



**HIBERNIA
COLLEGE**

**Integrating 21st-Century Skills into Irish
Primary Schools: A Pilot Study on the Outcomes,
Experiences and Observations of Teachers Prepared**

Item Type	Article
Authors	Meegan, John;Casey, Elva;O'Brien, Niamh
Download date	2026-06-18 07:52:33
Link to Item	http://hdl.handle.net/20.500.13012/135



**HIBERNIA
COLLEGE**

**Integrating 21st-Century Skills into Irish Primary Schools:
A Pilot Study on the Outcomes, Experiences and Observations of
Teachers**

Prepared for: Zeeko Education

Authors: John Meegan, Elva Casey
and Niamh O'Brien

Block B, The Merrion Centre,
Merrion Road, Dublin, Ireland
+353 1 661 0168
hiberniacollege.com

Contents

.....	1
Executive summary	4
The state of play for 21 st -century skills	5
Curriculum implementation of 21 st -century skills.....	7
Developing students' 21 st -century skills.....	8
Peer-to-peer teaching methodology.....	9
The Magical Leaders programme overview.....	10
Methodology.....	12
21 st -century skills self-report questionnaire.....	13
Focus Groups.....	15
Gathering data and sampling.....	15
Data analysis.....	17
Results	18
21 st -century skills development.....	19
Teachers' perspectives of the programme	22
Students' perspectives of the programme	23
The peer-to-peer teaching methodology	25
The challenges to programme delivery	26
Discussion.....	29
Limitations	31
Conclusion	32
References	34

Executive summary

The implementation of 21st-century skills and competency-based learning in European and OECD countries' educational curricula indicates affirmative action across global educational systems to develop a wider breadth of skills beyond traditional literacy and numeracy skills. There is broad agreement and significant common interest across national and international competency frameworks concerning the importance of 21st-century skills. This consensus is underpinned by the need for education to equip learners with transferable knowledge and skills rather than relying upon well-worn procedures. From the Irish primary school context, there is an explicit focus on, and pathway to, the development of 21st-century skills beginning with Aistear: The Early Childhood Curriculum Framework and progressing to the development of the new draft Primary School Curriculum. This skills and competency pathway continues into post-primary school settings as students transition into the Junior and Senior Cycle stages of their education. With this explicit focus on competency and skills-based education, many schools seek to develop skills through innovative teaching methods or by employing specific skills-based interventions. This report presents a small-scale pilot study of the 'Magical Leaders' programme, a 21st-century skills intervention programme suitable for primary school students between 10 and 12 years of age. The mixed-methods study investigated teachers' attitudes and perspectives of the Magical Leaders programme, the 21st-century skills outcomes, the programme's resources and the core peer-to-peer teaching methodology. Using focus group discussions and adapted reliable and validated scales, the findings of this research have highlighted the positive development of students' 21st-century skills, teachers' and students' perspectives of engaging with the programme and the peer-to-peer teaching methodology. Several challenges to programme delivery were identified, including the programme's digital components, teacher training, lesson preparation time and adherence to programme fidelity.

The state of play for 21st-century skills

A rapidly expanding knowledge-based society within a politically globalised, socially interconnected world has challenged educational institutions, policymakers and educators' priorities about what future generations need to succeed in life and add value to society (OECD, 2018; UNESCO, 2019). Education is tasked with equipping learners with the ability to meet the demands of an uncertain future where interdependence (Hargreaves et al., 2009) and transferrable skills are seen as crucial (Kotsiou et al., 2022). Such skills, prolifically referred to in the literature as 21st-century skills or more appropriately referred to now as future skills (ibid.), have become central to strategic decision-making within education as key stakeholders from both public and private educational institutions, and not-for-profit and government organisations continue to define what these skills are and how they can be assessed (Chen, 2019). In this paper, 21st-century skills are described as the knowledge, attitudes, values and skills required to prepare learners for an uncertain future (UNESCO, 2019) and to transform society and shape the future for the better (OECD, 2019). These skills fall into three domains of competence — cognitive, interpersonal and intrapersonal (Pellegrino and Hilton, 2012; Guerriero, 2017). Kotsiou et al.'s (2022) systematic literature review provides a current description of nine 21st-century meta-categories, each with an associated subset of skills:

- 1) Higher-order thinking skills
- 2) Dialogue skills
- 3) Digital and STEM literacy
- 4) Values
- 5) Self-management
- 6) Lifelong learning
- 7) Enterprise skills
- 8) Leadership

9) Flexibility

Several 21st-century skills frameworks have been analysed and reviewed (Dede, 2010; Voogt and Roblin, 2012; Binkey et al., 2012; Chalkiadaki, 2018) to gain consensus on an operational definition of each 21st-century skill. Kotsiou et al.'s (2022) scoping exercise built upon previous analysis with the inclusion of 21st-century frameworks developed by private institutions such as the *The future of jobs report 2020* by the World Economic Forum (WEF) (2020), as well as the analysis and review of updated frameworks such as the *The future of education and skills: education 2030* (OECD, 2018) and the '*Framework for 21st Century Learning Definitions*' (Partnership for 21st century learning, 2019). This review also included frameworks focused on the growing need for digital literacy skills development (DQ Institute, 2019) and democratic competencies (Barrett, 2016). Literature describing 21st-century skills is prolific with a general lack of consensus as to what is meant by each skill; however, there is an overall agreement that 21st-century skills are vital to prepare future generations to take up jobs that have yet to be created and to solve problems not yet imagined. Given the continued international interest and recognition of the breadth of 21st-century skills, consistent identification of these skills in educational policy and practice levels (Care et al., 2017) is common in many countries. However, expectations about how these skills marry with curricula or develop and mature are less clear (ibid.). Therefore, this pilot study examines teachers' experiences delivering a purposefully designed 21st-century skills-based programme in Irish primary schools by considering teachers' views of the programme's impact, resources, outcomes and, ultimately, the development of students' 21st-century skills.

Curriculum implementation of 21st-century skills

The implementation of 21st-century skills into both European (Gordon et al., 2009) and OECD countries' curricula (Ananiadou and Claro, 2009) indicates affirmative action across global educational systems to develop a wider breadth of skills beyond traditional literacy and numeracy skills (McGuinness, 2018). Educational reforms purposed to support the development of 21st-century skills can be seen with varying degrees of success in Canada (Boyd, 2021), Singapore (Rajandiran, 2021), Mexico (Islasm Calef and Aparicio, 2021), Pakistan (Chaudry and Tajwar, 2021), Kenya (Fomiškina et al., 2021) and Zimbabwe (Gory et al., 2021). International evidence from diverse education systems also shows governmental action to build teacher capacity to teach such skills through improvements to initial teacher education programmes (Reimers, 2020). There is broad agreement and significant common interest across national and international competency frameworks concerning the importance of 21st-century skills. This consensus is underpinned by the need for education to equip learners with transferrable knowledge and skills, rather than relying upon well-worn procedures (Guerriero, 2017). From the Irish primary school context, there is now a clear pathway for the development of 21st-century skills, beginning with Aistear: The Early Childhood Curriculum Framework (NCCA, 2009) and its themes of *Wellbeing, Identity and Belonging, Communicating and Exploring*, and *Thinking* onto the new draft Primary School Curriculum (NCCA, 2020) with its key competencies of *Being an Active Citizen, Being Creative, Being a Digital Learner, Being Mathematical, Communicating and Using Language, Fostering Wellbeing*, and *Learning to be a Learner*. The design and implementation of such frameworks draw attention to the concept of 'Deeper Learning' (Mayer, 2010) embedded within a sociocultural learning theory (Greeno, Pearson and Schon Field, 1996). Deeper learning occurs through the interconnection and coordination of facts, concepts, procedures, strategies and beliefs. Through this interconnected and coordinated learning, transferable knowledge that supports procedural

reproduction, factual retention, ideas, techniques and metacognition all prosper and flourish (Guerriero, 2017). The critical question is, how to better equip students with these skills?

Developing students' 21st-century skills

The prevalence of 21st-century skills in educational policies and school curricula has caused many schools to adopt school-based interventions or innovative teaching approaches to support and develop specific transferable skills, such as using traditional maths games to support higher-order thinking (Aprinastuti, 2019), adopting inquiry based-learning to develop scientific reasoning abilities (van der Graaf et al., 2019), employing alternative pedagogies to improve collaborative thinking and communication skills (Yusoff et al., 2018), and implementing programmable robots to enhance creativity (Um Albaneen Yusuf, 2019). Social and emotional learning (SEL) is often used as an overarching term to represent a wide array of non-academic transferrable skills, including 21st-century skills (Explore SEL, 2019). SEL programmes intend to develop five core competencies in students (CASEL, 2012):

- 1) Self-awareness
- 2) Self-management
- 3) Social awareness
- 4) Relationship skills
- 5) Responsible decision-making

Embedded within these categories are the skills necessary to recognise the impact and influence of emotions on one's behaviour, to self-regulate emotions and thoughts, to empathise with others, to manage conflict, and to make positive choices about behaviours and social interactions (CASEL, 2012). SEL school-based interventions are linked to improved outcomes and dispositions in social relationships, academic achievement and school

attendance (Durlak et al., 2011; Clarke et al., 2015; Corcoran et al., 2018). Research indicates the positive outcomes of specific skills-based programmes, yet teachers' capacity to teach to a broader set of goals, cognitive goals or socio-emotional skills is vital (Reimers, 2020; 2021). A key factor underpinning high levels of teachers' performance continues to be high-quality initial teacher preparation and professional support (Jensen et al., 2012). The development of institutional and teacher capacity plays a vital role in the sustainable development of students' 21st-century skills (Reimers, 2020) as the quality of teaching is still one of the most important influences on students' opportunities to learn (Hattie, 2009).

Peer-to-peer teaching methodology

While peer-to-peer learning may be seen as a relatively modern and new methodology, there is a long-established theoretical grounding for it. Piaget's (1985, p.10) Theory of Cognitive Development was based on the active involvement of peers. Various labels 'peer instruction' and 'peer methodology', it is defined by Boud, Cohen and Sampson (1999) as using teaching and learning strategies that involve students learning from each other without direct or immediate intervention from the teacher or instructor. Peer-to-peer teaching methodologies hold the potential to help create enriching learning environments by preventing an overreliance on instruction from one source (Friederichs, 2019). The broad consensus in the literature points toward acknowledging some significant effects students can have on the learning of their peers (Epple and Romano, 2011; Sacerdote, 2011). For example, the social benefits of peer-to-peer teaching methodologies and their contribution to creating a positive and enriching learning environment are highlighted by Ponferrada-Arteaga and Carrasco-Pons (2010). However, Kimbrough et al. (2022) note that the efficacy of peer-to-peer teaching as a methodology is likely dependent on the ability levels of said peers. They highlight the inefficacy of ability

tracking in this methodology and suggest that low-ability students suffer from the absence of high-ability peers to teach them in such scenarios. Ponferrada-Arteaga and Carrasco-Pons (2010) conducted a quantitative and qualitative study of secondary schools in Catalonia, which found that the school's climate, including verbal, social and peer relationships, could be impacted by peer-to-peer teaching methodologies. The authors pointed to factors such as values governing social status and popularity, the social- relationships between teachers and students and the impact of peer-to-peer teaching on the understanding of and engagement with rules and regulations within the school.

The Magical Leaders programme overview

The 21st-century skills programme at the centre of this study, the 'Magical Leaders' programme, was born out of a collaborative initiative between the Irish Department of Enterprise, Trade and Employment; Enterprise Ireland; and Zeeko. Zeeko is an Irish educational company that designs and produces educational resources and delivers professional development content to both primary and post-primary schools. The combined ambition was to create and develop an innovative approach to teaching 21st-century skills and entrepreneurship education in primary schools for students between 10 and 12 years old. The Magical Leaders programme is available to all primary schools in Ireland. The programme was developed in response to several European and national research reports and policies on education, including the OECD *The future of education and skills: education 2030* report. This report outlines three broad transformative competencies: creating new value, reconciling tensions and dilemmas, and taking responsibility (OECD, 2019). Each value consists of several associated 21st-century skills.

The programme comprises two parts:

Part 1 — Introductory programme

Part 2 — In-depth programme

This study, carried out by the Hibernia College research team on behalf of Enterprise Ireland and Zeeko, investigated teachers' attitudes and perspectives on the 21st-century skills outcomes, the programme's resources and the core teaching methodology of Part 1 of the programme. Part 2 is currently under development, and findings from this study will inform its future programme development. Part 1 of the programme comprises seven one-hour lessons, each with a specific 21st-century skill focus. Each lesson introduces a real-life entrepreneur whose success story showcases the importance of a particular set of 21st-century skills in their business. Students navigate an online game-based environment and are presented with various challenges. The challenges are based on real-life situations where students are expected to practise and develop their 21st-century skills embedded within a real-world context. The central teaching methodology is peer-to-peer-led instruction (Boud, Cohen and Sampson, 1999) as students teach lessons across the programme.

Our research aimed to investigate teachers' attitudes and perspectives towards the Magical Leaders programme, and the programme's 21st-century skills outcomes, resources and core teaching methodology. The research team envisions this pilot study will precede future larger studies of the programme to support improvements to future programme design, development and delivery (Williams-McBean, 2019). The overarching research question is:

- What are teachers' attitudes and perspectives of the Magical Leaders programme's 21st-century skills outcomes, resources and core teaching methodology?

The main objectives for the investigation were to:

1. Evaluate teachers' perspectives of the Magical Leaders programme and achievement of 21st-century skills
2. Evaluate and summarise teacher insights into the components of the programme
3. Investigate teachers' perspectives of the programme's peer-to-peer teaching methodology

Methodology

This review required teachers' involvement to help shape the investigation and lead to impactful changes to future programme development (Creswell and Clarke, 2017). Adopting a realist paradigm, this study intended to obtain different but complementary data to understand our research question best. A realist paradigm is best suited for evaluative mixed-methods studies investigating 'what works' in education and programme design (Hall, 2013). We adopted a mixed-methods convergent study (Creswell and Clarke, 2017) where qualitative focus group data were collected separately from Hixson, Ravitz and Whisman's (2012) assessment of 21st-century skills multi-element quantitative self-report questionnaire. Both data sets were analysed individually, methodologically triangulated (Fusch, Fusch, & Ness, 2018; Denzin 2009) and integrated into a narrative discussion to thoroughly understand the research question. The qualitative phase of our research brought nuance, context and understanding of teachers' attitudes and perspectives of the programme. At the same time, the quantitative data established linkages to the explicit 21st-century skills outcomes in the programme (Eckert, 2013). The researchers were independent agents consulted by Zeeko to carry out this research with objectivity and openness to the findings. Reflexivity in this study was valued as central to improvements in developing 21st-century skills in the Irish education system. The lead researcher took measures to prevent bias through the triangulation of results, peer consulting and continually demonstrating reflexivity.

21st-century skills self-report questionnaire

Hixson, Ravitz and Whisman's (2012) 21st-century skills questionnaire was adapted for this study, similar to Bakhshaei et al. (2020), Ravitz et al. (2020) and Sinay, Resendes and Graikinis (2015). This quantitative teacher survey is available for re-use in studies of 21st-century teaching and learning and has demonstrated high levels of reliability, improving on reliable measures from previous studies (Hixson, Ravitz and Whisman, 2012). The conceptualisation of skills assessed in the self-report questionnaire draws from the international innovative teaching and learning study (Shear et al., 2010), the deeper learning competencies (Vander Ark and Schneider, 2014) and the Partnership for 21st Century Learning (Battelle for Kids, 2019). The skills assessed were: critical thinking skills, collaboration skills, communication skills, creativity and innovation skills, self-direction skills, global connections, local connections, and using technology as a tool for learning. These skills align closely with those outlined in the Magical Leaders programme, which are:

- 1) Communication and active listening skills
- 2) Oracy and presentation skills
- 3) Emotional regulation
- 4) Team working skills
- 5) Creative problem solving
- 6) Critical thinking
- 7) Social skills
- 8) Leadership skills
- 9) Learning from feedback

Two additional sections were added to the questionnaire about teachers' attitudes and perspectives towards the programme's resources and outcomes. Each survey section provided a 21st-century skill definition, a list of related practices and questions about teachers' perspectives. After each definition, the questionnaire asked about the frequency of

student practices for that skill in the programme (e.g. How often did students have the opportunity to compare information from different sources before completing a task or assignment?). Response choices were:

- 1) 'Never'
- 2) 'Rarely'
- 3) 'Sometimes'
- 4) 'Very frequently'
- 5) 'Always'

In addition to the frequency of different practices, we asked the extent to which teachers agreed to a number of statements focusing on developed 21st-century skills and teachers' ability to assess each skill during the programme, using critical thinking as an example:

- 1) The programme develops students' critical thinking skills.
- 2) Most students have improved their critical thinking skills through engagement with the programme.
- 3) I have been able to effectively assess students' critical thinking skills.

The researchers added two supplementary questions to each 21st-century skill to investigate teachers' professional development:

- 1) The programme developed my understanding of critical thinking skills.
- 2) The programme developed my ability to teach critical thinking skills.

The response choices were:

- 1) 'Not really'
- 2) 'To a minor extent'

- 3) 'To a moderate extent'
- 4) 'To a great extent'
- 5) 'To a very great extent'

Focus Groups

The semi-structured focus group questions were designed to elicit teachers' personal experiences and perspectives of the programme. Following the procedures to conduct semi-structured focus groups outlined by Creswell and Poth (2018), the questions focused on common concepts featured in the self-report questionnaire, including:

- 1) Teachers' perspectives of the programme
- 2) 21st-century skills development
- 3) Students' experiences of the programme
- 4) The peer-to-peer teaching methodology

The focus groups were held online using the College's secure online communication platform.

Gathering data and sampling

Owing to the short time frame to carry out this research and the small sample size of teachers who had, or were soon to, deliver the programme, the focus group participants and participants invited to complete the self-report questionnaire, were identified and invited to participate in this research by Zeeko via their secure database. Using non-probabilistic convenience sampling, 120 primary school teachers (n = 120) were asked to complete the self-report questionnaire (Hixson, Ravitz and Whisman, 2012). Using purposive sampling, 12 teachers (n = 12) were interviewed across four focus group sessions. The focus group teachers (n = 12) had delivered the programme in the last 12 months, while the self-report questionnaire (n = 120) was sent to teachers who

had delivered the programme between April and June 2022. Ethical approval was obtained from the Hibernia College Ethics Committee in January 2022. A research privacy notice, informed consent form and information sheet were shared with all research participants prior to the commencement of this study. Teachers were invited to complete the self-report questionnaire via the College's secure online survey platform. Consent was captured in the first section of the questionnaire, while participants gave consent orally before the online focus groups held via Zoom. Throughout the study, the research team reassured participants of their right to opt out of the project at any time. Data was stored on a secure, College-approved cloud-based platform, and all research data was handled according to actions outlined in the ethical review submission. Transcripts were fully anonymised two weeks after submission. Focus group data was transcribed through a secure, third-party transcription service. Of the 25 participants that completed the self-report questionnaire, 72% of the responding teachers taught in Sixth Class while 28% taught in Fifth Class. The school types and responses represented in the self-report questionnaire are displayed in Table 1.

Table 1. Self-Report Questionnaire Responses and School Types

School type	Response number	Response percentage
Church of Ireland primary school	1	4%
Catholic co-educational primary school	18	72%
Multidenominational primary school	2	8%
Gaelscoil	1	4%
Catholic boys primary school	3	12%

Four focus groups were held between February and March 2022. Table 2 shows the focus group details.

Table 2. Focus Group Details

	Number of participants	Gender of participants	School types represented	Class types represented
Focus group 1	3	1 × female 2 × male	1 × Gaelscoil 1 × Multidenominational 1 × Catholic co-educational	3 × Sixth Class
Focus group 2	2	2 × female	1 × Gaelscoil 1 × Catholic co-educational	1 × Fifth Class 1 × Sixth Class
Focus group 3	4	1 × male 3 × female	4 × Catholic co-educational	3 × Sixth Class 1 × Fifth and Sixth Class
Focus group 4	3	3 × female	2 × Catholic co-educational 1 × home school	1 × Sixth Class 1 × Fifth and Sixth Class 1 × First-Sixth Class

Data analysis

The self-report questionnaire responses were gathered using Microsoft Forms and analysed using its inbuilt analysis tools. While the self-report questionnaire has demonstrated high levels of reliability, due to the low number of responses, the use of statistical software to analyse the data was deemed unnecessary for this report. The responses to each Likert scale question were transformed into stacked diverging bar charts, with neutrals split. This data was presented visually to give the research team a general overview of participant responses while the percentage breakdown for each question was also recorded. The percentage response for each question was transformed into qualitative descriptions for integration with qualitative themes.

The focus group data was analysed using thematic analysis (Braun and Clarke, 2021) following six phases: familiarisation with the data, generating original codes, searching for themes, reviewing, defining and naming themes, and producing a report. The six themes identified from the focus group thematic analysis (Braun and Clarke, 2021) were:

- 1) 21st-century skills development
- 2) Teachers' experiences of the programme
- 3) Students' experiences of the programme
- 4) The peer-to-peer teaching methodology
- 5) The challenges to programme delivery

Following a procedure provided by Bree and Gallagher (2016), themes were processed using Microsoft Excel, and were colour coded and later refined and integrated using a thematic map. Bree and Gallagher (2016) provide researchers with a robust physical process of managing data analysis that reflects the analysis framework (Braun and Clarke, 2006; 2013; 2021).

Results

A thematic analysis of the focus group data and additional comments left at the end of the self-report questionnaire (Braun and Clarke, 2021) identified six major themes:

- 1) 21st-century skills development
- 2) Teachers' perspectives of the programme
- 3) Students' perspectives of the programme
- 4) The peer-to-peer teaching methodology
- 5) The challenges to programme delivery

This section will present results from the thematic analysis alongside pertinent data gathered and analysed from the self-report questionnaire. The quantitative and qualitative data will be narratively integrated in the following section.

21st-century skills development

Four subthemes were identified under the 21st-century skills development theme:

- 1) Students' development of 21st-century skills
- 2) Making visible and acknowledging student voice
- 3) Building awareness and understanding of 21st-century skills, innovation, entrepreneurial education and Global Development Goals
- 4) Students' use of 21st-century skills across different contexts

Through engagement with the programme, teachers indicated students developed a range of 21st-century skills. Teachers expressed communication, critical thinking, teamwork and collaboration skills were especially well honed. This perspective is supported by questionnaire data as 74% of teachers indicated most students improved their collaboration skills to a great or very great extent; 62% of teachers indicated the programme develops students' critical thinking skills to a great or very great extent; and 73% of teachers indicated the programme develops students' communication skills to a great or very great extent. During focus group conversations, a female teacher from a co-educational Catholic school in the east of Ireland remarked:

I really liked the critical thinking element. When they had a decision to make or think maybe differently, or why you would do things. I found that area got a lot out of children that I wouldn't normally get an awful lot out of.

Another female teacher from a Gaelscoil in the east of Ireland stated, 'The collaboration and communication, just the teamwork and the ability to be able to work within a group and to be respectful of everybody in the group and to listen was great.' Teachers indicated students developed their critical feedback skills and their ability to reflect on their work and that of others, as expressed by a female homeschool teacher during one focus group when she stated:

I think it was wonderful for them to have the opportunity to speak and get some other child to say, 'Well, did you understand what they said?' or to give feedback to that pupil and for them to listen to one another and have a collegial forum together to explore themes rather than just being one person talking down to everybody and realising each of them has something to bring.

Teachers indicated students' confidence, and their ability to express opinions, ideas and acknowledge others was supported and developed. Group work instilled in students a responsibility and ownership of their learning. A male teacher from a co-educational Catholic school in southwest Ireland noted:

It was one of the things that appealed to me in doing the programme, giving them time, putting the onus on them to be a bit more responsible...It just gives them a greater insight into working together, when they have a common goal at the end.

Teachers described the development of students' emotional regulation skills as being beneficial, especially for returning to school after COVID-19 school closures. The programme developed students' resilience skills as they self-regulated when the group did not use their ideas. A female teacher from a co-educational Gaelscoil in the east of Ireland remarked,

'One that they were really, really interested in was the emotional regulation because of COVID everybody was, when they were in lockdown, there was a pressure cooker kind of scenario in different houses.' Teachers described how students related to real-life entrepreneur stories. The explicit naming and describing of key terms such as 21st-century skills, innovation and entrepreneurial education concepts and ideas built students' awareness and understanding of these concepts, with a female teacher from a Catholic co-educational school in the Irish midlands reporting, 'The terminology is great because I do another project, but in that program, you don't actually name the skills.' A male teacher from a co-educational Catholic school in the east of Ireland remarked, 'I think the programme definitely drew a bit more attention for us in the class to entrepreneurial and innovation skills in the world around us.'

Quieter students were allowed to make their own voice heard as being authentic, unique and valued by themselves and others. The programme especially gave quieter students a platform and opportunity to lead activities, build confidence and practise presentation skills, as suggested by a female teacher from a co-educational Catholic school in the west of Ireland when she stated, 'I think kids definitely gained confidence and some of your quieter children can gain that confidence maybe that you never thought they'd have.' The programme allowed quieter students to present themselves to their peers in a different light and opened new educational possibilities and experiences for others. A female teacher from a Gaelscoil in the east of Ireland stated:

It has given the quieter children in the class who wouldn't necessarily share their voice, it has given them a little bit more confidence. Also, the children maybe who would be prone to thinking outside the box, and not go for the obvious answer all the time. I think definitely those children are more confident with putting their ideas forward because they were obviously encouraged to do that.

The programme had a positive impact on students both inside and outside of the classroom as skills learned were transferred into other contexts. One female teacher from a Gaelscoil in the east of Ireland stated:

It made them think, and those skills were transferable, then added onto the yard to say, okay, I don't really like playing with that person, but I'm after learning a way around that, so can I put my learning into operation there on the yard.

The potential to adopt these skills in a post-primary school setting was also evident to teachers. One female teacher from a co-educational Catholic school in the southeast of Ireland expressed, 'It was beneficial and especially for Sixth Class pupils going into First Year where they will have to make more presentations.'

Teachers' perspectives of the programme

Two subthemes were identified under the theme of teachers' perspectives of the programme:

- 1) Teachers enjoyed teaching and delivering the programme.
- 2) The programme integrated well across the curriculum.

Teachers enjoyed teaching and delivering the programme. The thematic structure and the programme's outcomes and objectives were well received. Of the teachers surveyed, 52% indicated they were satisfied with the programme's outcomes to a great or very great extent. One female teacher from a co-educational Catholic school in the west of Ireland stated, 'I enjoyed doing it. I think I enjoyed it more than the children.' Teachers also enjoyed the demands it put on students to think critically, work collaboratively, and develop creativity and innovation skills. Quantitative data somewhat supported this view as 38% of teachers indicated most students improved their creativity and innovation

skills through engagement with the programme. In comparison, 45% of teachers indicated students generated their own ideas about how to confront a problem or question. This was supported during focus group conversations, with a female teacher from a co-educational Gaelscoil in the west of Ireland stating, 'To recognise a problem, and then to know that there are multiple ways of solving a problem — that stood out for me.'

Teachers indicated that the programme integrated well across the curriculum and supported engagement with the Primary Language Curriculum. Of the teachers surveyed, 50% indicated the programme enriched the school environment by developing students' 21st-century skills to a great or a very great extent. This data was supported by focus group data as one female teacher from a co-educational Gaelscoil in the east of Ireland said, 'It was good, in that it tied in with the new Primary Language Curriculum as well.'

Students' perspectives of the programme

Three subthemes were identified under the theme of students' perspectives of the programme:

- 1) Students enjoyed engaging with the programme and the peer-to-peer methodology.
- 2) The programme deepened students' awareness of the planning and preparation involved when presenting to others.
- 3) The programme disrupted traditional power relations in the classroom.

Teachers indicated that students enjoyed the programme content, structure and peer-to-peer methodology. One teacher from a co-educational Catholic school in the west of Ireland noted that, 'I think they enjoyed it. They seemed to be enthusiastic about participating and they

liked preparing and being given time to get their lesson ready.' Students enjoyed engaging with the game-based environment as it was novel to them. They also developed their skills of using technology as a tool for learning. This was supported by qualitative data as 45% of teachers indicated the programme developed students' skills in using technology as a tool for learning frequently and always.

The programme deepened students' awareness of the preparation involved when presenting to their peers and the role and responsibility of teachers on a daily basis. One male teacher from a co-educational Catholic school in southwest Ireland noted, 'There was that little bit of understanding, as to what it's like to present. They sometimes said look, we understand that it's not easy to teach, so there was a bit of empathy there as well.' Another teacher noted in the self-report questionnaire that, 'I think they learned a valuable lesson in empathy through their presentations.'

The programme disrupted traditional student power relations in the classroom. The more outgoing students had to negotiate a new role during the programme and listen while less outgoing children were presenting. One female teacher from a co-educational Catholic school in the east of the Ireland stated:

That was definitely a challenge for some of the children who would be used to being centre stage that they weren't given that role automatically. That they had to assume another role in the group. I do feel the children struggle with that a little bit. Maybe not being number one all the time.

Teachers also indicated that all students had an opportunity to contribute and that they listened attentively to their friends and respected each other's opinions. One female teacher from a co-educational Catholic school in the west of Ireland stated, 'You might have the one that might

make a smart comment just to try to get someone going, but I think they developed respect, more respect for each other as it went along.'

The peer-to-peer teaching methodology

Three subthemes were identified under the theme of the peer-to-peer teaching methodology:

- 1) The peer-to-peer methodology is a novel way of teaching, engaging and interacting with students.
- 2) The peer-to-peer methodology allows teachers to observe and become facilitators, not leaders of the learning.
- 3) The peer-to-peer methodology can be adopted across other curricular areas.

The peer-to-peer methodology is a novel way of teaching, engaging and interacting with students. Of the teachers surveyed, 59% indicated that most students enjoyed and engaged in the peer-to-peer teaching methodology to a great or very great extent. One female teacher from a co-educational Catholic school in the east of Ireland stated that, 'I think the peer education was great. The collaboration, the idea that they're working in collaboration, was good. It straightaway gave you buy-in.' The peer-to-peer methodology allowed teachers to observe and become facilitators, not leaders, of learning in contrast to traditional teacher-led pedagogies. One female teacher from a co-educational Catholic Gaelscoil in the east of Ireland stated:

I got to see the class as a whole kind of from the back and you don't get opportunities like that when you're teaching, because you're always on call, so it gave a great opportunity for me to see how groups were interacting together to see how they engaged.

Teachers also employed the peer-to-peer methodology across other curricular areas to support self-reflection, critical thinking and peer-to-peer feedback. One female teacher from a co-educational Catholic school in the east of Ireland noted, 'I think it's quite a nice idea to introduce in science and geography and history.' Another male teacher from a co-educational Catholic school in southwest Ireland stated that, 'I've actually used it an awful lot myself across other curricular areas and just getting them to look inwards and even other groups to kind of think critically, but fairly assess their peers' work.'

The challenges to programme delivery

Four subthemes were identified under the theme of challenges to programme delivery:

- 1) Digital components
- 2) Teacher training and programme preparation
- 3) Physical resources
- 4) Adhering to programme fidelity

The programme was felt to be too dependent on digital technologies, and teachers failed to deliver the programme effectively due to technical issues in some instances. One male teacher from a co-educational Catholic school in southwest Ireland stated, 'I found the actual programme itself, that it wasn't an issue with our laptops or computers or the Internet. The programme itself was quite unresponsive and it took a lot of time to get from place to place within it.' Teachers indicated they, and their students, became frustrated by the digital elements of the programme and that the graphics were outdated, causing students to lose interest. One female teacher from a co-educational Gaelscoil in the east of Ireland stated:

I thought the graphics were fine, but for the children it wasn't maybe as modern, or up to date, or as techy as they would've liked. I found I was trying to nearly compensate a little bit for that element of it.

The reliability, responsiveness and integration of the digital elements of the programme across devices and across different school infrastructures were problematic for teachers and students. The programme was not app-ready, which teachers found frustrating. One male teacher from a co-educational multid denominational school stated:

It just was a little bit too slow for them at times to move to the next phone, so I sometimes ended up skipping ahead and just watching the video, so I really had to adapt it myself and that was probably one of the biggest challenges.

Teachers indicated the programme training was ineffective and impractical. A male teacher from a co-educational Catholic school in the midlands stated:

I didn't feel prepared in any way to actually deliver the programme. First of all, I didn't think that there was — now again, I understand there were external factors and I know that COVID didn't allow the proper teacher training to take place, and we were doing it over Zoom. I'd love to have somebody show me, 'Look, this is how it works. This is what it looks like.'

Teachers felt unprepared to deliver the programme and, so, students struggled to engage with it. The teacher training focused on organisation strategies, not on what a successful lesson looked like — the effective way to teach and deliver the programme, focusing on 21st-century skills outcomes and success criteria. From the self-report questionnaire, one teacher noted that:

The programme is probably very beneficial, but is very hard to deliver as the children and myself were unsure of what we were getting into and the programme was too difficult. The children found it hard to grasp what they were to do and then they were fearful of making assumptions or interacting with new ideas as it was all so new to them.

Teachers found preparing student groups, planning and pre-teaching students to deliver the lessons time-consuming and challenging to manage. One male teacher from a co-educational multid denominational school in the east of Ireland stated:

I suppose one of the challenges was their preparation...giving them time even to go out of class or whatever, and being able to give them time in their preparation as well, because you nearly needed to work with them to guide them a little bit as to how you're going to present this.

Teachers also indicated the time allowance for lessons was unrealistic, as noted by one teacher in the self-report questionnaire: 'One-hour lessons are far too long to complete in one sitting. The pupils got bored after 30 minutes so we had to return to it another day.'

Students lacked deep and meaningful content knowledge when delivering the peer-to-peer lessons. They became unnerved when their peers posed questions that they did not readily know the answers to. One female teacher from a co-educational school in the east of Ireland noted:

I suppose the fact that they didn't have a very deep knowledge of what they were presenting on. If some of the other children asked them a question, they were going, 'I don't know.' They literally knew I'm presenting this little bit of information, but they didn't know anything beyond that.

The teacher guidelines and students' workbooks were repetitive and content heavy, and some language was deemed too advanced for some students. One teacher noted in the questionnaire that, 'The vocabulary is still too difficult for Fifth and Sixth Class. A lot of pre-teaching of the vocabulary is needed, which is very time-consuming.' Another female teacher from a co-educational Catholic Gaelscoil in the east of Ireland stated, 'I thought there was just too much in the workbook. There's an awful lot of great points, but less is more in my opinion for the workbook.'

Adhering to programme fidelity was challenging due, in part, to COVID-19 restrictions, time constraints on planning and delivering the lessons, and negotiating this as part of a busy curriculum. Teachers indicated they completed particular lessons in a bespoke way and focused on the skills they felt most beneficial to their school and classroom context. One male teacher from a co-educational multidenominational school in the east of Ireland stated that, 'From my point of view, I picked and chose what I was able to do, the skills that we could do, and we're trying to have them doing a little bit of leadership.' A female teacher from a co-educational Catholic Gaelscoil in the east of Ireland stated, 'I suppose we did it slightly differently. We did it in a reasonably short time frame. I gave them a little bit of time in school, and the children presented one day after another, after another.'

Discussion

The findings of this research have highlighted both congruent and discrepant results (Lee and Greene, 2007) between qualitative and quantitative data. Overall congruence between the qualitative focus group data and the teachers' self-report quantitative data is seen across the development of students' 21st-century skills, teachers' and students' perspectives of engaging with the programme, the peer-to-peer teaching

methodology, and elements of the programme structure. Amid this general congruence, discrepant data is seen mainly in relation to the digital elements of the programme.

Data from the self-report questionnaire indicated an overall improvement in students' 21st-century skills, especially in the areas of critical thinking, collaboration, communication, and creativity and innovation. This positive development of skills was also seen across focus group data, with the skills of critical feedback, teamwork, responsibility, ownership of learning and leadership being regularly identified. In comparison, in the self-report questionnaire, teachers indicated less improvement in students' self-direction, skills, making global and local connections, and using technology as a tool for learning. Across both datasets, teachers indicated they, and their students, had a positive experience of the programme and the peer-to-peer teaching methodology but that some elements of the programme were problematic. Congruence across both datasets is seen in the impractical length of the lessons, with teachers regarding the one-hour time limit as being unrealistic. Of the teachers surveyed, 42% also indicated that the lesson plans are unclear and difficult to follow.

Discrepant data is seen mostly concerning the digital elements of the programme. Focus group data described a variety of challenges in relation to digital elements of the programme, such as teachers and students feeling frustrated by the fact that the programme was not app-ready and had outdated graphics. The digital elements' reliability, responsiveness and integration across different school infrastructures were also problematic for teachers and students. Despite these views of the programme's challenges, 45% of teachers indicated most students had improved their skills in using technology as a tool for learning, and 41% of teachers indicated most students enjoyed and engaged with the online, game-based activities to a great or very great extent.

Limitations

Owing to the short time frame to carry out this study and the small sample size of teachers who had, or were soon to, deliver the programme, the focus group participants and participants invited to complete the self-report questionnaire, were identified and invited to take part in this research by Zeeko via their secure database of teachers. This raised a conflict of interest in the eyes of the research team. The research team made this conflict of interest very clear to Zeeko before the commencement of this study. The research team informed Zeeko that this would be an academically robust, thorough and objective review in which negative reviews of the programme may be identified. The research team did not have access to Zeeko's database and, so, insisted that, as much as possible, a diverse population of teachers would be invited to take part in the focus groups and that the self-report questionnaires be sent to as many diverse school contexts as possible. While the research team made every effort to ensure a diverse sample size was used in this study, we acknowledge that the small numbers involved and the relatively low national take-up of the programme to date are limitations of this study. Due to the low number of questionnaire responses, the use of statistical software in this study was deemed unfeasible. The research team would welcome a broader, more complete study as the sample size increases over time with the inclusion of statistical analysis. Other limitations highlighted were discrepancies between the qualitative and quantitative data. This may be the result of quantitative sampling problems, as alluded to above, more so than qualitative theme development issues. In this study, the research team had more trust in the focus group data than in the self-report questionnaire because the number of questionnaire responses were low and the sample size was small. Gathering responses was also challenging. The poor level of responses could have been due to a lack of teacher interest in completing the questionnaire, the time it took to complete it, or busy teacher schedules. The research team noted that the average time to complete the survey was 22 minutes and 6 seconds,

while the questionnaire guide indicated approximately 20 minutes to complete the questionnaire. Another possible reason for lack of response may have been the number of questions on the self-report questionnaire. Questions on global and local connections were included in the questionnaire but were not explicit skills covered in the programme, though links to global and local connections could be made through various programme elements, including the entrepreneur stories and videos. Another limitation of this study is the lack of student voice. This was much discussed at the beginning of this study and acknowledged by the research team. Due to time constraints for the completion of this project, the research team were not in a position to survey and interview students, only teachers. The research team hopes the findings of this pilot study will complement and support future programme reviews, which must include other major stakeholders, including students, school leaders and parents/guardians.

Conclusion

This research indicates teachers' overall positive attitudes and perspectives of the 'Magical Leaders' 21st-century skills-based programme while also presenting the challenges to programme delivery. Students' skills of critical thinking, collaboration, communication, and creativity and innovation were especially well developed and support wider literature on the positive impact of school-based skills interventions (Durlak et al., 2011; Clarke et al., 2015; Durlak et al., 2015; Corcoran et al., 2018). Issues raised by teachers included the programme's digital components, teacher training, preparation time, physical resources, and adherence to programme fidelity. On the subject of teacher training, this speaks to the literature on building the capacity of teachers to teach to a broader set of skills (Reimers, 2020; 2021) and the need for high-quality initial teacher preparation and professional support (Jensen et al., 2012) to achieve this higher standard. Teachers and students indicated positive perspectives of

the peer-to-peer teaching methodology while also highlighting its challenges. This study supports broad consensus in the literature suggesting the positive effects students can have on the learning of their peers (Epple and Romano, 2011; Sacerdote, 2011). It also highlights the efficacy of peer-to-peer teaching as a methodology that is likely dependent on said peers' ability levels, indicating that low-ability students suffer from the absence of high-ability peers to teach them in such scenarios (Kimbrough et al., 2022).

References

Ananiadou, K. and Claro, M. (2009) '21st century skills and competences for new millennium learners in OECD countries', *OECD Education Working Papers*, 41. doi: <http://dx.doi.org/10.1787/218525261154>.

Bakhshaei, M., Hardy, A., Ravitz, J. and Seylar, J. (2020) *Instructional coaching holds promise as a method to improve instruction with technology*. Society for Information Technology & Teacher Education (SITE).

Barrett, M.D. (2016) *Competences for democratic culture: living together as equals in culturally diverse democratic societies*. Strasburg: Council of Europe Publishing.

Battelle for Kids (2019) *Framework for 21st century learning definitions*. [Online] Available at: <https://www.battelleforkids.org/learning-hub/learning-hub-item/framework-for-21st-century-learning-definitions> (Accessed: 16 August 2022).

Binkley, M., Erstad O., Herman, J., Raizen, S., Ripley, M., Miller-Ricci, M. and Rumble, M. (2012) 'Defining twenty-first century skills', in Griffin, P., McGaw, B. and Care, E. (eds.) *Assessment and teaching of 21st century skills*. Dordrecht: Springer, pp.17–66.

Boyaci, D.B. and Atalay, N. (2016) 'A scale development for 21st century skills of primary school students: a validity and reliability study', *International Journal of Instruction*, 9(1), pp.133–135. doi: <https://doi.org/10.12973/iji.2016.9111a>.

Boyd, T. (2021) 'Education reform in Ontario: building capacity through collaboration', in Reimers, F.M. (ed.) *Implementing deeper learning and 21st century education reforms*. Cham: Springer. doi: https://doi.org/10.1007/978-3-030-57039-2_2.

Boud, D., Cohen, R. and Sampson, J. (1999) 'Peer learning and assessment', *Assessment & Evaluation in Higher Education*, 24(4), pp.413–426.

Braun, V. and Clarke, V. (2021) *Thematic analysis: a practical guide to understanding and doing*. SAGE Publications.

Bree, R.T. and Gallagher, G. (2016) 'Using Microsoft Excel to code and thematically analyse qualitative data: a simple, cost-effective approach', *All Ireland Journal of Higher Education*, 8(2).

Care, E., Kim, H., Anderson, K. and Gustafsson-Wright, E. (2017) *Skills for a changing world: national perspectives and the global movement*. Washington, DC: Brookings Institution Reports.

Chalkiadaki, A. (2018) 'A systematic literature review of 21st century skills and competencies in primary education', *International Journal of Instruction*, 11(3), pp.1–16. doi:10.12973/iji.2018.1131a.

Chaudhry, R. and Tajwar, A.W. (2021) 'The Punjab schools reform roadmap: a medium-term evaluation', in Reimers, F.M. (ed.) *Implementing deeper learning and 21st century education reforms*. Cham: Springer. doi: https://doi.org/10.1007/978-3-030-57039-2_5.

Chen, D. (2019) 'Toward an understanding for assessing 21st-century skills: based on literature and national assessment practice', *The annual meeting of the National Council on Measurement in Education (NCME)*. Toronto, Ontario, Canada 4–8 April. [Online] Available at: <https://eric.ed.gov/?id=ED606274> (Accessed: 14 September 2022).

Clarke, A.M., Morreale, S., Field, C.A., Hussein, Y. and Barry, M.M. (2015) *What works in enhancing social and emotional skills development during childhood and adolescence? A review of the evidence on the effectiveness of school-based and out-of-school programmes in the UK*. National University of Ireland Galway: World Health Organization (WHO) Collaborating Centre for Health Promotion Research .

Collaborative for Academic, Social, and Emotional Learning (CASEL) (2012) *Effective social and emotional learning programs: preschool and elementary school edition. CASEL guide 2013*. Collaborative for Academic, Social, and Emotional Learning.

Corcoran, R.P., Cheung, A.C.K., Kim, E. and Xie, C. (2018) 'Effective universal school-based social and emotional learning programs for

improving academic achievement: a systematic review and meta-analysis of 50 years of research', *Educational Research Review*, 25, pp.6–72. doi: <https://doi.org/10.1016/j.edurev.2017.12.001>.

Creswell, J.W. and Clark, V.L.P. (2017) *Designing and conducting mixed methods research*. SAGE Publications.

Dede, C. (2010) 'Comparing frameworks for 21st century skills', in Bellanca, J.A. and Brandt, R.S. (eds.) *21st century skills: rethinking how students learn*. Bloomington, IN: Solution Tree Press, pp.51–76.

Krause, D. & Denzin, N.K. 1989, *The Research Act: A Theoretical Introduction to Sociological Methods*, American Sociological Association.

DQ Institute (2019) *DQ global standards report 2019: common framework for digital literacy, skills and readiness*. [Online] Available at: <https://www.dqinstitute.org/wp-content/uploads/2019/03/DQGlobalStandardsReport2019.pdf> (Accessed: 14 September 2022).

Durlak, J.A., Weissberg, R.P., Dymnicki, A.B., Taylor, R.D. and Schellinger, K.B. (2011) 'The impact of enhancing students' social and emotional learning: a meta-analysis of school-based universal interventions', *Child Development*, 82(1), pp.405–432. doi: <https://doi.org/10.1111/j.1467-8624.2010.01564.x>.

Eckert, S.A. (2013) 'What do teaching qualifications mean in urban schools? A mixed-methods study of teacher preparation and qualification', *Journal of Teacher Education*, 64(1), pp.75–89.

Epple, D., Newlon E. and Romano, R. (2022) 'Ability tracking, school competition and the distribution of educational benefits', *Journal of Public Economics*, 83(1), pp.1–48.

EASEL Lab at the Harvard Graduate School of Education (no date) *Navigate the complex field of social and emotional learning*. Available at: <http://exploresel.gse.harvard.edu> (Accessed: 14 September 2022).

Friederichs, A. (2019) 'Peers teaching peers', *TD Magazine*, 2 January.

Fomiškina, J., Woogen, E., Peiris, A., Abdulrazzak, S. and Cameron, E. (2021) 'Nurturing every learner's potential: education reform in Kenya', in Reimers, F.M. (ed.) *Implementing deeper learning and 21st century education reforms*. Cham: Springer. doi: https://doi.org/10.1007/978-3-030-57039-2_6.

Fusch, P., Fusch, G.E. and Ness, L.R. (2018) 'Denzin's paradigm shift: Revisiting triangulation in qualitative research', *Journal of social change*, 10(1), p.2.

Gory, D., Bhatia, J. and Reddy, V.R.M. (2021) 'From content knowledge to competencies and exams to exit profiles: education reform in Zimbabwe', in Reimers, F.M. (ed.) *Implementing deeper learning and 21st century education reforms*. Cham: Springer. doi: https://doi.org/10.1007/978-3-030-57039-2_7.

Griffin, P. and Care, C. (2014) *Assessment and teaching of 21st century skills: methods and approach*. Dordrecht: Springer.

Hall, R. (2013) 'Mixed methods: in search of a paradigm', in *Conducting research in a changing and challenging world*. Nova Science Publishers, pp.71–78.

Hattie, J. (2009) *Visible learning: a synthesis of over 800 meta-analyses relating to achievement*. Routledge.

Hixson, N.K., Ravitz, J. and Whisman, A. (2012) *Extended professional development in project-based learning: impacts on 21st century skills teaching and student achievement*. West Virginia Department of Education.

Islas, P.M., Calef, A.K. and Aparicio, C. (2021) '2013 Mexico's education reform: a multi-dimensional analysis', in Reimers, F.M. (ed.) *Implementing deeper learning and 21st century education reforms*. Cham, Springer. doi: https://doi.org/10.1007/978-3-030-57039-2_4.

Jensen, B., Hunter, A., Sonnemann, J. and Burns, T. (2012) *Catching up: learning from the best school systems in East Asia*. Grattan Institute.

Jamali, U.A.Y. (2019) 'Fostering creativity using robotics among gifted primary school students', *Gifted and Talented International*, 34(1-2), pp.71-78. doi: <https://doi.org/10.1080/15332276.2020.1711545>.

Joyes, C., Rossignoli, S. and Fenyiwa Amonoo-Kuofi, E. (2019) *21st Century Skills: evidence of issues in definition, demand and delivery for development contexts (K4D helpdesk report)*. Brighton, UK: Institute of Development Studies.

Kelly, S. (2017) 'Shared principles of causal inference in qualitative and quantitative research', in Wyse, D., Selwyn, N., Smith, E. and Suter, L.E. (eds.) *The BERA/SAGE handbook of educational research*. SAGE Publications, Limited, pp.90-115.

Kimbrough, E.O., McGee, A.D. and Shigeoka, H. (2022) 'How do peers impact learning? An experimental investigation of peer-to-peer teaching and ability tracking', *Journal of Human Resources*, 57, pp.1-37.

Kotsiou, A., Fajardo-Tovar, D.D., Cowhitt, T., Major, L. and Wegerif, R. (2022) 'A scoping review of future skills frameworks', *Irish Educational Studies*, 41(1), pp.171-186.

Lee, Y.J. and Greene, J. (2007) 'The predictive validity of an ESL placement test: a mixed methods approach', *Journal of Mixed Methods Research*, 1(4), pp.366-389.

McGuinness, C. (2018) *Research-informed analysis of 21st century competencies in a redeveloped primary curriculum: final report*. [Online] Available at: https://www.ncca.ie/media/3500/seminar_two_mcguinness_paper.pdf (Accessed: 14 September 2022).

Organisation for Economic Co-operation and Development (OECD) (2018) *The future of education and skills: education 2030*. OECD.

Organisation for Economic Co-operation and Development (OECD) (2019) *OECD future of education and skills 2030 conceptual learning framework: core foundations for 2030*. OECD.

Partnership for 21st century learning. (2019) *Framework for 21st Century Learning Definitions Battelle for Kids*. Partnership for 21st century learning. Accessed May 2021. https://static.battelleforkids.org/documents/p21/P21_Framework_DefinitionsBFK.pdf.

Pellegrino, J.W. (2017) 'Teaching, learning and assessing 21st century skills', in Guerriero, S. (ed.) *Pedagogical knowledge and the changing nature of the teaching profession*. Paris: OECD Publishing, pp.223–251.

Pellegrino, J.W. and Hilton, M.L. (2012) *Education for life and work: developing transferable knowledge and skills in the 21st century*. Washington, DC: The National Academic Press.

Piaget, J. (1985) *Equilibration of cognitive structures: the central problem of intellectual development*. Translated by Terrance Brown and Kishore Julian Thampy. Chicago: University of Chicago Press.

Ponferrada-Arteaga, M. and Carrasco-Pons, S. (2010) 'Togetherness, coexistence or confrontation — the impact of school climate and culture on peer-to-peer social relations in Catalonia, Spain', *Mediterranean Journal of Educational Studies*, 15(1), pp.87–107.

Rajandiran, D. (2021) 'Singapore's teacher education model for the 21st century (TE21)', in Reimers, F.M. (ed.) *Implementing deeper learning and 21st century education reforms*. Cham: Springer. doi: https://doi.org/10.1007/978-3-030-57039-2_3.

Ravitz, J., Bakhshaei, M., Hardy, A. and Seylar, J. (2020) 'Assessing classroom technology use for 21st century skills: a research-based rubric', *International Society for Technology in Education (ISTE)*. Anaheim, United States 28 November–1 December.

Reimers, F.M. (2021) 'In search of a twenty-first century education renaissance after a global pandemic', in Reimers, F.M. (ed.) *Implementing deeper learning and 21st century education reforms*. Cham: Springer. doi: https://doi.org/10.1007/978-3-030-57039-2_1.

Reimers, F.M. (ed.) (2020) *Empowering teachers to build a better world: how six nations support teachers for 21st century education*. Singapore: Springer Singapore.

Stehle, S.M. and Peters-Burton, E.E. (2019) 'Developing student 21st century skills in selected exemplary inclusive STEM high schools', *International Journal of STEM Education*, 6(1), pp.1–15. doi: <https://doi.org/10.1186/s40594-019-0192-1>.

Sinay, E., Resendes, M. and Graikinis, D. (2015) *Fostering entrepreneurial thinking and entrepreneurship learning in the Toronto District School Board: assessing teachers' and administrators' attitudes, perceptions, knowledge, skills and practices and students' mindset and self-efficacy*. Research report no. 14/15–29. Toronto, Ontario, Canada: Toronto District School Board.

Shear, L., Means, B., Gallagher, L., House, A. and Langworthy, M. (2010) *ITL research design*. Menlo Park, CA: SRI International.

Sonia, G. (2017) *Educational research and innovation pedagogical knowledge and the changing nature of the teaching profession*. OECD Publishing.

Topping, K.J. (2005) 'Trends in peer learning', *Educational Psychology: An International Journal of Experimental Educational Psychology*, 25(6), pp.631–645. doi: <https://doi.org/10.1080/01443410500345172>.

United Nations Educational, Scientific and Cultural Organization (UNESCO) (2019) *Educational content up close: Examining the learning dimensions of education for sustainable development and global citizenship education*. Paris: UNESCO.

United Nations Educational, Scientific and Cultural Organization (UNESCO) (2021) *Futures literacy: an essential competency for the 21st century*. Available at: <https://en.unesco.org/futuresliteracy/about> (Accessed: 14 September 2022).

van der Graaf, J., van de Sande, E., Gijssels, M. and Segers, E. (2019) 'A combined approach to strengthen children's scientific thinking: direct instruction on scientific reasoning and training of teacher's verbal support', *International Journal of Science Education*, 41(9), pp.1119–1138. doi: <https://doi.org/10.1080/09500693.2019.1594442>.

Vander Ark, T. and Schneider, C. (2014) *Deeper learning for every student every day*. Getting Smart.

Voogt, J. and 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), pp.299–321.

Wan Yusoff, W.M., Hashim, R., Khalid, M., Hussein, S. and Kamalludeen, R. (2018) 'The impact of hikmah (wisdom) pedagogy on 21st century skills of selected primary and secondary school students in Gombak District Selangor Malaysia', *Journal of Education and Learning*, 7(6), pp.100–110. doi: <https://doi.org/10.5539/jel.v7n6p100>.

Williams-McBean, C. (2019) 'The value of a qualitative pilot study in a multi-phase mixed methods research', *Qualitative Report*, 24(5), pp.1055–1064. doi: <https://doi.org/10.46743/2160-3715/2019.3833>.

World Economic Forum. (2020). '*The future of jobs report 2020*'. Retrieved from Geneva.