and other initiatives (Ananiadou 2009, Binkley et al. 2012, Voogt & Roblin 2012, all cited in Lewin & McNicol, 2015; UNESCO, 2015b). There is also evidence of a poor match between the use of ICTs for the development of 21st Century Skills, and their application across the curriculum. Further challenges include a lack of clear guidance on appropriate pedagogical approaches and minimal access to ICT resources in many settings (Lewin & McNicol, 2015; UNESCO, 2015a, 2016b). However, there are also examples where a clear and consistent approach within the education sector is seen to have a positive impact on overcoming such challenges, leading to models for the effective use of ICTs in the development of 21st Century Skills in international development contexts (Rutkowski et al., 2011).

For more detailed discussion and analysis on the role of ICTs and edtech in the delivery of 21st Century Skills, see Annex 2.

4.3 Evidence on the role of education system reform to deliver 21st Century Skills

As indicated in Section 4.1 and Annex 2 of this report, while ICT and the use of technology for educational ends are seen by many commentators as central to a number of frameworks for the definition of '21st Century Skills', the use of edtech does not address what many see as the fundamental underlying issues associated with the teaching of 21st Century Skills (Care et al., 2019). Most specifically, these issues are closely associated with the range of policy and delivery components that traditionally make up education systems, and which are seen to influence the delivery of teaching and learning – curriculum, assessment and classroom practices (Kim et al., 2019a, 2019b; Vista et al., 2018)

In assessing the current status of 21st Century Skills at both the global and national levels, Kim et al. (2019a) state that the major issue facing national education systems is how to implement fully a 21st Century Skills agenda that is aligned with changing educational goals yet also focuses on teaching, learning and assessment. Further to this, Kim et al. (2019b), in discussing teaching and assessing 21st Century Skills in Africa, highlight the need to bridge any system-level gaps between policy, intent, curriculum and real classroom practice in relation to 21st Century Skills development. Most specifically, this means ensuring alignment between curriculum, pedagogy, teacher training and learning assessments. For example, when the components in the system are misaligned, changes in curriculum reform may yield few improvements in student learning if the other parts of the system, such as assessment and pedagogy, are not similarly adjusted (Kim et al., 2019b).

In addressing this, Kim et al. (2019a) argue that while the primary route to shift learning goals has traditionally been through curriculum reform, in the case of 21st Century Skills it is more appropriate to focus on assessment reform as the one strategy to align the components of the education system to the changing goals. This view is supported by Care and Vista (2017a, 2017b). However, Care et al. (2019) argue that there is still no clear understanding of how progression and attainment of these skills can be defined. **Kim and Care (2018) argue for the development of 'learning progressions' as a key tool to provide both curriculum and teachers with access to descriptions of how skills progress over time, thus enabling the design of appropriately challenging student tasks, criteria for assessment, and to support the scaffolding of learning in stages.**

However, other commentators argue for more traditional approaches to systems reform based on regional or sectoral priorities. Dewan and Sarkar (2017), in discussing measures being taken in South Asia to supplement education with 21st Century Skills training, recommend that a range of specific measures be in place to foster skills development between both the education system and the labour market. These measures include: public and private financing to improve access to and quality of education from pre-primary to secondary level; budget mechanism reforms to address systemic gaps between education and employment systems; policy and planning to improve pedagogy and labour diversification through skills training; improved school-to-work transition through skills training targeted to specific jobs; a focus on using technology for learning and to get students ready and build their capacities for the ‘rapidly changing world of technology’; and the provision of alternative learning pathways for youth. Suatra et al. (2017) highlight the role of higher education (HE) institutions in the development of identified 21st Century Skills associated with employability, i.e. communication, problem-solving, decision-making, analytical and critical thinking, synthesising information, teamwork, interpersonal skills and continuous learning.

There is a range of emerging examples where, in order to navigate these issues, countries are selecting a variety of pathways to explore optimal models through systems reform. For example, Singapore (MoE Singapore, 2019) has developed an approach which adopts a value-centric framework that will be implemented across the core curriculum and incorporates a range of 21st century competencies (including civic literacy, global awareness and cross-cultural skills; critical and inventive thinking; and communication, collaboration and information skills) as well as social and emotional competencies. Similarly, Australia’s national curriculum identified seven general capabilities associated with 21st Century Skills which teachers are expected to integrate throughout their teaching on all subjects (Care et al., 2017). Similar examples are cited by UNESCO (2016a) in relation to its study on nine countries across Asia–Pacific, pointing in particular to cases from Hong Kong, the Philippines and India.

As examples of education systems in LMICs that are seeking to address these challenges, UNESCO (2016a) also cites some approaches to systemic reform being used across a selection of countries in Asia–Pacific, although its report highlights that many of these approaches are not comprehensive in ensuring alignment across all necessary components. It also reports highly variable levels of reform in terms of the integration of 21st Century Skills into school-level practice through, for example, the revision of textbooks, the development of teaching guides, and the reform of pre-service and in-service teacher training. In Costa Rica, the National Development Plan for 2015–2018 and a new curriculum for 2018 emphasises the development and application of key 21st Century Skills and attitudes, such as socio-emotional, communication, critical thinking, citizenship and problem-solving (OECD, 2017). Similarly, Kenya is currently developing a new competency-based curriculum designed to integrate seven competencies within and across all subject areas, to ensure a comprehensive approach to skills development (Care et al., 2017).

In terms of evidence of the impact of such programming, whether in LMICs or elsewhere, the majority of commentators highlight the lack of conclusive evidence resulting largely from the unclear and imprecise definition of ‘21st Century Skills’ at the global level, as well as a lack of systemic understanding in how to measure or capture their attainment (Care et al., 2019). Brown et al. (2015) draw attention to the lack in evidence on a range of systemic interventions in LMICs, including on the impact of reforming curricula and training

teachers to build transferable skills; providing teachers with incentives or help them to network; and building institutional management and other capacity. **More than half of the available evidence synthesised by Brown et al. (2015) is drawn from studies of pilot or experimental projects rather than programmes, and there are no impact evaluation studies looking at the effectiveness of policies. Similarly, Dewan and Sarkar (2017) emphasise the paucity of data on the ways that education systems in South Asia are supporting youth in their preparedness to enter the workforce.**

For more detailed discussion and analysis on the role of systemic reform interventions in the delivery of 21st Century Skills, including through specific interventions in curriculum reform, approaches to assessment, and classroom practice, see Annex 3.

4.4 Summary

Findings from the literature suggest that approaches to the delivery of 21st Century Skills are currently impacted by ongoing discussions about both the definition and understanding of '21st Century Skills' (Care et al., 2016). On this basis, while there is a broad range of documented interventions from around the world, many commentators conclude that there is currently little or no substantial evidence available on the most effective tools and approaches to delivering those skills. **Brown et al. (2015) also note that more than half of the available evidence is drawn from studies of pilot interventions or experimental projects rather than full programmes, and there are no impact evaluation studies looking at the effectiveness of policies on outcomes related to 21st Century Skills.**

The examined literature recognises the potential of ICT for enhancing 21st Century Skills, primarily through functionalities that enhance the capacities for communication, collaboration, critical analysis and creative use of knowledge and information-finding (Lewin & McNicol, 2015; McNulty 2016, 2017, 2018). Such technologies are also adaptable to circumstance. Gaible et al. (2018) provide examples of a range of further models for the use of technology in an educational context in low-resource settings, in ways that are seen to enhance learner engagement, enable access to resources, and facilitate peer-to-peer support among teachers. However, a number of further commentators point towards the large-scale systemic barriers that impact on the use of ICTs for the development of 21st Century Skills in such settings, most particularly the limitations in teacher and school-level capabilities (Ananiadou 2009, Binkley et al. 2012, Voogt & Roblin 2012, all cited in Lewin & McNicol, 2015; UNESCO, 2015b).

Although a number of cases outline steps that can be undertaken to address these barriers, much of the literature concludes that the use of edtech does not address what many see as the fundamental underlying issues associated with the teaching of 21st Century Skills (Care et al., 2019). In response, this points towards the need to focus instead on other elements of the education system. Most specifically, this involves gaining a clear understanding of how progression and attainment of individual 21st Century Skills can be defined (Care et al., 2019), and then reflecting this in an alignment between curriculum, assessment and teacher training for classroom practices, which may or may not include the use of edtech (Kim et al., 2019a, 2019b; Vista et al., 2018).

As with the use of ICTs and edtech for 21st Century Skills, there are a number of emerging national examples of systemic reform that are designed to address these issues. Cases cited by the literature covered in this study include Singapore, Australia, the Philippines, India and Costa Rica. **However, in terms of evidence of the impact of such systemic re-programming, whether in LMICs or elsewhere, the majority of commentators highlight the lack of conclusive evidence (Care et al., 2019).**

These findings point towards a need to develop clear models for mapping the progression of acquisition for 21st Century Skills and, based on that to develop tools for gathering evidence on the impact of the range of system-wide interventions associated with their delivery. A number of recommendations for future action and research emerging from these findings are set out in Section 5.

5. Conclusions and recommendations

5.1 Conclusions

There is a broad range of available literature discussing 21st Century Skills, and within this, there is evidence of general agreement across commentators on the need for new forms of learning to tackle global challenges. **However, despite this consensus, there is no unique and single approach to the definition of '21st Century Skills'**. Multiple sources identify a variety of competencies and skills included under the banner of '21st Century Skills', and while synthesis studies such as Scott (2015), Voogt and Roblin (2010, 2012) and Chalkiadaki (2018) highlight the similarities across key frameworks, their reviews demonstrate the extent to which a broad range of different attributes, competencies and skills have been considered in defining both '21st Century Skills' and the range of parallel terminologies with which they are associated.

Approaches to the delivery of 21st Century Skills are currently impacted by these ongoing discussions over the definition and understanding of 21st Century Skills (Care et al., 2016). **On this basis, while there is a broad range of documented interventions for 21st Century Skills training from around the world, many commentators conclude that there is currently little or no substantial evidence available on the most effective tools and approaches to deliver those skills.**

A further issue emerging from the broad range of definitions of '21st Century Skills' is the extent to which the described capabilities, competencies and skill sets in any given framework of 21st Century Skills are of relevance to specific regional or national contexts. Most specifically, depending on a diverse range of global, regional and national contexts, there is evidence of a potential disconnect between particular definitions of '21st Century Skills' and their application. The range of attributes cited under '21st Century Skills' in many frameworks indicate the prioritisation of skill sets for operating within a highly connected, highly resourced, globally diverse knowledge-based economy. This contrasts significantly with discussions of future need in many development contexts which, other than measuring demand based on national economic status and plans for modernisation, often seek to highlight those attributes, frequently framed in such settings under the category of 'life skills', that ensure ongoing resilience in the face of poverty, conflict, economic and environmental crisis.

In short, the need for 21st Century Skills seems to be clear in contexts of rapid development, such as East Asian countries (Rolleston, 2018; Kattan, 2017), where labour markets are increasingly demanding a workforce with non-routine cognitive skills and interpersonal skills (Kattan, 2017; Suatra et al., 2017). However, the urgency for 21st Century Skills is less evident in development contexts, where the priority might instead be for ensuring a bedrock of cognitive skills – particularly reading and mathematics – which are often recognised to be a prerequisite for developing competencies such as critical thinking and problem-solving (Rolleston, 2018; Kattan, 2017; UNESCO, 2012).

While it is acknowledged that there are extensive projected demands at the global level, any discussions should recognise the level of diversity of demand across regions (e.g. East Asia vs sub-Saharan Africa), as well as the ways in which contextual and economic circumstances of underdevelopment can inform practical skills needs and priorities at national and sub-national

levels. These same context-specific and cultural circumstances also inform the nature of local demand for 'life skills', when considered as a subset of 21st Century Skills.

In response, this study concludes that an analysis of the relationship between the contexts assumed by these various frameworks for 21st Century Skills is missing in the literature. It also points towards the need to ensure that the terminologies and definitions associated with '21st Century Skills' are not used lightly when discussing regional or national priorities, and that the realities of national and sub-national socioeconomic status need to be taken into consideration when defining future skills needs for the workforce and the labour market.

The study's findings also point towards the need for a model of donor programming for LMICs that can address regional or national future priority needs in terms of basic education enhancement, STEM skills and 'life skills', at the same time as working to identify and provide for targeted interventions on 21st Century Skills development in national or economic development contexts where there is evidence of a demonstrated sectoral or sub-sectoral demand.

Finally, these findings also suggest a need to research the development or adoption of a model of definition for '21st Century Skills' that (1) accommodates the range of professional capabilities, core knowledge areas and personal attributes that are included as commonalities across the leading range of existing 21st Century Skills frameworks; and (2) integrates existing and emerging globalised employment priorities with those other forms of resilience frequently required in a development context and currently framed within the SDGs as 'life skills'. In addressing this, it is suggested that any institution seeking to engage with 21st Century Skills programming in a range of global settings should adopt whichever pre-existing model provides users with the most flexible and outputs-orientated framework, rather than generating another framework of definition in an already diverse and potentially crowded field.

5.2 Recommendations

This sub-section includes two recommendations for future action and a number of recommendations for research emerging from the findings across the three main sections of this study. As such, they seek to address issues emerging from evidence associated with the definition of, demand for and delivery of 21st Century Skills.

5.2.1 Recommended future actions

Two suggestions for future actions are presented below.

Any institution seeking to engage with 21st Century Skills programming in a range of global settings should adopt the most flexible and outputs-orientated of pre-existing 21st Century Skills frameworks.

As far as possible, this model should already accommodate the key range of professional capabilities, core knowledge areas and personal attributes associated with 21st Century Skills frameworks, as well as have the potential to integrate existing and emerging employment priorities with those other forms of resilience frequently required in a development context and currently framed within the SDGs as 'life skills'.

Of the existing frameworks for the definition of '21st Century Skills', **it is proposed that the most appropriate model to adopt is the ATC21S model (Assessment and Teaching of 21st Century Skills) developed by Griffin, McGaw and Care in 2012 and further supplemented in 2015 by Griffin and Care with supporting guidelines for methods and approaches to delivery.** There are a number of reasons why this framework is best suited to DFID or other donor institutions seeking to engage with 21st Century Skills programming in a potentially diverse range of global settings.

Firstly, ATC21S streams a diverse range of skills into a manageable set of practically demonstrable capabilities ('ways of thinking', 'tools for working', 'ways of working' and 'ways of living'), thereby presenting an outputs-orientated model that also enables the potential accommodation of new and emerging skill sets that may be generated, for example, by specific contextual, social, economic or political priorities.

Secondly, in terms of the individual skills featured within the framework, ATC21S already takes into full account both 'professional' and 'personal' skills and competencies. This enables it to work towards fuller integration between those employer-orientated 21st Century Skills that are of greatest relevance to employers within the global knowledge economy (e.g. as highlighted by the P21 Framework for 21st Century Learning) and the personal livelihoods and resilience-orientated 'life skills' currently advocated for within the field of international development by, for example, UNESCO and the SDGs. However, in approaching the application of ATC21S as a tool to enable the better integration of '21st Century Skills' with 'life skills', it is also recommended that any selection of desired professional and personal competencies from across a range of sources be reviewed and refined according to contextual need as well as in order to avoid unnecessary duplication across skill sets by narrowing categorisation. For example, a review of 21st Century Skills and life skills frameworks undertaken as part of this study (see Annex 1, Table 4) revealed potential areas of overlap on a number of skill sets including, for example, between 'collaboration' (as a 21st Century Skill) and 'interacting with others' (as a 'life skill'), and between 'problem-solving' (as a 21st Century Skill) and 'overcoming problems and finding solutions' (as a 'life skill').

Thirdly, within this, and unlike a number of other frameworks, ATC21S presents 'ICT skills' as a defined and stand-alone set of skills, rather than as a cross-cutting and fully integrated requirement of 21st Century Skills. This provides the ATC21S framework with a flexibility of application that is relevant both to highly connected, highly resourced and knowledge-driven national or regional economies, and low-resourced emerging or developing national or regional economies.

Fourthly, outside of definitions and the inclusion of particular skill sets, the design of the ATC21S model is widely concerned with facilitating the acquisition of required skills, and therefore deliberately frames them in ways that enable discussion and uptake by policymakers, educators, trainers and employers operating within the education system, the TVET sector and the labour market.

Fifthly, and looking in particular at pathways for the acquisition of these skills, the ATC21S model is already supplemented by substantial and emerging research and pedagogic thinking which provides guidelines and approaches for facilitating the design and delivery of teaching, learning and assessment of these skills. This is clearly of great practical value to policymakers, programmers and other stakeholders seeking to implement 21st Century Skills programming.

In this context, the ATC21S model can be seen as operating in a flexible enough manner that enables donors to acknowledge the existing and ongoing challenges of definition and diversity of demand according to context, and to work with these in a variety of settings according to context-specific priorities and needs. Further to this, from a delivery perspective, the ATC21S model is designed as an outputs-orientated framework: it both enables programmers and stakeholders to conceptualise skills definitions in terms of demonstrable attributes and behaviours, and is working to generate guidelines and tools designed to support the application of 21st Century Skills training in an educational context.

- **Donors should seek to adopt a model of 21st Century Skills programming for LMICs that can also address regional or national needs in terms of priorities for basic education enhancement, STEM skills and ‘life skills’.**

The chosen model of 21st Century Skills programming for LMICs should work to identify and provide for targeted interventions on 21st Century Skills development in national development contexts where there is evidence of sectoral or sub-sectoral demand. However, it is anticipated that implementing such a model will also require the gathering of information to inform programming practice. The recommendations on future research included under ‘demand’ and ‘delivery’ below, set out a number of proposed themes that might further support this action.

5.2.2 Recommended future research

Based on the findings of this study, there are a number of recommendations for future research emerging from the literature and in relation to the availability of evidence.

- ***Further research on the definition of ‘21st Century Skills’***

In relation to the definition of ‘21st Century Skills’, the evidence presented in Section 2 points towards the ongoing need to refine the definition of ‘21st Century Skills’ towards a globally applicable framework. This study concludes that an analysis of the relationship between the socioeconomic contexts assumed by the various terminologies associated with ‘21st Century Skills’ is missing in the literature.

It also points towards the need to ensure that the terminologies and definitions associated with ‘21st Century Skills’ are not used lightly when discussing regional or national priorities, and that the realities of national and sub-national socioeconomic status need to be taken into consideration when defining future skills needs for the workforce and the labour market. These findings also suggest a need to research the development of a model of definition for 21st Century Skills that integrates existing and emerging globalised employment challenges with those other forms of resilience frequently required in a development context and currently framed as ‘life skills’.

With this in mind, suggested areas of research in this field include:

- Identifying models for ensuring the closer integration of ‘21st Century Skills’ (as applied in the context of globalised and knowledge-based economies) and ‘life skills’ (as applied in the context of international development and LMICs).

- ***Further research on the demand of 21st Century Skills***

In relation to better understanding the demand for 21st Century Skills, there is a need for research that can give a clearer understanding of current regional diversity in the levels of demand for 21st Century Skills in a way that can inform donor programming on this theme at both national and regional levels. While it is acknowledged that there are extensive projected demands at the global level, donor-based discussions should also recognise the level of diversity of demand across regions (e.g. East Asia vs sub-Saharan Africa), as well as the ways in which contextual and economic circumstances of underdevelopment can inform practical skills needs and priorities at national and sub-national levels.

It is suggested that any donor-led programming that encompasses 21st Century Skills should consider exploring the opportunities for highly targeted and context-specific investment in such settings, with a view to also enabling the wider beneficial impact identified by Rolleston (2018). This should be led in part through a process led by evidence across a range of criteria for regional and national state systemic engagement, as well as industry sector and local labour market demand. In supporting the development of such approaches, recommended research includes:

- Mapping the varying levels of demand for 21st Century Skills in sub-Saharan Africa, East Asia, South Asia and Latin America, including within specific sectors of employment and industry;
- Identifying the regional and national social and economic drivers of demand for 21st Century Skills within LMICs; and
- Within regional and national settings, mapping types and levels of systemic engagement with 21st Century Skills development, including in terms of governmental, private sector, labour market and employer engagement.

Working to identify future demand for 21st Century Skills from a specifically developmental perspective, further recommended areas for research include:

- Identifying the systemic and infrastructural environments that need to be in place in order to create or facilitate the demand for 21st Century Skills within LMICs, as well as the systemic and infrastructural capabilities that are required in order to provide those skills;
- Identifying the social and economic markers and other criteria that can help provide evidence of the shift within regional or national market economies from an industrial economy towards a knowledge-management economy, thereby fostering an increased demand for 21st Century Skills; and
- Identifying a series of markers of 'readiness' within LMICs to inform the introduction of initiatives for 21st Century Skills development.

- **Further research on the delivery of 21st Century Skills**

In relation to understanding the various pathways for acquisition of 21st Century Skills, the literature in this study concludes that, partly as a result of a lack of consensus over the definition of '21st Century Skills', there is also a lack of consensus in approaches to the teaching and assessment of 21st Century Skills.

A major recommendation from UNESCO's (2016a) *review of the challenges* for emerging economies seeking to adopt or integrate '21st Century Skills' was to support definition and understanding of '21st Century Skills' by undertaking in-depth research into the nature and development of the skills themselves. From a pedagogic perspective, this also links with recommendations for future research from Care et al. (2019) and Kim et al. (2019a; 2019b), who place a particular focus on the general need to understand 'learning progressions' across the skill sets commonly included within 21st Century Skills.

With this in mind, there is a need for research that will undertake further impact evaluation in order to address the lack in evidence on a range of current systemic interventions including:

- Evidence of the impact of reforming curricula to develop 21st Century Skills;
- Evidence of the impact of assessment reform to develop 21st Century Skills; and
- Evidence of the impact of pedagogic reform and teacher training to develop 21st Century Skills.

Suggested areas for future research emerging from this include:

- The identification of approaches and guidelines for the assessment of 21st Century Skills; and
- The identification of approaches and guidelines for the teaching of 21st Century Skills.

Finally, further areas of suggested research include gathering evidence of the impact of other sub-systemic initiatives designed for the acquisition of 21st Century Skills including, for example, dedicated 21st Century Skills training; the use of edtech; school leadership training; school–employer partnerships; community and peer-to-peer interventions, and so on.

6. References

- Awuah, L. J. (2015). Supporting 21st-century teaching and learning: The role of Google Apps for Education (GAPE). *Journal of Instructional Research*, 4, 12–22.
- Barnett, T., Lawless, B., Kim, H., & Vista, A. (2017). *Complementary strategies for teaching collaboration and critical thinking skills*. Washington, DC: Brookings. Retrieved from <https://www.brookings.edu/blog/education-plus-development/2017/12/12/complementary-strategies-for-teaching-collaboration-and-critical-thinking-skills/>
- Behuria, P., & Goodfellow, T. (2019). Leapfrogging manufacturing? Rwanda's attempt to build a services-led 'developmental state'. *European Journal of Development Research* 31(3), 581–603. Retrieved from <https://doi.org/10.1057/s41287-018-0169-9>
- Brown, A. N., Rankin, K., Picon, M., & Cameron, D. B. (2015). *The state of evidence on the impact of transferable skills programming on youth in low- and middle-income countries* (3ie Scoping Paper No. 4). New Delhi: International Initiative for Impact Evaluation (3ie). Retrieved from https://www.3ieimpact.org/sites/default/files/2019-01/sp4-youth_and_transferable_skills.pdf
- Byungura, J. C., Hansson, H., Muparasi, M., & Ruhinda, B. (2018). Familiarity with technology among first-year students in Rwandan tertiary education. *Electronic Journal of e-Learning*, 16(1), 30–45. Retrieved from <https://eric.ed.gov/?id=EJ1175337>
- Care, E., & Anderson, K. (2016). How education systems approach breadth of skills. Washington, DC: Center for Universal Education at the Brookings Institution. Retrieved from https://www.brookings.edu/wp-content/uploads/2016/05/brookings_how-education-systems-approach-breadth-of-skills_web_07-2016.pdf
- Care, E., Anderson, K., & Kim, H. (2016). *Visualizing the breadth of skills movement across education systems*. Washington, DC: Center for Universal Education at the Brookings Institution. Retrieved from <https://www.brookings.edu/research/visualizing-the-breadth-of-skills-movement-across-education-systems/>
- Care, E., Kim, H., Anderson, A., & Gustafsson-Wright, E. (2017a). *Skills for a changing world: National perspectives and the global movement*. Washington, DC: Brookings. Retrieved from <https://www.brookings.edu/wp-content/uploads/2017/03/global-20170324-skills-for-a-changing-world.pdf>
- Care, E., Kim, H., & Vista, A. (2017b). *How do we teach 21st Century Skills in classrooms?*. Washington, DC: Brookings. Retrieved from <https://www.brookings.edu/blog/education-plus-development/2017/10/17/how-do-we-teach-21st-century-skills-in-classrooms/>
- Care, E., & Vista, A. (2017a). *Education assessment in the 21st century: New skillsets for a new millennium*. Washington, DC: Brookings. Retrieved from <https://www.brookings.edu/blog/education-plus-development/2017/03/01/education-assessment-in-the-21st-century-new-skillsets-for-a-new-millennium/>

- Care, E., & Vista, A. (2017b). *Education assessment in the 21st century: Moving beyond traditional methods*. Washington, DC: Brookings. Retrieved from <https://www.brookings.edu/blog/education-plus-development/2017/02/23/education-assessment-in-the-21st-century-moving-beyond-traditional-methods/>
- Care, E., Vista, A., & Kim, H. (2018a). *Optimizing assessment for all: Measuring 21st Century Skills*. Washington, DC: Brookings. Retrieved from https://www.brookings.edu/product/optimizing-assessment-for-all/?utm_campaign=Center%20for%20Universal%20Education&utm_source=hs_email&utm_medium=email&utm_content=72437259
- Care, E., Vista, A., Kim, H., & Scoular, C. (2018b). *Collaborative capacity building in 21st Century Skills assessment: Reflections from Mongolia*. Washington, DC: Brookings. Retrieved from <https://www.brookings.edu/blog/education-plus-development/2018/10/19/collaborative-capacity-building-in-21st-century-skills-assessment-reflections-from-mongolia/>
- Care, E., Vista, A., Kim, H., & Anderson, K. (2019). *Education system alignment for 21st Century Skills: Focus on assessment*. Washington, DC: Brookings. Retrieved from <https://www.brookings.edu/research/education-system-alignment-for-21st-century-skills/>
- Chalkiadaki, A. (2018). A systematic literature review of 21st Century Skills and competencies in primary education. *International Journal of Instruction*, 11(3), 1–16. Retrieved from http://www.e-iji.net/dosyalar/iji_2018_3_1.pdf
- Clarke, L., & Care, E. (2017). *How do you teach critical thinking when the norm is not to question?*. Washington, DC: Brookings. Retrieved from <https://www.brookings.edu/blog/education-plus-development/2017/12/05/how-do-you-teach-critical-thinking-when-the-norm-is-not-to-question/>
- Dewan, S., & Sarkar, U. (2017). From education to employability: Preparing South Asian youth for the world of work. JustJobs Network Inc. Retrieved from <https://www.unicef.org/rosa/reports/preparing-south-asian-youth-world-work>
- Dunbar, M. (2015). *Skills and capacity: What does learning need to look like today to prepare the workforce of 2030?* (DFID think piece). Retrieved from <http://www.heart-resources.org/wp-content/uploads/2016/01/DFID-Skills-and-Capacity-Think-Piece-Dunbar.pdf?x30250>
- Ertmer, P. A., Ottenbreit-Leftwich, A. T., & Tondeur, J. (2014). Teacher beliefs and uses of technology to support 21st-century teaching and learning. In *International Handbook of Research on Teachers' Beliefs* (pp. 403–419). New York, NY: Routledge
- Fiore, S. (2019, 30 April) Collaborative problem solvers are made not born – here's what you need to know [*The Conversation*]. Retrieved from <https://theconversation.com/collaborative-problem-solvers-are-made-not-born-heres-what-you-need-to-know-110663>
- Gaible, E., Mayanja, M. and Michelazzi, A. (2018). *Transforming education through technology: Second-stage report*. London: Health & Education Advice & Resource Team (HEART). Retrieved from <https://www.heart-resources.org/assignment/a-scoping-study-transforming-education-through-technology/>

Gates, S., Lippman, L., Shadowen, N., Burke, H., Diener, O., & Malkin, M. (2016). *Key soft skills for cross-sectoral youth outcomes*. Washington, DC: USAID's YouthPower: Implementation, YouthPower Action. Retrieved from

https://www.youthpower.org/sites/default/files/YouthPower/resources/Key%20Soft%20Skills%20or%20Cross-Sectoral%20Youth%20Outcomes_YouthPower%20Action.pdf

Griffin, P., McGaw, B., & Care, E. (2012). *Assessment and teaching of 21st Century Skills*. Springer: Dordrecht.

Jaberian, H., Vista, A., & Care, E. (2018). *Monitoring for 21st Century Skills: Solutions adopted by the United Nations*. Washington, DC: Brookings. Retrieved from

<https://www.brookings.edu/blog/education-plus-development/2018/11/26/monitoring-for-21st-century-skills/>

Kattan, R. B. (2017, December). Powered by education, East Asia is getting ready for the Fourth Industrial Revolution [*Education for Global Development* blog]. Retrieved from

<http://blogs.worldbank.org/education/education-east-asia-fourth-industrial-revolution>

Kennedy, F., Pearson, D., Brett-Taylor, L., & Talreja, V. (2014). The Life Skills Assessment Scale: Measuring life skills of disadvantaged children in the developing world. *Social Behaviour and Personality*, 42(2), 197–210. Retrieved from <https://www.sbp-journal.com/index.php/sbp/article/view/3518/0>

Kenworthy, L., & Kielstra, P. (2015). *Driving the skills agenda: Preparing students for the future* (Economist Intelligence Unit Report). Retrieved from

<http://www.economistinsights.com/analysis/driving-skills-agenda>

Kim, H., & Care, E. (2018). Learning progressions: Pathways for 21st century teaching and learning. Washington, DC: Brookings. Retrieved from <https://www.brookings.edu/blog/education-plus-development/2018/03/27/learning-progressions-pathways-for-21st-century-teaching-and-learning/>

Kim, H., Care, E. & Ruscelli, D. (2019a). A collaborative approach to teaching and assessing 21st Century Skills in Africa. Brookings. Retrieved from

<https://www.brookings.edu/blog/education-plus-development/2019/04/25/a-collaborative-approach-to-teaching-and-assessing-21st-century-skills-in-africa/>

Kim, H., Care, E., & Vista, A. (2019b). *Education systems need alignment for teaching and learning 21st Century Skills*. Washington, DC: Brookings. Retrieved from

<https://www.brookings.edu/blog/education-plus-development/2019/01/30/education-systems-need-alignment-for-teaching-and-learning-21st-century-skills/>

Lewin, C., & McNicol, S. (2015). Supporting the development of 21st Century Skills through ICT.

In Brinda, T., Reynolds, N., Romeike, R., & Schwill, A. (Eds.), *KEYCIT 2014: Key competencies in informatics and ICT* (pp. 181–198). Retrieved from <https://publishup.uni-potsdam.de/opus4-ubp/frontdoor/deliver/index/docId/7032/file/cid07.pdf>

- Lippman, L., Ryberg, R., Carney, R., & Moore, K. A. (2015). *Key 'soft skills' that foster youth workforce success: Toward a consensus across fields* (Workforce Connections No. 2015-24A). Bethesda, MD: Child Trends. Retrieved from <https://www.childtrends.org/wp-content/uploads/2015/06/2015-24AWFCSoftSkillsExecSum.pdf>
- Lippman, L. H., Moore, K., Guzman, L., Ryberg, R., McIntosh, H., Ramos, M., Caal, S., Carle, A., & Kuhfeld, M. (2014). *Flourishing children: Defining and testing indicators of positive development*. Heidelberg: Springer Science and Business Media.
- Manpower Group. (2013). 2013 Talent shortage survey research results. Milwaukee, WI: Manpower Group. In Lippman, L., Ryberg, R., Carney, R., & Moore, K. A. (2015). *Key 'soft skills' that foster youth workforce success: Toward a consensus across fields* (Workforce Connections No. 2015-24A). Bethesda, MD: Child Trends. Retrieved from <https://www.childtrends.org/wp-content/uploads/2015/06/2015-24AWFCSoftSkillsExecSum.pdf>
- McNulty, N. (2016, 11 July) Why teaching 21st Century Skills using educational technology is essential [Web log post]. Retrieved from <https://www.niallmcnulty.com/2016/07/why-teaching-21st-century-skills-using-educational-technology-is-essential>
- McNulty, N. (2017, 27 August). How EdTech can equip learners with the right skills for the 4th industrial revolution [Web log post]. Retrieved from <https://www.niallmcnulty.com/2017/08/how-edtech-can-equip-learners-with-the-right-skills-for-the-4th-industrial-revolution/>
- McNulty, N. (2018, 8 July). Are South African schools ready for the 4th industrial revolution? [Web log post]. Retrieved from <https://www.niallmcnulty.com/2018/07/are-south-african-schools-ready-for-the-4th-industrial-revolution/>
- Mills, K., & Kim, H. (2017). *Teaching problem solving: Let students get 'stuck' and 'unstuck'*. Washington, DC: Brookings. Retrieved from <https://www.brookings.edu/blog/education-plus-development/2017/10/31/teaching-problem-solving-let-students-get-stuck-and-unstuck/>
- MoE Singapore (2019). *21st century competencies* [Ministry of Education Singapore website]. Retrieved from <https://www.moe.gov.sg/education/education-system/21st-century-competencies>
- Ngendahayo E., & Askell-Williams, H. (2016). Rwanda's new competence-based school curriculum. In Orrell, J., & Curtis D. D. (Eds.), *Publishing higher degree research: Making the transition from student to researcher*. Higher Education Horizons Vol. 1. Rotterdam: Sense Publishers.
- OECD. (2017). *Education in Costa Rica: Reviews of national policies for education*. Paris: OECD Publishing. Retrieved from <https://doi.org/10.1787/9789264277335-en>
- Owen, D., & Vista, A. (2017). *Strategies for teaching metacognition in classrooms*. Washington, DC: Brookings. Retrieved from <https://www.brookings.edu/blog/education-plus-development/2017/11/15/strategies-for-teaching-metacognition-in-classrooms/>
- Rolleston, C. (2018, 1 June). 21st Century Skills: Upskilling for an uncertain future? [Web log post]. Retrieved from <https://www.younglives.org.uk/content/21st-century-skills-upskilling-uncertain-future>

Rutkowski, D., Rutkowski, L., & Sparks, J. (2011). Information and communications technologies support for 21st-century teaching: An international analysis. *Journal of School Leadership*, 21(2), 190–215.

Scott, Cynthia, L. S. (2015). *The futures of learning 2: What kind of learning for the 21st century?* (ERF Working Paper No. 14). Paris: UNESCO Education Research and Foresight. <https://unesdoc.unesco.org/ark:/48223/pf0000242996>

Suarta, I. M., Suwintana, I. K., Sudhana, I. F. P., & Hariyanti, N. K. D. (2017). Employability skills required by the 21st century workplace: A literature review of labor market demand. *Advances in Social Science, Education and Humanities Research 102*, International Conference on Technology and Vocational Teachers (ICTVT 2017). Atlantis Press. Retrieved from <https://doi.org/10.2991/ictvt-17.2017.58>

UNESCO. (2012). *Youth and skills: putting education to work*. Paris: UNESCO. Retrieved from <https://unesdoc.unesco.org/ark:/48223/pf0000218003>

UNESCO. (2015a). *Asia–Pacific Education Research Institutes Network (ERI-Net) regional study on transversal competencies in education policy & practice (phase III): Preparing and supporting teachers in the Asia–Pacific to meet the challenges of twenty-first century learning*. Bangkok: UNESCO.

UNESCO. (2015b). *2013 Asia–Pacific Education Research Institutes Network (ERI-Net) regional study on transversal competencies in education policy & practice (phase I)*. Paris: UNESCO.

UNESCO. (2016a). *Assessment of transversal competencies: Policy and practice in the Asia–Pacific Region*. Bangkok: UNESCO Office Bangkok. Retrieved from <https://unesdoc.unesco.org/ark:/48223/pf0000246590>

UNESCO. (2016b). *2014 Asia–Pacific Education Research Institutes Network (ERI-Net) regional study on transversal competencies in education policy & practice (phase II): School and Teaching Practice*. Paris: UNESCO.

Van Laar, E., van Deursen, A. J., van Dijk, J. A., & de Haan, J. (2017). The relation between 21st-century skills and digital skills: A systematic literature review. *Computers in Human Behaviour*, 72, 577–588.

Vista, A., & Care, E. (2017a). *Education assessment in the 21st century: Pathways to the future*. Washington, DC: Brookings. Retrieved from <https://www.brookings.edu/blog/education-plus-development/2017/03/13/education-assessment-in-the-21st-century-pathways-to-the-future/>

Vista, A., & Care, E. (2017b). *Education assessment in the 21st century: New technologies*. Washington, DC: Brookings. Retrieved from <https://www.brookings.edu/blog/education-plus-development/2017/02/27/education-assessment-in-the-21st-century-new-technologies/>

Vista, A., Kim, H., & Care, E. (2018a). *Working with countries in Asia to raise awareness of 21st Century Skills in classrooms*. Washington, DC: Brookings. Retrieved from <https://www.brookings.edu/blog/education-plus-development/2018/06/14/working-with-countries-in-asia-to-raise-awareness-of-21st-century-skills-in-classrooms/>

Vista, A., Kim, H., & Care, E. (2018b). *Use of data from 21st Century Skills assessments: Issues and key principles*. Washington, DC: Brookings. Retrieved from <https://www.brookings.edu/wp-content/uploads/2018/10/EffectiveUse-Vista-Kim-Care-10-2018-FINALforwebsite.pdf>

Voogt, J., & Roblin, N. P. (2010). *21st Century Skills* (Discussion Paper). Enschede: University of Twente.

Voogt, J., & Roblin, N. P. (2012). A comparative analysis of international frameworks for 21st century competences: Implications for national curriculum policies. *Journal of Curriculum Studies*, 44(3), 299–321. doi:10.1080/00220272.2012.668938

WHO (1997) *Life skills education for children and adolescents in schools*. Geneva: World Health Organization.

Youth Power. (2019). *Soft skills for positive youth development*. Retrieved from <https://www.youthpower.org/soft-skills-positive-youth-development>

Annex 1: Syntheses of definitions of 21st Century Skills

Table 1: Conceptualisation of 21st Century Skills in different frameworks

P21	En Gauge	ATCS	NETS / ISTE	EU	OECD
Learning and innovation skills 1. Critical thinking and problem solving; 2. Creativity and innovation; 3. Communication and collaboration	Inventive thinking 1. Adaptability, managing complexity and self-direction; 2. Curiosity, creativity and risk taking; 3. Higher order thinking and sound reasoning.	Ways of thinking 1. Creativity and innovation; 2. Critical thinking, problem solving, decision making; 3. Leadership to learn, metacognition	Creativity and Innovation Creative thinking, construct knowledge, and develop products and processes using technology	Learning to learn	
			Critical thinking, problem solving and decision making		
	Effective communication 1. Teaming, collaboration and interpersonal skills; 2. Personal, social and civic responsibility; 3. Interactive communication	Ways of working 1. Communication; 2. Collaboration (teamwork)	Communication and collaboration Students use digital media and environments to communicate and work collaboratively	Communication 1. Communication in mother tongue; 2. Communication in foreign languages	Interacting in heterogeneous groups 1. Relate well to others; 2. Cooperate, work in teams; 3. Manage and resolve conflicts.
Information, media and technology skills 1. Information literacy; 2. Media literacy; 3. technology literacy	Digital-age literacy 1. Basic, scientific, economic and technology literacies; 2. Visual and information literacies; 3. Multicultural literacy and global awareness	Tools for working 1. Information literacy; 2. ICT literacy		Digital competence	Using tools interactively 1. Use language, symbols and text interactively; 2. Use knowledge and information interactively; 3. Use technology interactively
Life and career skills 1. Flexibility and adaptability; 2. Initiative and self-direction; 3. Social and cross-cultural skills; 4. Productivity and accountability; 5. Leadership and responsibility	High productivity 1. Prioritising, planning and managing for results; 2. Effective use of real-world tools; 3. Ability to produce relevant, high quality products.	Living in the world 1. Citizenship – local and global; 2. Life and career; 3. Personal and social responsibility (including cultural awareness and competence)	Digital citizenship Understand human, cultural and societal issues related to technology.	Cultural awareness and expression Social and civic competences Sense of initiative and entrepreneurship	Acting autonomously 1. Act within the big picture; 2. Form and conduct life plans and personal projects; 3. Defend and assert rights, interests and needs.

(continued p.53)

<p>Core Subjects</p> <ol style="list-style-type: none"> 1. English, reading or language; 2. Foreign languages; 3. Arts; 4. Mathematics; 5. Economics; 6. Science; 7. Geography; 8. History; 9. Government and civics 		<p>Core curriculum</p> <ol style="list-style-type: none"> 1. Home language 2. Mathematics 3. Science 4. History 5. Arts or Humanities 		<ol style="list-style-type: none"> 1. Mathematical 2. Basic competences in science 3. Basic competence in technology 4. Communication in mother tongue 5. Communications in foreign languages 	
<p>Interdisciplinary themes</p> <ol style="list-style-type: none"> 1. Global awareness; 2. Financial, economic, business and entrepreneurial literacy; 3. Civic literacy; 4. Health Literacy and environmental literacy 					

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Table 2: Essential competencies and skills for 21st century learning

Competencies and skills	Source	Competencies and skills	Source	Competencies and skills	Source	Competencies and skills	Source
Learning to know, learning to do, learning to be and learning to live together	International Commission on Education for the Twenty-first Century (1996)	<i>The other 3 Rs: Reasoning</i> (analytical, critical thinking and problem-solving skills); <i>Resilience</i> (flexibility, adaptability and self-reliance); and <i>Responsibility</i> (application of intelligence, creativity and knowledge for a 'common good')	P21 (2007a, 2007b) Sternberg and Subotnik (2006)	<i>Entrepreneurial skills:</i> ability to 'think on your feet', observe and evaluate opportunities and ideas that may be new, autonomy, the ability to think unconventionally, imagine new scenarios and question conventional wisdom	P21 (2007a, 2008) Robinson (2006) Wagner (2010)	<i>Teamwork and interconnectedness:</i> capacity for collaborative teamwork, good written and oral presentation skills, professionalism, a good work ethic, ability to foster interdisciplinary cooperation and global exchange of ideas, ability to counter discrimination due to origin, gender or age	Conference Board et al. (2006) Leis (2010) Redecker et al. (2011)
<i>The 4 Cs</i> (communication, collaboration, critical thinking and creativity) taught within the context of core subject areas: social and cross-cultural skills; proficiency in languages other than English; understanding of economic and political forces that affect societies and twenty-first century interdisciplinary themes; global awareness; financial, economic, business and entrepreneurial literacy; civic literacy and health literacy, including health and wellness awareness	Conference Board et al. (2006) P21 (2007a, 2013)	Innovation skills, creativity, divergent thinking, courage to 'seize' problems, enthusiastic experimentation; the capacity to 'break new ground', invoke fresh ways of thinking, put forth new ideas and solutions, pose unfamiliar questions, and arrive at unexpected answers	Barry (2012) Center for Curriculum Redesign and OECD (2012) Gardner (2008) P21 (2007a, 2013) Robinson (2006) Sternberg (2007)	Capacity for collaboration and teamwork using authentic, project-based learning; ability to teach peers in groups; ability to engage in networked collaborations either locally or at a distance	Facer (2009) P21 (2007a)	<i>Communication and collaboration:</i> ability to express thoughts clearly and persuasively both orally and in writing, articulate opinions, communicate coherent instructions, and motivate others through speech	Barry (2012) Levy and Murnane (2004) P21 (2007a, 2013)
<i>Rigour, relevance and respect:</i> <i>Rigour</i> (what students are able to do as a result of their learning); <i>Relevance</i> (understanding of how learning connects to current real-world challenges and future work); <i>Respect</i> (promoting respectful relationships among teachers and students that foster academic and social competence)	Wagner et al. (2006) P21 (2007a, 2007b)	Critical thinking; capacity for active investigative thinking and inquiry; ability to access, analyse interpret, apply and synthesize information; ability to examine, interpret and evaluate evidence, and ask relevant questions; ability to integrate ideas from different disciplines or spheres into a coherent whole and communicate that integration to others	Ackerman and Perkins (1989) Barry (2012) Bransford (2007, cited in P21 2007b) Gardner (2008) P21 (2007a, 2007b) Redecker et al. (2011) Tucker and Coddling (1998) US Dept. of Labor, SCANS (1991) Wagner (2010)	Collaborative, empathic and social skills; communication skills	P21 (2007a, 2013)	Academic and applied knowledge; ability to connect knowledge and skills, learning and competence, inert and active learning, codified and tacit knowledge and creative and adaptive learning	Carneiro (2007)

(continued p.55)



Knowledge, evidence and learning for development

Competencies and skills	Source	Competencies and skills	Source	Competencies and skills	Source	Competencies and skills	Source
Core subjects include English, Reading or Language Arts; World Languages; Art; Mathematics; Economics; Science; Geography; History; Government and Civics with a balance between education in technical and natural science subjects, and culture and humanities; mastery of major schools of thought, including science, mathematics and history	Davies, Fidler and Gorbis (2011) Gardner (2008) P21 (2007a, 2007b) Salas-Pilco (2013)	Technical and complex problem solving skills; communication; collaboration; willingness to grapple with tough challenges and problems with elusive solutions; clear and effective oral and written communication	Conference Board et al. (2006) P21 (2007a) Tucker and Coddling (1998) Wagner (2010)	Civic citizenship: civic literacy, capacity to understand the local and global implications of civic issues	P21 (2007a, 2013)	Metacognition: self-directed learning; planning; goal-setting; monitoring one's own progress; adaptability; ability to set learning goals, and plan and monitor your own learning; ability to assess progress and take action with results; self-efficacy	Bransford (2007, cited in P21 (2007b)) P21 (2007b)
Information, media and technology literacy: ability to access, evaluate and use information; capacity to understand and analyse the nature of media messages; ability to analyse, evaluate and create messages in a variety of forms; ability to create messages as self-expression and to influence and inform others; digital citizenship	Davies, Fidler and Gorbis (2011) ETS (2007) Leis (2010) P21 (2007a, 2007b, 2013) Prensky (2012) Trilling and Fadel (2009) Wan and Gut (2011)	Social and cross-cultural skills: ability to interact effectively with others (knowing when it is important to listen and when to speak, and how to conduct oneself in a respectable, professional manner); ability to work effectively in diverse teams (respecting cultural differences and collaborating with people from a wide range of social and cultural backgrounds); awareness of and appreciation for differences among individuals and communities; capacity for openness to different capacity for openness to different ideas and values; social skills; emotional resilience; empathy	Gardner (2008) Leadbeater (2008) National Research Council (2012) P21 (2007a, 2013) Pink (2005)	Skills related to thinking and reflection taught as a 'meta-curriculum' and interwoven with traditional core subjects; 'habits of mind' (analysis, interpretation, precision and accuracy, problem solving, reasoning); sense-making; and using expert thinking (detailed knowledge and metacognition) to support decision-making	Ackerman and Perkins (1989) Bolstad (2011) Conley (2007) Levy and Murnane (2004) Mansilla and Jackson (2011) P21 (2007a, 2007b)	Intercultural competencies: ability to understand and communicate with others; respect and tolerance; ability to listen attentively to others; capacity for flexibility and negotiation; global competence; ability to cooperate with contributors in interdisciplinary and intercultural teams	Barrett et al. (2014) Carneiro and Draxler (2008) Levy and Murnane (2004) Mansilla and Jackson (2011) P21 (2007a) UNESCO (2013c)
Curiosity, adaptability and commitment to continuous learning	Gijsbers and van Schoonhoven (2012) Herring (2012) P21 (2007a, 2011) Redecker et al. (2011)	Ways of thinking, ways of working, tools for working, and skills for living in the world	Griffin, McGaw and Care (2012)	Seeking and valuing diversity: ability to live and work together in culturally diverse societies and organizations; ability to welcome, seek out and engage the talents and ideas of diverse participants; ability to respect and value the concerns of different people and cultures; willingness to acquire the social and cross-cultural skills needed to seek out the views of others; capacity to value and practise living peacefully as part of a highly diverse, global population; ability to understand how to negotiate solutions to worldwide political conflicts and environmental challenges	Barrett et al. (2014) UN (2012)	Personal responsibility, self-management and reflection: capacity for leadership, resourcefulness, self-control, empathy, ethics, integrity, flexibility, adaptability, initiative, self-direction; inventive thinking, risk-taking, reflection, productivity, accountability, fulfillment of one's responsibilities as a worker and as a citizen; teamwork and time management	Gardner (2008) Metiri Group and NCREL (2003) National Research Council (2012) P21 (2007a, 2013) Prensky (2012) US Department of Labor, SCANS (1991)

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Table 3: Most-cited 21st Century Skills across frameworks

EnGauge 21st century skills (2003)
Digital age literacy (basic, scientific, economic, technological, visual, information, multicultural literacy, global awareness), inventive thinking (adaptability, managing complexity, self-direction, curiosity, creativity, risk taking, higher-order thinking and sound reasoning), effective communication (teaming and collaboration, interpersonal skills, personal, social and civic responsibility, interactive communication), high productivity (prioritizing, planning and managing for results, effective use of real world tools, ability to produce relevant high quality products)
OECD (DeSeCo) (2005)
Using tools interactively (language, symbols, texts, knowledge, information, technology), interacting in heterogeneous groups (relate well to others, co-operate, work in teams, manage and resolve conflicts), acting autonomously (act within the big picture, form and conduct life plans and personal projects, defend and assert rights, interests, limits and needs)
European Parliament and Council (2006)
Communication in the mother tongue, communication in foreign languages, mathematical competence and basic competences in science and technology, digital competence, learning to learn, social and civic competences, sense of initiative and entrepreneurship, cultural awareness and expression.
The P21 Framework for 21st Century Learning (2007)
Learning and motivation skills: creativity, critical thinking, problem solving, communication, collaboration Information, Media and Technology Skills: information, media, communication and technology literacy, Life and Career skills: flexibility, adaptability, initiative and self-direction, social and cross-cultural skills, productivity and accountability, leadership and responsibility

(continued p.57)

ATC21S (2012)

Ways of thinking (creativity and innovation, critical thinking, problem solving, decision making, metacognition), tools for working (information literacy, ICT literacy), ways of working (communication, collaboration) and ways of living in the world (local and global citizenship, life and career, personal and social responsibility, cultural awareness)

UNESCO (LMTF, 2013)

Physical well-being (physical health and hygiene, food and nutrition, physical activity, sexual health), social and emotional skills (social and community values, civic values, mental health and well-being), culture and the arts (creative arts, cultural knowledge, self and community identity), literacy and communication (oral fluency and comprehension, reading fluency and comprehension, receptive and expressive vocabulary, written expression and composition), learning approaches and cognition (persistence and attention, cooperation, autonomy, knowledge, comprehension, application, critical thinking), numeracy and mathematics (number concepts and operations, geometry and patterns, mathematics application), science and technology (scientific inquiry, life science, physical science, earth science, awareness and use of digital technology)

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Table 4: 21st Century Skills/'life skills' matrix

	Life Skills	Partnership for 21st century skills (P21)(2007)	OECD	EnGauge 21st Century Skills (2003)	Assessment and Teaching of 21st Century Skills (ATCS)	Key competences for lifelong learning (a European Reference Framework)	ATC21S (2012)
Collaboration	0	1	1	1	1	1	1
Communication	0	1	1	1	1	1	1
Communication in mother tongue	0	1	0	0	1	1	0
Core subjects: economics, geography, government and civics	0	1	0	0	0	0	0
Creativity	0	1	0	1	1	0	1
Critical thinking	0	1	0	1	1	0	1
Cultural awariness	0	0	0	0	0	0	1
Decision making	0	0	0	0	0	0	1
Develop quality products/Productivity	0	1	1	1	0	1	0
Flexibility and adaptability	0	1	1	0	0	0	0
History and arts	0	1	0	0	1	0	0
ICT Literacy	0	1	1	1	1	1	1
Information Literacy	0	0	0	0	0	0	1
Innovation	0	0	0	0	0	0	1
Interacting with others (life skills)	1	0	0	0	0	0	0
Interdisciplinary themes	0	1	0	0	0	0	0
Learning to learn	0	0	0	0	1	1	0
Life & Career	0	0	0	0	0	0	1
Local and global citizenship	0	0	0	0	0	0	1
Manage and solve conflicts (life skills specific)	1	0	1	0	0	0	0
Math	0	1	0	0	1	1	0
Metacognition	0	0	0	0	0	0	1
Overcoming problems and finding solutions (life skills specific)	1	0	0	0	0	0	0
Personal and social responsibility	0	0	0	0	0	0	1
Planning	0	0	1	1	0	0	0
Problem solving	0	1	0	1	1	0	1
Risk taking	0	0	0	1	0	0	0
Science	0	1	0	0	1	1	0
Self-direction	0	1	1	1	0	0	0
Sense of initiative & entrepreneurship	0	0	0	0	0	1	0
Social and/or cultural skills, citizenship	0	1	1	1	1	1	0
Taking initiative (life skills specific)	1	0	0	0	0	0	0
Understanding and following instructions (life skills specific)	1	0	0	0	0	0	0

Author: Salim Salamah.

Sources: Voogt & Roblin, 2012; Chalkiadaki, 2018; Kennedy et al., 2014.

Annex 2: The potential of edtech to deliver 21st Century Skills

A2.1 Introduction

As noted in Section 1 of this report, ICT and the use of technology for educational ends are seen by many commentators as central to a number of frameworks for the definition of '21st Century Skills'. These frameworks and commentators frequently present ICTs and associated capabilities as either: a distinct skill set within 21st Century Skills; a cross-cutting area of knowledge facilitating the development of specific competencies (e.g. communication, collaboration, etc.); or a holistic platform which, it is assumed, forms the default professional and educational working environment for the emerging global knowledge economy.

This section reviews in more detail some of the literature associated with exploring the use of ICTs and edtech to deliver 21st Century Skills. It includes a summary of the ways in which they are seen to contribute to those skills, as well as some evidence of their use in these ways, particularly in developmental settings. The section concludes with an overview of the identified challenges within the education system of the use of ICTs and edtech to deliver 21st Century Skills, together with a summary of possible approaches to addressing those challenges.

A2.2 ICTs and the development of 21st Century Skills

Lewin and McNicol (2015) provide a summary overview of some of the ways in which the acquisition of 21st Century Skills can be enhanced through the application of ICTs within an educational context. They frame their analysis around the '4Cs' conceptualisation of 21st Century Skills (see Scott, 2015)

Firstly, in terms of communications, students and professionals require the ability to 'exchange, criticise, and present information and ideas' (Ananiadou, 2009, cited in Lewin & McNicol, 2015). ICT is an important tool for supporting communication, both in education and within in a wide range of social practices (National Research Council, 2012, cited in Lewin & McNicol, 2015). Effective use of ICTs makes it easier to reach a wide audience and communicate at a distance, faster and more ubiquitously.

Secondly, as highlighted by findings in Section 2 of this study, collaboration is one of the skills clearly demanded by the 21st century workplace, particularly with the shift away from manual work (Dede, 2010, cited in Lewin & McNicol, 2015) towards a geographically dispersed and globalised knowledge economy. Through the capabilities of ICTs for communication, collaborative team-working is increasingly being facilitated by digital tools, which allows team members in diverse locations to work together more and more effectively.

Thirdly, critical thinking refers to the capacity for making informed decisions on the basis of analysing, synthesising and evaluating information. Students are required to and can develop this capacity through utilising the huge range of information sources available online, and the

potential of portfolios and social media tools that can support the development of student critical reflection in school contexts has been noted (Crook et al., 2010, cited in Lewin & McNicol, 2015).

Fourthly, creativity is cited as a necessary skill for addressing the anticipated challenges faced by the 21st century workforce. Lewin and McNicol cite arguments for making the case that ICT can support learner creativity in many ways including by developing ideas, making connections and creating digital outputs (Loveless, 2002, cited in Lewin & McNicol, 2015), with more recent developments emerging from online interactivity increasing opportunities for creative activities.

However, Lewin and McNicol (2015) place importance on the fact that the above skills are not necessarily exclusively associated with information and communications technologies and devices. Rather, they are more commonly associated with the more transferable capabilities associated with digital literacy. Digital literacy does not simply refer to technical skills, but to 'the ability to use information and communication technologies to find, evaluate, create, and communicate information, requiring both cognitive and technical skills' (ALA, 2011, cited in Lewin & McNicol, 2015).

In general terms, these findings are supported by McNulty (2016, 2017, 2018) who, writing in a South African context, comments on the potential role of edtech to further support the delivery of 21st Century Skills. McNulty (2018) suggests that, in a generalised educational context, ICT can be used to improve learners' experience in five main ways. Firstly, in terms of personalised learning, this includes making it possible for ICT-based learning to fit the learner's specific knowledge needs and be undertaken at the learner's desired pace. This capability lies, for example, in the use of ICT-based functionality to deliver e-learning courses and educational apps to aid self-directed study. The ability to undertake self-study – defined as the ability to learn and use technology for creative purposes in the workplace – as well as the ability to use technology to facilitate that learning process, is described by McNulty (2016) as an essential 21st Century skill.

Secondly, the use of edtech can expand learning opportunities, including through knowledge consolidation, the exploration of cross-curricular linkages for skills and knowledge, and also the development of specific skills for the use of key technologies and e-resources (McNulty, 2018).

Thirdly, McNulty (2017) highlights the functionality of ICTs to support the use of game mechanics in the classroom to enable cooperative problem-solving and innovation. He also highlights the potential for such functions to enable the use of digital resources in the classroom to facilitate a move away from rote learning and regurgitation cycles, and towards educational opportunities that encourage students to use knowledge and critical thinking, thereby developing their abilities as problem-solvers and to creatively use technology as part of those solutions. The use of game technologies can stimulate individual learning based on interest and motivation, thereby increasing learning engagement (McNulty, 2018)

Fourthly, as indicated by the above, the use of digital platforms for group tasks and online problem-solving in collaborative learning scenarios enhances communication, team-working and collaborative skills (McNulty, 2018).

Finally, McNulty's (2018) fifth criteria raises the potential of edtech not just for learners but also for the education system as a whole, by focusing on the use of edtech and gamification functionalities as a digital means of offering individual learning feedback in an environment that

provides immediate formative assessment, gathers data on individual progress in real time, and makes the assessment process invisible to learners.

The implications of edtech's assessment functionality for the education system is further explored by Voogt and Roblin (2010), who highlight the potential of ICTs to make the delivery of assessment more effective and efficient. On their assessment, both the P21 and the ATC21S frameworks acknowledge that ICT and edtech can contribute to increase the speed with which results become available, thereby reducing the costs and time required to score and to provide feedback. According to Voogt and Roblin, the ATC21S framework suggests that technology can also be used to improve assessment practices by modifying core processes associated with the design and delivery of tests and scoring, as well as by changing the nature of what is tested or learned. From this perspective, it is argued that technology can be used to expand and enrich assessment tools by including more authentic tasks, and also used to help assess new constructs (such as, for example, the '4Cs') that have either been difficult to assess or which have emerged as part of those specific 21st Century Skills required for the information age.

A2.3 Evidence of the use of ICTs for the development of 21st Century Skills in development contexts

There are multiple examples of ways in which ICTs may contribute to the development of 21st Century Skills in development contexts. However, across the range of cases, it should be noted that there is frequently a huge diversity in terms of scale, scope and application, as well as questions over the extent to which they maintain a particular focus on 21st Century Skills rather than subject-specific outcomes. For example, a review conducted by Rutkowski et al. (2011) found evidence of school-based support for ICT use for the development of 21st Century Skills in only three out of 18 countries (South Africa, the Russian Federation and Thailand).

Gaible et al. (2018) outline a variety of bespoke initiatives taken in seven DFID focal countries. Based on the cited examples, the primary uses of these technologies for learning in an educational context include: supporting the delivery of learning activities by using software and/or preloaded media; using applications for learning by young learners through gamification and animation; using technology for the transmission of teaching to pupils from another location; and using technology to support virtual learning (e.g. physics labs). At a subject-specific level, there are examples of technology being used to develop skills for learning engineering, mathematics and the sciences, and to support the learning of languages. At the level of teacher development, there are examples of technology being used to share resources for teaching and learning. In the context of higher education, research conducted in Ghana by Awuah (2015) (commissioned by Google) examines the relation between the use of Google Apps and students' performance. The results, though not generalisable, demonstrate a positive relation between using Google Apps and improved experiences of collaboration between faculty and students.

When these general activities are compared with what are defined as 21st Century Skills, the technology is being used to facilitate learning and in some cases, work to enable self-directed learning and support communication and collaboration. However, more study would be needed to assess the extent to which engagement with these technologies is also developing a broader range of key 21st Century Skills such as creativity, critical thinking and problem-solving.

A2.4 Challenges and issues for implementation

While integration of edtech for the development of 21st Century Skills in classrooms is encouraged by theorists and policymakers, it also presents substantial challenges in practice. In particular, teachers often lack both the skills and the space within the curriculum to either teach their students 21st Century Skills (Voogt et al., 2013, cited in Lewin & McNicol, 2015), or utilise the educational technologies to do so. In this context, Lewin and McNicol (2015) suggest that teacher education systems, as well as educational infrastructural provision, need to support school-level staff in understanding better how ICTs can facilitate 21st century learning.

As evidence of this, a key report by UNESCO (2015a) examines the levels of preparation and support for teachers in the Asia-Pacific region in the use of ICTs to facilitate the learning of 'transversal competencies (TVCs)', a broad term that includes a range of transferable skills and competencies associated with regular definitions of 21st Century Skills, as well as other 'soft skills' such as citizenship and social-emotional skills (Care et al., 2018b). While the report shows that the use of ICT in the classroom can positively affect student learning, and that ICT is included as an integral component of many learning frameworks that seek to develop those 'transversal competencies', it also goes on to highlight a number of problematic issues at school level.

Firstly, in conceptual terms, given a lack of clarity or understanding of 'transversal competencies', many teachers equate these skills only with the use of ICTs. Secondly, in practical terms, the use of ICT as an instructional tool in the classroom can be challenging due to a range of issues including:

- A lack of basic proficiency among teachers in ICT;
- A lack of time to learn new technology and integrate it within lesson plans;
- Minimal access to ICT at some schools;
- Large class sizes and short lesson periods constraining the ability of teachers to use ICT in the innovative ways required; and
- A lack of training in ICT for teachers that draws on approaches that mirror the development of 21st Century Skills (e.g. self-study, mentoring and peer learning processes).

The study also cites further, less acute, issues including: use of ICT is sometimes viewed as being contrary to teachers' overall pedagogic vision of educational delivery; the school environment may not actively promote the use of ICT or support for new teaching practices; and a lack of synergy between educational ICT software and curricula (Kopcha 2010, Plomp & Voogt 2009, Voogt & Pelgrum 2005, all cited in UNESCO, 2015a).

Evidence of issues associated with infrastructure is supported by a UNESCO study (2016) that reviews the use of ICT for the development of 21st Century Skills. Half of the case studies featured (India, Mongolia, Republic of Korea, Thailand and Viet Nam) reported that schools lacked the necessary instructional materials and ICT resources, and that this affected the development of skills among students. Taking India as an example, the greatest challenge faced by both private and government schools to integrate transversal competencies into education is the lack of appropriate materials and ICT facilities.

Evidence of issues associated with the professional development of teachers is supported by that same study. Again, in India, many teachers also felt there was a lack of clarification on the holistic definition of '21st Century Skills', meaning that they had little practical guidance as to how to effectively develop these competencies among their students (UNESCO, 2016).

In summary, the main challenges associated with the use of ICTs for the development of 21st Century Skills within a formal school system include issues arising from teacher capabilities, teacher training, school infrastructure and resourcing, school leadership, pedagogic approaches and curriculum models.

A2.5 Addressing identified challenges

In addressing these challenges, there are a number of basic approaches that any education system can utilise.

Firstly, the provision of professional development can assist teachers to acquire basic ICT skills and build confidence; and it helps teachers to use technology as an instructional tool to improve student development in 21st century-related competencies. Mentoring is seen as an effective means for teachers to overcome common barriers to integrating technology into their practice, as mentors can present teachers with different models for teaching with technology and can provide assistance that meets their specific needs (UNESCO, 2015a).

Ertmer, Ottenbreit-Leftwich and Tondeur (2014) provide further analysis of the factors that enable teachers to use technology in a way that facilitates the teaching and learning of 21st Century Skills, highlighting the importance of environmental factors. Those cited include: adequate access to resources within the classroom; opportunities for teachers to gain own personal knowledge and confidence to use the technology available; teacher confidence to apply technological knowledge in innovative ways; a school and professional teaching culture that is facilitative (with support from teaching peers and school leadership); and teacher pedagogical beliefs that support the development of 21st Century Skills. Ertmer et al. (2014) go on to provide examples of how teachers have used technology in ways that have facilitated the development of 21st Century Skills. For example, the use of blogging is indicated as a way for teachers to help learners understand and share with others their learning journeys while they learn a mathematical concept. Within this, cases from Rwanda (World Bank, 2019) communicate the importance of leadership in creating an enabling environment for the development of 21st Century Skills, through leadership using or modelling the use of technology for engaging with staff and pupils, as well as maintaining dialogue about education in the digital sphere.

Secondly, in looking at changes in pedagogic approaches that can enhance the use of ICTs in facilitating the development of 21st Century Skills, Ananiadou (2009, cited in Lewin & McNicol, 2015) argues for cross-curricular approaches to development. However, such a model also demands substantial changes in standard pedagogical practices (Voogt & Roblin, 2012, cited in Lewin & McNicol, 2015) and assessment approaches (Binkley et al. 2012, Voogt & Roblin 2012, both cited in Lewin & McNicol, 2015). Even in contexts where the teaching of 21st Century Skills is integrated across subjects, such as Asia-Pacific, the development of ICT skills is frequently taught as a specific, stand-alone subject (UNESCO, 2015b). For example, in Shanghai, equipping students with the ICT skills needed for employment is taught primarily through stand-

alone subjects titled 'Labour and Technique' and 'Information Technology'. Similar subjects are also documented in Thailand (ibid.).

However, there are examples of system-wide approaches designed to address these overarching issues. In South Africa, the combination of the policy drive to 'advance high order thinking skills such as comprehension, reasoning, problem-solving and creative thinking and enhance employability and productivity' (Ministry of Education, 2003, cited in Rutkowski et al., 2011) and the presence of 'institutional support (from the school leadership, from other colleagues, or for ICT use)' is often predictive of ICT use in the classroom, and facilitates the use of edtech for the promotion and integration of 21st Century Skills in the classroom (Rutkowski et al., 2011). Similarly, Thailand's national policy offers systemic support for teacher development, with the specific goal of enhancing capacity to integrate ICT into school teaching practice for the development of teaching 21st Century Skills (Rutkowski et al., 2011).

A2.6 Conclusion

The literature highlights that the place of edtech in relation to 21st Century Skills is twofold: while it is embedded in the enhancement of 21st Century Skills across a range of competencies, it is also regarded (and taught) as a skill set in its own right (Lewin & McNicol, 2015; UNESCO, 2015b).

The examined literature recognises the potential of ICT for enhancing 21st Century Skills through functionalities that enhance the capacities of students to effectively communicate at a distance, collaborate with geographically dispersed teams, develop the faculties to critically analyse digital information, and enable creative working (Lewin & McNicol, 2015; McNulty, 2016, 2017, 2018). Additionally, the use of technology also has a role in contributing to teacher development and improving assessment practices and tools (Voogt & Roblin, 2012). This is supported by examples of the use of ICTs in education across a broad range of development contexts (Gaible et al., 2018). However, the extent to which cited cases include specific objectives associated with 21st Century Skills is open to further analysis.

Despite this, there are a number of systemic challenges that impact on the use of ICTs for the development of 21st Century Skills, namely the lack of capabilities among teachers, inadequate mechanisms for teacher professional development, and low levels of school-level support for innovative use of ICTs. At a systemic level, there is also evidence of a poor match between the use of ICTs for the development of 21st Century Skills and their application across the curriculum. Further challenges include a lack of clear guidance on appropriate pedagogical approaches and minimal access to ICT resources in many settings (Lewin & McNicol, 2015; UNESCO, 2015a, 2016). However, there are also examples where a clear and consistent approach within the education sector is seen to have a positive impact on overcoming such challenges, leading to models for the effective use of ICTs in the development of 21st Century Skills in international development contexts.

Annex 3: System reform to deliver 21st Century Skills

A3.1 Introduction

As indicated in Section 4.1 and Annex 2 of this report, while ICT and the use of technology for educational ends are seen by many commentators as central to a number of frameworks for the definition of 21st Century Skills, the use of edtech does not address what many see as the fundamental underlying issues associated with the teaching of 21st Century Skills. Most specifically, these issues are closely associated with the range of policy and delivery components that traditionally make up education systems.

This section reviews in more detail some of the literature associated with exploring the range of systemic components whose reform might contribute to greater clarity and effectiveness in delivering 21st Century Skills. This is undertaken while also bearing in mind the range of challenges resulting from the current lack of definition or availability of evidence within this emerging field. It commences with a summary overview of the key components that are seen to influence the delivery of teaching and learning – curriculum, assessment and classroom practices. Each of these components is then addressed in turn, with a discussion on the approaches that commentators suggest can be applied to help deliver 21st Century Skills.

A3.2 An overview of perspectives on system-wide reform for 21st Century Skills

In assessing the current status of 21st Century Skills at both the global and national levels, Kim et al. (2019a) state that the major issue facing national education systems is how to implement fully a 21st Century Skills agenda that is aligned with changing educational goals yet also focuses on teaching, learning and assessment. Within this, the priority is alignment between the components of the system – curriculum, assessment and pedagogy – to support student learning.

In practical terms, Kim et al. (2019a) state that this involves ensuring that what the systems determine students know (i.e. curricular learning objectives) is reflected by the kinds of tasks that indicate whether students have attained the learning objectives (i.e. assessment), which in turn, reflects the classroom activities and strategies (i.e. pedagogy) that reinforce the learning objectives and prepare students for assessments. When the components in the system are misaligned, changes in one component (e.g. curriculum reform) may yield few improvements in student learning if the other parts of the system, such as assessment and pedagogy, are not similarly adjusted.

Further to this, Kim et al. (2019), in discussing teaching and assessing 21st Century Skills in Africa, highlight the need to bridge any system-level gaps between policy, intent, curriculum and real classroom practice in relation to 21st Century Skills development. Most specifically, they state this means ensuring alignment between curriculum, pedagogy, teacher training and learning assessments.

However, alignment across curriculum, pedagogy and assessment, as well as addressing those existing gaps, assumes that there is an understanding of the specific learning goals in question. In the case of 21st Century Skills, Kim et al. (2019a) highlight that this deep level of

understanding is not there yet, either at a systemic or classroom level. In addressing this, they propose three key recommendations:

1. A need to start from the basics and understand the nature of 21st Century Skills by identifying the components, subcomponents, processes, and subprocesses involved in skills such as critical thinking, collaboration and problem-solving.
2. Once there is understanding of the developmental nature of these skills, there needs to be systemic mechanisms for differentiating between levels of skills. In the first instance, Kim et al. (2019a) propose the formal use of 'learning progressions' – pathways that describe how students typically achieve mastery of a particular learning domain or skills.
3. The development of 21st Century Skills assessments that are 'authentic', i.e. reflect what students will be asked to do in real-life situations, as a means of capturing and reporting on what students are able to do within the school environment.

In looking at the undertaking of this process, Kim and Care (2018) present the role of 'learning progressions' as a key factor. They highlight revising curricula to include these skills does not address lack of understanding of the nature of the skills or how to teach the skills. Instead, they state that teachers need to have access to descriptions of how skills progress over time so they can design classroom tasks that are within the appropriate level of development for their students, and can scaffold their learning in stages. From a pedagogic perspective, learning progressions, also referred to as '**learning continua**' or '**developmental progressions**', can assist with this. Although standards and curricula are often prioritised in educational documentation, it is the progress toward the standards and meeting curricular goals that is important to the actual teaching of those skills. This 'progress' can be seen as a roadmap that supports instructional planning.

However, in the context of 21st Century Skills, there are two main challenges to developing this. First, many existing progressions have emerged from a more historical subject-based approach, due to common knowledge about learning sequences on particular technical skill sets. In the case of 21st Century Skills, however, these clearly work across subjects and need to be linked rather than discrete. Second, and more fundamentally, there still is not the understanding of how 21st Century Skills develop – little data exists on individual development of many 21st Century Skills, or about how they progress from basic forms to complex forms. This is a point highlighted by Care et al. (2019), who state that although a few education systems have developed early frameworks which include increasing levels of competency, there are no generic examples that describe how some of these skills progress. Therefore, it is not possible to provide that guidance for teachers on what might be expected of students at different levels of skill, and how they might move students from one level to the next (Kim & Care, 2018).

In addressing this, Kim et al. (2019a) argue that, while the primary route to shift learning goals has traditionally been through curriculum reform, in the case of 21st Century Skills it is more appropriate to focus on assessment reform as the one strategy to align the components of the education system to the changing goals.

However, other commentators argue for more traditional approaches to systems reform based on regional priorities. Dewan and Sarkar (2017), in discussing measures being taken in South Asia to supplement education with 21st Century Skills training, recommend a range of specific

measures be in place to foster skills development within the education system. At a cross-system level, their recommended systems interventions for improving skills development included public and private financing to improve access to and quality of education from pre-primary to secondary level; and also the development of budget mechanism reforms to address systemic gaps between education and employment systems.

Within the education system specifically, Dewan and Sarkar (2017) propose interventions for (1) policy and planning to improve pedagogy and labour diversification through skills training; (2) improving the school-to-work transition through skills training that is relevant, targeted to specific jobs; (3) using technology for learning to get students ready and build their capacities for the 'rapidly changing world of technology'; and (4) the provision of alternative learning pathways for the youth who have little or no foundational schooling, through programmes which offer accelerated numeracy and literacy alongside skills training and development. As discussed under Section 3, this last recommendation is of particular relevance to development contexts or to emerging economies.

The report by Dewan and Sarkar (2017) concludes with some broad recommendations on the need for Technical and Vocational Education and Training (TVET) sector improvement within South Asia, and the need for improved synergy between the provision of mainstream schooling, the teaching of life skills and soft skills, and the teaching of specific technical or employability skills. They also continue to highlight the need for improved enrolment rates in the region.

Suatra et al. (2017), in discussing the means of ensuring employability and fitness for entering the labour market of graduates through the development of 21st Century Skills, highlight concerns over the extent to which higher education (HE) institutions currently lay emphasis on the development of identified employability skills (communication, problem-solving, decision-making, analytical and critical thinking, synthesising information, teamwork, interpersonal skills and continuous learning). In addressing this, they state that HE programmes should be designed to develop knowledge and provide opportunities for graduates to develop these skills since these skills operate as the 'missing link' between education and the labour market, particularly at an international level.

A3.3 Evidence of approaches to system-wide reform in LMICs or rapidly developing economies

Looking at education systems in LMICs that are seeking to address these challenges, UNESCO (2016a) cites examples of approaches to systemic reform being used across a selection of countries in Asia-Pacific, although the report also seeks to highlight that many of these approaches are not comprehensive in ensuring alignment across all necessary components of the education system. For example, the majority of countries featured in the study make explicit reference to 21st Century Skills as part of policy documentation on overall educational goals and objectives, although at a lower level, the mention or inclusion of guidelines for the assessment of those skills is variable. In Hong Kong (China), India and Viet Nam, for example, the inclusion of relevant assessment approaches is reflected in several components, indicating a close integration of 21st Century Skills within the mainstream curriculum. However, in Malaysia, Mongolia and Thailand, such inclusion is reflected in several but not all components.

Similarly, across the participating countries, UNESCO (2016a) reports highly variable levels of reform in terms of the integration of 21st Century Skills into school-level practice through, for example, the revision of textbooks, the development of teaching guides, and the reform of pre-service and in-service teacher training. In this context, Viet Nam, India, Hong Kong and, to a lesser extent, Thailand have been more effective in implementing initiatives for change than Malaysia, Mongolia or the Philippines. However, all countries are seen to have put in place measures to provide follow-up with a view to ensuring an ongoing process of reform and integration in terms of school-level delivery.

In other settings, Care, Vista and Kim (2018a) point towards current systemic reform measures in Nepal. As set out in the Nepali School Sector Development Plan 2016 (cited in Care et al., 2018a), the Nepali education vision is to 'contribute to the development of self-sustainable, competitive, innovative, and value-oriented citizens', and the plan itself states the importance of competencies such as critical thinking, creativity and analysis. Further, Nepal, Mongolia and Cambodia are all countries that are cited as having made explicit their goals in skills development, which are also strongly aligned with the **SDGs** by also aiming to achieve both access to education and high-quality learning experiences and outcomes.

A3.4 Challenges to system-wide reform for the delivery of 21st Century Skills

In their synthesis study looking at the availability of evidence of the impact of transferable skills programming in LMICs, Brown et al. (2015) draw attention to the lack in evidence on a range of systemic interventions, including on the impact of: reforming curricula and training teachers to build transferable skills; providing teachers with incentives or helping them to network; and building institutional management and other capacity. They also highlight a gap in evidence about whether learner-centred approaches are effective for teaching transferable skills, which was a concern among many roundtable participants.

Similarly, Dewan and Sarkar's 2017 report emphasises the paucity of data on the ways that education systems in South Asia are supporting the youth in their preparedness to enter the workforce. They found few examples of South Asian countries with statistical data that connected education provision with youth employment. As evidence of this, they refer to the World Bank's Skills Toward Employment and Productivity (STEP) framework, which held an associated dataset for only one South Asian country, Sri Lanka.

Jaberian et al. (2018), in discussing emerging solutions for the monitoring of 21st Century Skills adopted by the UN, also agree that the sources of 21st Century Skills assessment data are relatively sparse, and that as a result, the data use remains limited. Importantly, they also highlight a diversity of systemic priorities across countries. At a policy level, they conclude that most countries agree on the need for inclusion of 21st Century Skills in the education systems. However, they highlight that, in relation to the strand of competencies and practices aligned with 'life skills' and the SDGs, there remains some resistance in certain national contexts to including certain fundamental, but contextually 'controversial' concepts including human rights, gender equality, or climate change in education policies and teaching materials.

A3.5 Reforming curriculum for the delivery of 21st Century Skills

The increased emphasis on 21st Century Skills at the global level has increased the demand for formal education to ensure, alongside knowledge related to traditional academic subjects, the development of a broad set of generic and transferable skills, **including competencies for ways of thinking, ways of working, tools for working, and skills for living**. These skills are seen to provide learners with those capabilities necessary to operate within a rapidly changing society, such as communication, problem-solving, collaboration and critical thinking (Care et al., 2017).

However, despite this demand, there currently remains an absence of well-established, evidence-based approaches to curriculum development that demonstrate how to teach these skills and show how students have benefited from the process (Care et al., 2017). This lack remains particularly acute in development contexts.

There is a range of emerging examples where countries are selecting a variety of pathways to explore optimal models through curriculum reform. For example, Singapore (MoE Singapore, 2019) has developed an approach which adopts a **value-centric framework** that will be implemented across the core curriculum, and which incorporates a range of 21st century competencies (including civic literacy, global awareness and cross-cultural skills; critical and inventive thinking; and communication, collaboration and information skills) as well as social and emotional competencies. Similarly, Australia's national curriculum identified **seven general capabilities** associated with 21st Century Skills which teachers are expected to integrate throughout their teaching on all subjects (Care et al., 2017). Similar examples are cited by UNESCO (2016a) in relation to its study on nine countries across Asia–Pacific, pointing in particular to cases from Hong Kong, the Philippines and India.

In Costa Rica, based on an understanding that the education system needs to progress to respond to the changing demands for skills, the National Development Plan for 2015–2018 and a new curriculum for 2018 emphasises the **development and application of key 21st Century Skills** and attitudes, such as socio-emotional, communication, critical thinking, citizenship and problem-solving (OECD, 2017). Similarly, Kenya is currently developing a **new competency-based curriculum** designed to integrate seven competencies within and across all subject areas to ensure a comprehensive approach to skills development (Care et al., 2017).

A3.6 Reforming assessment for the delivery of 21st Century Skills

A3.6.1 Introduction

It is widely acknowledged by a number of commentators that a major challenge to the delivery of 21st Century Skills development in a formal educational context is the lack of clear approaches and tools for their evaluation and assessment, either at school level or systemic level. This is compounded by a generalised lack of understanding and knowledge about how 21st Century Skills can be taught, as well as evidence of the possible lack of alignment between traditional curricula and a 21st Century Skills learning agenda at many national levels (Vista et al., 2018b).

Despite enthusiasm for the adoption and roll-out of 21st Century Skills teaching at the global level, Vista et al. (2018b) show that very few of the current international large-scale assessments

(ILSAs) explicitly capture 21st Century Skills. Similarly, Voogt and Roblin (2010) state that only two of the five 21st Century Skills frameworks they examined (P21 and ATC21S) focus on possible features of formative and summative assessment for 21st Century Skills. Looking beyond 21st Century Skills frameworks, Gates et al. (2016) also highlight the lack of evaluation tools and approaches to measure 'soft skills'. In the context of developing countries, Jaberian et al. (2018) suggest that the 'life skills' grouped under SDG Target 4.7 remains one of the most challenging targets to measure and monitor given the wide range of both established and relatively new concepts grouped under the '21st Century Skills' umbrella, as well as the absence of specific processes to collect and analyse related data.

Although the use of large-scale assessment data for system accountability and monitoring is well established, specific information about student performance expectations for 21st Century Skills is provided by only a handful of education systems that have these skills formally embedded in their curriculum, and therefore have the mechanisms for system-wide data collection, use and dissemination (Vista et al., 2018). As evidence of this, UNESCO (2016a) points towards the different levels of approach and integration when comparing the integration of 21st Century Skills assessment across formal education in India, Hong Kong and Viet Nam with the only partial integration seen in Malaysia, Mongolia and Thailand.

A3.6.2 Assessment design for the development of 21st Century Skills

With the shift in education towards complex skill sets like creativity, problem-solving, collaborative skills and critical thinking, Care and Vista (2017a) argue that the assessment challenge has preceded the development of how to teach the skills. Attempts to use existing approaches to measure these complex skills are ineffective (ibid.) since, in an educational context, meaningful assessment requires, firstly, defining what one intends to measure, and secondly, having a consistent system to define the scale of what is being measured. This is not straightforward for the measurement of competencies, which can manifest in a huge variety of ways depending on the learning context (Care & Vista, 2017b). In this context, the competencies to be assessed represent behaviours rather than outputs, and the challenge is how to define that behaviour in such a way that it can be measured objectively at large scale (Care & Vista, 2017a).

An additional challenge is that the nature of complex skills like creativity, problem-solving, collaborative skills and critical thinking defies automation. In moving towards 21st Century Skills, industrialisation and ICTs have automated many working tasks and jobs, weakening the demand for traditional skills and domain-based competencies. The recommendations underpinning 21st Century Skills, at least in the context of the globalised knowledge economy, is that the emerging workforce needs to have the capabilities to **engage in complex, non-routine activities**. This requires skills that are themselves complex and non-routine, and are therefore difficult to capture for measurement and assessment purposes. For example, **collaborative problem-solving** requires both cognitive and social skills – identifying a problem, identifying resources needed, and how to manage them – while at the same time using interpersonal skills such as participation, communication and negotiation (Care & Vista, 2017a).

- ***Technology-enabled assessment***

It is suggested that the use of ICTs and new technologies have a particular role to play in supporting assessment, both for individuals and also at a systems level. In general terms,

McNulty (2018) raises the potential of edtech for not only learners but also for the education system as a whole, by focusing on the use of edtech and gamification functionalities as a digital means of offering individual learning feedback in an environment that provides immediate formative assessment, gathers data on individual progress in real time, and makes the assessment process invisible to learners. Voogt and Roblin (2010) explore this further, highlighting the potential of ICTs to make the delivery of assessment more effective and efficient.

More specifically, Care and Vista (2017a) draw attention to the use of online and digitally interactive tasks which can be specifically designed to elicit demonstration and therefore assessment of the complex sub-skills underlying, for example, the collaborative problem-solving skill set, where the correct–incorrect dichotomy is not always useful or sufficient (Vista & Care, 2017b). If measurements can be refined, online and digitally interactive tasks can provide an opportunity to understand the paths taken by individual students, and therefore toward exploring paths taken by *groups* of students (Care & Vista, 2017a). This can include embedded assessments that are woven into the fabric of the learning environment, which itself can be designed to function similarly to the working environment. As these two environments line up, the greater the relevance of the assessment process (ibid.).

Furthermore, technology can also augment the data to understand students' problem-solving processes by capturing task actions in addition to the usual test responses. This includes using technology to capture and analyse process data. Process data includes distinct keystrokes, mouse movements, and all capturable time-stamped user activities in a digital environment. The process data can be analysed either discretely by looking at specific markers that can be linked with cognitive processes, or holistically by looking at sets of connected markers such as sequences of actions that can be linked to more complex cognitive processes (Vista & Care, 2017a). It is argued that such approaches reflect in far greater detail the observations a teacher would make as part of normal teaching practice in the classroom; for example, related to informally evaluating students by time-on-task or the sequence of processes that students follow. Such capture can inform not only individual student assessment, but can provide rich data for analysis of student approaches to problem-solving within traditional domains (Vista & Care, 2017b), contributing in turn to the potential to improve student outcomes on skill sets that will be required for the future (Vista & Care, 2017a).

However, while transitioning to a digital testing environment opens up a wealth of opportunity in countries where ICT access and user skills are almost universal, and facilitates an advantage of economies of scale while providing a medium for teaching, learning, and assessment (Vista & Care, 2017b), the current applicability of such models in developing or low-resource settings is clearly open to question.

A3.6.3 Evidence of the use of assessment for the development of 21st Century Skills in development contexts

Approaches to measurement of 21st Century Skills are now starting to emerge in the education space, but there is still a long way to go when it comes to practical implementation in the classroom (Care et al., 2018b).

In discussing the development of such approaches with representatives from participating countries from sub-Saharan Africa, Kim et al. (2019a) highlight that transforming existing assessment tasks into new ones to capture dimensions of collaboration and problem-solving is a complicated process. The authors suggest that bringing teacher experience together with system views from national-level directors can contribute to the development of exemplar items and would also foster a stronger link between policy and classroom practice. Understanding the classroom context is an essential step in developing 21st Century Skills assessment tools for the classroom. They also suggest finalising a set of assessment items that capture collaboration and problem-solving, by working with inputs from both teachers and students in studying the skills and sub-skills students draw on when engaging in assessment tasks.

A3.6.4 Challenges and issues for implementation of assessment reform

However, challenges specific to the assessment of 21st Century Skills may also be one reason why education systems are having difficulty with translating policies into actual practice in schools and classrooms. For example, the inherent nature of transferable skills that can be demonstrated across different situations and in response to different contexts require assessment approaches that are either sufficiently broad – i.e. can operate across multiple subjects and disciplines – or sufficiently dynamic to capture this essential quality (Vista et al., 2018b). The qualitatively different structure of these skills requires some completely new approaches, both in the measurement aspect and collection of assessment data (ibid.).

Care et al. (2019) argue that the primary challenge facing the assessment of 21st Century Skills is the absence of clear understanding of how progression and attainment of these skills can be defined. Without an absolutely clear understanding of a learning domain, or ‘construct’, designing assessment frameworks and tasks is impossible. Without an understanding of what increasing levels of competency in a skill look like, it is not possible to draft the assessment tasks that will target different levels.

At a systemic level, despite increasing visibility of concepts such as ‘assessment for learning’ or ‘formative assessment’, the primary use of assessment by national education systems remains summative – for use in certification, identification of eligibility for education progress, and system accountability. Care et al. (2019) argue that the assessment of 21st Century Skills, still in its infancy, does not lend itself easily to the modes of assessment that typically populate summative assessment approaches.

Gates et al. (2016) highlight the lack of evaluation tools and approaches to measure soft skills. Similarly, Voogt and Roblin (2010) state that only two (P21 and ATC21S) of the five examined frameworks focus on possible features of formative and summative assessments of 21st Century Skills. The authors acknowledge that the use of formative testing would be merely a means of demonstration and for accountability purposes, whilst the use of formative assessments would better support learning processes.

In discussing the issue of 21st Century Skills assessment as a global concept, Care et al. (2019) also highlight educational assessment concerns over whether, in fact, the same learning domain is being measured across the different populations where it may be administered. According to the SDGs, all assessments should be appropriately targeted for different ability levels, and also

for individuals from different cultures and sub-groups. This would involve taking into account varied national emphases on curriculum, pedagogy and assessment.

Although there are several instruments and advanced assessment approaches that have been demonstrated to capture 21st Century Skills, the challenge is how to use these systemically and ensure that they are not only valid and reliable, but also practical in the contexts they are to be used. Additional challenges, particularly when looking at the development of a global model, include a lack of comprehensive operational definitions, a lack of standards for making evidence-based inferences, and questions over the cross-cultural validity of the definitions (Vista et al., 2018b). As such, there have been debates on whether we should assess these skills globally in a standardised way at all (Jaberian et al., 2018).

A3.7 Pedagogy and classroom teaching for the delivery of 21st Century Skills

A3.7.1 Introduction

The basis of classroom teaching has historically been led by curricula. These curricula have outlined the substance of what is to be taught, sequences to follow to ensure movement from the simple to complex, and expectations about the quality of anticipated student performance or knowledge (Care et al., 2017).

However, as identified elsewhere in this study, there remains an uneven and under-informed approach regarding guidance on the teaching of 21st Century Skills in formal contexts, particularly in development contexts. Brown et al. (2015) conducted a comprehensive evidence scoping project that catalogued all the impact evaluation evidence on interventions to build transferable skills (21st Century Skills) for youth in LMICs. They found very little available evidence on what works in terms of integrating transferable skills into curriculum reform or into core teacher training. Any available evaluations focused instead on transferable skills programmes that have been introduced as stand-alone courses in schools (Brown et al., 2015). In support of this finding, a major recommendation from a UNESCO (2016a) **review of the challenges** facing East Asian countries as they adopt or integrate '21st Century Skills', was to undertake in-depth research into the nature and development of the skills themselves to inform the development of formalised approaches to teaching.

Despite this, though, there is a range of emerging examples where education systems are working to support teachers through new models via curriculum reform. For example, Singapore's new curriculum (MoE Singapore, 2019) incorporates a range of 21st century competencies as well as social and emotional competencies that will be implemented across the core curriculum. The syllabi provided by the Ministry of Education offer guiding principles for the variety of teaching approaches that teachers can implement to enhance learning (Care et al., 2017b). Similarly, Australia's national curriculum identified **seven general capabilities** associated with 21st Century Skills which teachers are expected to integrate throughout their teaching on all subjects, **guided by online resources** provided by the Australian Curriculum Assessment and Reporting Authority (ibid.).

In addition, there are documented examples of guidelines and approaches for teachers to use across subject areas in encouraging a range of 21st Century Skills. The available literature suggests these are largely captured in semi-formal settings for peer-to-peer sharing, such as online blogs. With this in mind, the literature is also generated by and focuses on teachers operating primarily in developed contexts – Europe and North America. In general, these highlight classroom practices that provide concrete examples of how a few key 21st Century Skills might be integrated into daily teaching practices, not as a discrete subject area but as part of standard classroom culture (Care et al., 2017b).

A3.7.2 Approaches to classroom teaching of 21st Century Skills

In general terms, there is a need to ensure teaching related to 21st Century Skills is utilised in the classroom, ideally in high school or earlier (Fiore, 2019). Research has demonstrated it is possible to teach competencies such as collaboration and communication, although the methods have yet to be systematically adapted for the classroom (ibid.). In approaching the teaching of 21st Century Skills, Care et al. (2017b) state that the two key components for teachers to address are (1) to identify what demonstration of any of the 21st century competencies might look like, and (2) to identify how to elicit or stimulate performance so that teachers know which aspects of those competencies the individual is ready to learn.

In delivering this, teachers need support from curriculum materials and other resources that provide them with the necessary frameworks for teaching and assessing the range of competencies associated with 21st Century Skills. Also, students need regular opportunities for practice within the school setting, including working across disciplines. In addition, any systematic instruction and practice setting needs to include feedback on those interpersonal and professional competencies that drive successful collaboration, communication, critical and reflective thinking, and so on. Teachers require guidelines for the assessment of students on processes like relationship management, where they encourage participation from each other, as well as skills in communication where they actively listen to their team members (Fiore, 2019).

However, when discussing these matters at the global level, it is also necessary to acknowledge how to introduce such models and approaches, particularly in educational contexts where approaches such as critical thinking may go against cultural models of exchange. One problem with incorporating skills development into the school curriculum in developing countries is the difficulty to reconcile with a heavy dependence on rote learning. It requires significant investment in the professional development of teachers to enable them to demonstrate the skills they are expected to teach to their students (Kenworthy & Kielstra, 2015).

Classrooms in different contexts around the world have their own cultures, and implementation of the strategies outlined here may not be straightforward. For example, societal or classroom concepts of power have **practical consequences** for the degree to which approaches associated with 21st Century competencies can be nurtured and tolerated within classrooms. Teachers' confidence in their role is an essential ingredient in encouraging and supporting, for example, critical thinking in the classroom, and both teachers and students need to recognise the difference between respect for the person, and a critical and curious approach to concepts and ideas (Clarke & Care, 2017).

However, there are a number of emerging classroom-based approaches and techniques that are regarded by pedagogues as contributing to the development of 21st Century Skills within a classroom context, some of which are set out below.

- ***Approaches to teaching problem-solving skills***

In discussing classroom approaches for the development of problem-solving skills among learners, Mills and Kim (2017) provide a number of practical guidelines. They state that problem-solving skills do not necessarily develop naturally, and instead need to be explicitly taught in a way that can be transferred across multiple settings and contexts. In keeping with Care et al. (2017b), they highlight the importance of developing a standard classroom culture for problem-solving, and do so through language and activities that enable students to think around **achieving a particular goal, and manage their mental processes** in addressing this. In the first instance, this includes peer-to-peer interaction to share problems, and explicit discussion of what was done to solve those problems. Mills and Kim (2017) state that, by **naming what it is they did to solve the problem**, students can be more independent and productive as they apply and adapt their thinking when engaging in future tasks.

In the classroom context, this approach also highlights it is the role of the students and *not the teachers* to work through the problems. The teacher's role is to provide support to learners in solving the problems, but is not there to solve any problems on behalf of the students. Mills and Kim (2017) also claim that this approach also helps tie problem-solving struggles to problem-solving strategies so that the students will not only see value in working harder but also in working smarter by trying new and different strategies and revising their process.

- ***Approaches to teaching metacognitive skills***

Building on the model presented by Mills and Kim (2017), which emphasises the importance of encouraging students how to be independent and self-regulated learners, Owen and Vista (2017) outline a number of strategies associated with encouraging 'metacognition' among classroom-based learners. This involves a process they present as a mechanism to enhance student learning for immediate outcomes and for helping students to understand their own learning processes. They argue that metacognition is central to other 21st Century Skills sets such as reflective thinking, problem-solving, decision-making and critical thinking, and base their approach on research evidence that it is a teachable skill in its own right (Moely et al. 1995, Schraw 1998, both cited in Owen & Vista, 2017).

Key approaches include models of reflective, self-directed learning that are based on group work. They include setting a classroom rule that groups ask a question *together*, rather than individually, meaning that a student who has encountered a problem must consult with their group first. If the group cannot collectively find the solution, they can raise their hands simultaneously. Anecdotal evidence suggests this approach shifts student thinking from a simplistic 'submission to feedback' principle towards a more involved process, where students must consider what feedback they would want, what advice they would give themselves, and where they think they need to improve. Owen and Vista (2017) argue that this approach encourages the students to independently exercise control over their learning and progress, thereby making them more independent and self-directed learners.

- ***Approaches to teaching collaborative skills***

Owen and Vista's (2017) model ties in closely with the approaches to developing collaborative approaches to critical thinking outlined by Barnett et al. (2017). In a classroom context, Owen and Vista argue that collaborative discussion relies on peer interaction, communication and sharing, occasionally supported by expert guidance to extend student thinking. Primarily, students and not teachers should drive the process of exchange as they present, defend, elaborate upon, and respond to each other. As they make connections, they will also clarify their understanding, refine their thinking and synthesise information.

However, Barnett et al. (2017) argue that, in using this approach, teachers need to teach collaborative and discussion skills explicitly and systematically – a point echoed by Fiore (2019). At the most general level, collaborative problem-solving requires team members to establish and maintain a shared understanding of the situation they are facing. At the start, typically there is an uneven distribution of knowledge within teams. Members must maintain communication to help each other share and interpret elements of the problem. Further steps can include laying out team subtasks based upon member roles, or creating mechanisms to coordinate actions. Finally, collaborative problem-solving requires keeping the team organised by monitoring interactions and providing feedback to each other. As part of this, team members need basic interpersonal competencies that help them manage relationships within the team, as well as the ability to take others' perspectives, in order to consider alternative views of problem elements (Fiore, 2019).

However, it is suggested that students rarely receive meaningful **instruction, modelling and feedback on collaboration**, although such inputs are regarded as crucial. Although classes that implement collaborative problem-solving do provide some instruction and feedback, it is more likely to be about the subject-based knowledge than their teamwork (Fiore, 2019).

Suggested approaches to staging this approach include: (1) commencing with an entire-class conversation before moving students to less-supported conversations, in order to establish norms for conversation in the classroom; (2) providing students with a specific question on which they have to take a stance; (3) providing students with some key pieces of rubric and vocabulary to help them articulate their contributions and manage the discussion; and (4) requiring students to document their discussions for the purpose of capturing conclusions and also undertaking self-assessment. Any self-assessment might include identifying the levels of contribution from each individual, and analysis of the reasons for these.

It is argued that such approaches to developing **critical thinking** skills in a collaborative setting can be used irrespective of the subject, content or skills learned, and, crucially, stimulate the ability to analyse material and concepts as part of standard practice.

- ***Approaches to teaching critical thinking skills***

Clarke and Care (2017), in discussing approaches to the development of critical thinking in one specific school setting, cite the case of stand-alone subject, 'Integrated Studies' being created, which draws on content from English, Science and Humanities, and uses this material to help focus student attention on 21st Century Skills, particularly collaboration, problem-solving and critical thinking. In this setting, and taking an 'active learning' approach, students are encouraged to interrogate information and focus on understanding problems that affect the community at large. Activities include debates requiring students to understand multiple sides of a debate by

collecting a range of information and analysing the positions of different stakeholders. The students then work as a group to develop a position that can be used to convince others. Students are also challenged to develop and execute research through scaffolding tasks designed to develop critical thinking by guiding them through systematic steps as they proceed from premise to conclusion (Clarke & Care, 2017).

This teaching model is presented as inquiry-based and places collaborative and critical thinking at its core. It involves teaching the language of critical thinking, so that students understand the structure of an issue comprised of elements including argument, premise, evidence and contention. It also covers tasks for the synthesis of learning and application of critical thinking skills. Clarke and Care (2017) argue that these approaches allow students to develop explicit strategies for dealing with information.