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Editorial

EDITORIAL: Thinking About Learning

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Abstract

This volume contains four articles that address the idea of how technology tools can enhance teaching and learning. Judy Henning and her colleagues look at the relationship between prior experience with 1:1 computing and its impact on teacher preparation. Annika Buell and Sohyun Meacham share their work to develop critical thinking regarding online text in second graders. human apart from and in concert with learning technologies. In their literature review, Hongyan Yang and Rachel Wong highlight research around the use of ePortfolios in post-secondary education. Finally, Matthew Botkin reviews Al Kingsley's book My Secret #EdTech Diary.

Keywords: *educational technologies; K-12 education; higher education; learning technologies; educational platforms; ePortfolios; digital literacy; critical thinking; Issues and Trends in Learning*

In my job as Associate Professor of Science and Computer Science Education and Associate Dean of the School of Education at Manhattanville University, I have recently been in frequent conversations – as no doubt many of us have – that are thinking about the ways that technologies can enhance the learning of K-16 students and the development of those who teach them. Too often, these discussions are focused more on tools that I would like: How will generative AI enhance and/or destroy learners and learning everywhere? How can learning management systems' analytics be used to capture/improve student engagement? What technologies should teacher candidates engaged with as part of their teacher preparation programs?

As a result of these discussions, I find myself wanting to think more and more deeply and, most importantly, first, about learning and how we engage ourselves and our students in learning itself. Once we do that, we can then more productively think about the technologies and techniques that can enhance learning.

> *A paintbrush is as much a technology as a manufacturing plant, and teaching is far more akin to painting than manufacturing, though it shares many common features with both. Teaching can be thought of as the application of tools,*

> *methods, principles, techniques, and structures to help people learn… (Dron, 2024, p. 3)*.

In this issue, we have collected a set of articles that focus on some technologies that can contribute to learning. Judy Henning and her colleagues look at the relationship between prior experience with 1:1 computing and its impact on teacher preparation. Annika Buell and Sohyun Meacham share their work to develop critical thinking regarding online text in second graders. In their literature review, Hongyan Yang and Rachel Wong highlight research around the use of ePortfolios in post-secondary education. Finally, Matthew Botkin reviews Al Kingsley's book My Secret #EdTech Diary.

Excelsior!

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Surveyed Preservice Teachers Reveal Skills Acquired From 1:1 Environment

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Abstract

Are high school students ready for their postgraduate education or a career that may not have been invented yet? As teachers focus on career prep and the necessary future-ready skills in the classroom, teachers are using technology to hone skills necessary for students' future success. Success in higher education or career pursuits requires students to develop a combination of technology through student-centered, project-based learning around the 4Cs (critical thinking/problem solving, communication, collaboration, and creativity/innovation). The literature on technology skills and 4C skills has historically focused on one set of skills or the other in isolation. This research addresses this gap in the literature by comparing the acquisition of the two skill sets to each other in the same (1:1 technology) environment. This is a mixed methods study using survey data collected from pre-service teachers in an education course. The study aims to understand what technology and 4C skills pre-service teachers who graduated from a 1:1 technology high school possess. The findings of this study showed that the respondents are more prepared and comfortable using their 4C skills than their technology skills. The potential implications of technology and 4C skills deficiencies and strengths on future teaching practices are discussed. technology) environment.

Keywords: *1:1 instructional technology; career readiness, teacher perception, P21 framework, 4Cs, student-centered learning, project-based learning*

When considering instructional technology's role in education and its importance in our schools, one only needs to start with the investment schools and districts are making. United States schools were expected to spend $27.6 billion (about $85 per person in the US) on educational technology in 2021 (Nagel, 2021). According to EdTech Evidence Exchange, U.S. public schools were spending $26-$41 billion (about $130 per person in the US) per year on educational technology before the COVID-19 pandemic (Bamforth, 2021). As schools locked down and went to virtual learning during the pandemic, it only makes sense that school technology expenditures increased even more.

A report by the Education Technology and Smart Classroom Global Market Trajectory and Analysis predicted that global education tech expenditures will reach $195.7 billion (about $600 per person in the US) in 2026. If schools are investing their limited resources in such significance, there must be a reason why they believe in its ability to benefit students (CISION PR Newswire, 2022).

Literature Review

In 2021, approximately 90% of secondary schools in the U.S. were 1:1 computing environments, with school districts purchasing a device for each student. That same year, 84% of elementary schools also provided a device for each student (Bushweller, 2022). U.S. school districts are embracing 1:1 computing in their schools and using educational funds to leverage technology with a goal of increasing student academic achievement (Sauers & McLeod, 2018).

Instructional technology can be used to address the digital divide and re-imagine learning experiences for students (U.S. Department of Education Office of Educational Technology, 2017). Opportunities include providing virtual learning options when physical options are not available and taking the learning outside of the school building (i.e., museums, virtual field trips, etc.). The literature shows multiple ways in which instructional technology can benefit schools and students. Several studies show that the integration of instructional technology tools has led to increased student motivation and engagement (Olson et al., 2015; Urrea, 2010; Mouza, 2008; Bebell & Kay, 2010). Instructional technology integration has also been shown to increase individualized and student-centered learning and instruction (Dunleavy et al., 2007; Hallman, 2019). Students in technology-infused classrooms are also shown to be less reliant on the teacher for assistance (Clariana, 2009).

The integration of instructional technology in classrooms has been linked to increased instructional flexibility as well as more small group and collaborative work (Shapley et al., 2011; Bebell & Kay, 2010). Instructional technology integration has also been shown

to create more meaningful instructional moments and deeper learning (Mouza, 2008; Maninger & Holden, 2009). Research also shows that instructional technology has also been used to make remote learning more manageable and to help close achievement gaps.

Student computer access facilitates personalized project-based learning, a successful teaching strategy. The 4Cs include critical thinking/problem solving, communication, collaboration, and creativity/innovation (D'Addario, 2022). Project-based learning allows educators to incorporate projects focusing on the 4Cs to teach students the digital skills needed to thrive in a global society (Trilling & Fadel, 2009). Project-based learning hones the 4Cs and encourages students to create knowledge rather than just consume it. These projects allow students to take ownership of their learning as they tackle relevant topics found in the real world. "Therefore the 21st century requires that students acquire the 4Cs (communication, collaboration, critical thinking and creativity) on how to engage with the information and not just receive it" (Tunjera & Chigona, 2020, p. 126).

Trilling and Fadel (2009) explain that critical thinking/problem solving develops expert thinking skills, communication/collaboration develops complex communication skills, and creativity/innovation develops applied imagination and invention skills. "These skills are the keys to unlocking a lifetime of learning and creative work . . . The 21st century global economy is also requiring higher levels of imagination, creativity, and innovation to continually invent new and better services and products for the global marketplace" (Trilling & Fadel, 2009, p. 49). Teachers integrate technology and digital skills in the curriculum to ensure students are successful in education, career, and a global society.

Twenty-first-century skills, including the 4Cs, are important to make students ready for careers that may not currently exist. Richard Riley, former U.S. Secretary of Education (1993-2001) said, "We are currently preparing students for jobs that don't yet exist…using technologies that haven't been invented…in order to solve problems we don't even know are problems yet" (Bednar, 2022, para 1). By teaching digital skills through the 4Cs, students can be career ready. "Career readiness means equipping students with a nuance set of skills that can prepare them for the unknown" (Buckle, n.d., para. 6).

Educators should never use technology for the sake of using technology. "Teaching with technology goes beyond mere acceptance of digital tools but should be purposefully applied in their daily practices to achieve teaching and learning goals" (Tondeur et al., 2020, p. 127). An educator preparing students for a job that has not been invented must know more than how to navigate an application. Students must be

able to apply knowledge of that application to relevant real-world problems. By actively engaging in technology through student-centered projects, students can acquire the skills needed to know how the same application can be used to problem-solve in other areas. “The 21st century communication encourages a shift from the traditional teacher-centered to digital learner-centered strategies in order to develop the 4Cs” (Tunjera & Chigona, 2020, p. 132).

Beginning in 2004, a qualitative longitudinal Canadian study explored the development and retention of the digital skills in middle school students who experienced 1:1 middle-level technology in 2004 (Leger & Freiman, 2016). After ten years, students were interviewed about their technological skills and how their tech savviness impacted their success in education and career. The interviews reveal students “are competent in information and communication technology skills (and) seem better able to solve problems in the technologically rich environment” (Leger & Freiman, 2016, p. 58).

These interviews show students felt confident and empowered by their tech prowess. For example, “The world of computers is an ever-changing one, so adaptability is an important trait to have if you want to survive in an increasing digital workplace” (Leger & Freiman, 2016 p. 63). Students in the study felt confident in their digital literacy skills so they could be resourceful and knew how to adjust to the changes in technology. Students acquired three specific digital skills identified in the Canadian study. “These digital skills are technological resourcefulness, digital self-efficacy (empowerment), and open-mindedness toward technology” (Leger & Freiman, 2016 p. 64). The proficiency of these digital skills varied with each of the student study participants.

Theoretical Framework

The theoretical background for this study was based on the Partnership for 21st Century Learning (P21) framework. In 2002, the Partnership for 21 Century Skills was founded as a nonprofit organization that included a coalition of business leaders, policymakers and educational leaders discussing the importance of establishing future-ready P21 technology skills in today’s students (Battelle for Kids, n.d., para. 1). This group was later changed to Partnership for 21st Century Learning. This framework is “A unified vision for learning to ensure students success in a world where change is constant and learning never stops” (Battelle for Kids, 2019, para. 1). This framework identifies the key innovation and learning skills as creativity, critical thinking, communication, and collaboration, also as the 4Cs. Using technology to provide students with the 4Cs is essential in making students successful in the 21st century.

The theoretical basis for the P21 framework is a construct that students must be given the proper opportunities to prepare them for careers and success in the workplace

(Remake Learning, 2016). Students gain these skills by “engaging in activities that promote creativity, critical thinking, communication, and collaboration-the P21’s research based 4Cs. Many of these opportunities for integrating core knowledge and critical thinking skills stem from technological literacy and related areas like media literacy" (Remake Learning, 2016, para. 5).

In schools, a 1:1 environment for technology is when all students are provided with their own mobile computing devices. “One-to-one refers to one computer for every student” (Great School Partnerships, 2013 para 1). The purpose of this is to contribute to the limited but growing body of research on the impact of a 1:1 technology environment’s impact on students' preparedness with the 4Cs. Thus, the guiding research question of this study is: Are pre-service teachers who graduated from a 1:1 technology environment more prepared in their career-ready technology skills or in their 4C skills?

Methodology

This research builds upon a previous article (Artman et al, 2022) published in a 2022 issue of *Issues and Trends in Instructional Technology.* It adds further knowledge to the subject matter, specifically when addressing the research question. For this mixed method research project, a confidential Likert Scale survey was created (1- Very Low, 5- Very High) to evaluate technology and career readiness skills. The survey consisted of 30 Likert Scale questions, plus 6 background questions and 2 qualifying questions. The 2 qualifying questions eliminated potential participants who did not attend a 1:1 middle school or high school or who had already taken a college-level course on instructional technology, as we were interested in examining pre-service teachers who were technological novices. For this research project, the qualifying questions, one background question, and 15 career readiness skill questions were analyzed. The survey was conducted after IRB approval was received. Respondents completed the survey during two separate semesters (fall 2020 and spring 2021) of TE100 Teaching in a Democratic Society, an introductory teaching course, at a regional public Midwestern university.

After gaining instructor approval, students in TE100 were invited to participate in the study either face-to-face or via email. Participation was anonymous and voluntary; students could choose to participate or not without consequence or reward. After qualifying questions and incomplete surveys, the final N for the project was 89. Data were collected on 15 questions related to career readiness technology skills and the 4Cs of education (communication, collaboration, critical thinking, and creativity). Responding students were also asked to rate the extent to which they felt instructional technology was an integral part of their educational experience.

The introductory education pre-service course was selected because the students in the course were most likely to have the most recent high school and middle school experience with 1:1 technology. Due to the course's introductory level, students were also less likely to have taken college-level instructional technology coursework which would have eliminated them as potential participants. Subjects were provided online access to the survey via a Qualtrics link, and data was downloaded and secured by a two-factor authentication system. Analysis for correlation was conducted on student survey responses.

Findings

Correlation was calculated using SPSS among 15 questions on pre-service teachers' comfort level in using the 4Cs (critical thinking/problem solving, communication, collaboration, and creativity/innovation) and the background question. Once completed, the correlation was compared to the previous study (Artman et al., 2022) on the student's comfort level with technology skills.

Results

Table 1. Table 1 summarizes the characteristics of the data set including range, mean, and standard deviation of the 15 technology and career readiness skills questions and the background question.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Please rate your comfort/ability level collaborating with classmates on an academic project using technology tools.	89	2	5	3.93	.77
Please rate your comfort level/ability collaborating with classmates using technology tools to communicate instead of being in the same location.	89	2	5	3.88	.86
Please rate your comfort level/ability to create a presentation (PowerPoint, Google Slides, video, etc.) to present to your classmates.	89	3	5	4.42	.69
Please rate your comfort level presenting in front of a class or a group or your peers.	89	1	5	3.45	1.12
Please rate your ability to express your ideas fully, clearly, and professionally in an online setting.	89	2	5	3.80	.81
Please rate your comfort level/ability to find creative solutions to real life problems.	89	2	5	3.80	.77
Please rate your ability to express yourself using media (artwork, images, video, music, etc.)	89	1	5	3.44	.94

created using online or digital tools.					
Please rate how much you agree with this statement: My middle school/high school teachers used instructional technology tools and/or internet resources to encourage collaboration between classmates.	89	2	5	3.78	.94
Please rate how much you agree with this statement: My middle school/high school teachers used instructional technology tools and/or internet resources to encourage communication between students and teachers.	89	1	5	3.83	1.04
Please rate how much you agree with this statement: My middle school/high school teachers used instructional technology tools and/or internet resources to enhance communication skills in their students.	88	1	5	3.57	.99
Please rate how much you agree with this statement: My middle school/high school teachers used instructional technology tools and/or internet resources to encourage creativity in their students.	89	1	5	3.63	1.04
Please rate how much you agree with this statement: My middle	89	1	5	3.65	.98

school/high school teachers used instructional technology tools and/or internet resources to enhance critical thinking skills in their students.					
Please rate how much you agree with this statement: My middle school/high school teachers used instructional technology tools and/or internet resources to help me view problems from different points of view/perspectives.	89	1	5	3.67	.93
Please rate how much you agree with this statement: My middle school/high school teachers used instructional technology tools and/or internet resources to help me brainstorm new ideas.	89	1	5	3.80	.97
Please rate how much you agree with this statement: My middle school/high school teachers used instructional technology tools and/or internet resources to encourage discussion about real life scenarios, issues, and problems.	89	1	5	3.64	.99
Please rate how much you agree with this statement: Instructional technology was a central part of my education in middle school and/or high school.	89	1	5	3.74	1.01

The standard deviation of 12 of the questions is below 1.0, which indicates a low variance. This low variance allows for better predictions to be made from the data set. The mean of means is 3.75, which indicates a high overall level of confidence from respondents in their technology skills.

The results of our analysis of correlation are depicted in Table 2, results suggest that 10 out of 15 correlations were statistically significant on these questions with a p<.05 at the two-tailed level. Of those 10, five were statistically significant at the p<.01 level and five were significant at the p<.05 level. A total of five technology skill questions were not correlated at the significant level. These are questions 4, 6, 10, 13, and 15. Results broadly indicate that students' comfort level and ability to implement technological components in their classrooms is positively correlated with feeling instructional technology was a central part of their own education at the middle and high school level.

Table 2. Table 2 details the correlation between the technology skills questions and the background.

Correlation Data

Background Question: Instructional technology was a central part of my education in middle school and/or high school.	
Variable – Technology Skill	Correlation
Collaborate with classmates on an academic project using technology tools	.682**
Collaborate with classmates using technology tools to communicate instead of being in the same location	.384**
Create a presentation to present to classmates	.325**
Presenting in front of a class or group or your peers	.148
Express your ideas fully, clearly, and professionally in an online setting	.425**
Find creative solutions to real life problems	.155
Express yourself using media created using online or digital tools	.261*
Agree with the statement: My middle school/high school teachers used instructional technology tools and/or internet resources to: (next eight variables)	
Encourage collaboration between classmates	.321**
Encourage communication between students and teachers	.213*
Enhance communication skills in their students	.125
Encourage creativity in their students	.241*
Enhance critical thinking skills in their students	.209*
Help me view problems from different points of view/perspectives	.122
Help me brainstorm new ideas	.241*
Encourage discussion about real life scenarios, issues, and problems.	.195
**** p<0.01 (2-tailed); * p<0.05 (2-tailed)**	

To establish reliability on the novice measure, or a never before distributed survey instrument, an analysis was conducted to establish a Cronbach Alpha score. It is

generally recognized that a score above .7 is acceptable and anything above .8 is optimal. This would indicate a strong internal consistency of the items being measured. Internal consistency of the items on this instrument was found to be excellent with a Cronbach Alpha coefficient of .911.

Summary

This project was designed as exploratory research to gauge the confidence level of pre-service teachers with their technology and 4C skills. The research focused on pre-service teachers who attended middle school or high school in a 1:1 technology environment. The researchers found that respondents had a higher level of confidence in their ability with the 4Cs than in their technology skills. Results from the 2022 study based on respondents' confidence in their own ability to implement different technological components in their classrooms found that of the 15 included questions, 13 were significantly correlated to the background question. Findings from this study found that 10 of the 15 questions based on student's ability with the 4Cs were significantly correlated to the same background question. An even distribution was observed across all 15 questions with five statistically significant highly correlated ($p<.01$), five statistically significant moderately correlated ($p<.05$) and five with no statistically significant correlation ($p>.05$). All 15 were positively correlated to the background question though.

Table 3. Table 3 details the correlational significance of the technology skills to the background question.

Correlation Data

Background Question: Instructional technology was a central part of my education in middle school and/or high school:		
Correlational Significance to Technology Skill		
Not Significant Low Correlation p > .05	Presenting in front of a class or group or your peers	.148
	Find creative solutions to real life problems	.155
	Enhance communication skills in their students	.125
	Help me view problems from different points of view/perspectives	.122
	Encourage discussion about real life scenarios, issues, and problems.	.195

	Presenting in front of a class or group or your peers	.148
Statistically Significant Moderate Correlation p < .05	Express yourself using media created using online or digital tools	.261
	Encourage communication between students and teachers	.213
	Encourage creativity in their students	.241
	Enhance critical thinking skills in their students	.209
	Help me brainstorm new ideas	.241
Statistically Significant High Correlation p < .01	Collaborate with classmates on an academic project using technology tools	.682
	Collaborate with classmates using technology tools to communicate instead of being in the same location	.384
	Create a presentation to present to classmates	.325
	Express your ideas fully, clearly, and professionally in an online setting	.425
	Encourage collaboration between classmates	.321

** p<0.01 (2-tailed); * p<0.05 (2-tailed)

When comparing the results of the current study to the earlier study (Artman et al., 2022), we observed some interesting trends. Results do show that while more questions from the first study were significantly correlated to the background question (13) than the fifteen 4C questions (10) in this study, the strength of those significant correlations was, on average, greater in the current study. When looking at the questions that were significantly correlated to the background question, the average correlation in the original study was .304 compared to .33 in this study.

Among the findings of note, the correlational data showed that respondents had the highest level of confidence in their ability to collaborate with others using technology tools (.682), using technology tools to communicate over distance (.384), and

expressing ideas fully and clearly in an online setting (.425). Respondents also expressed more confidence in their own abilities when the technology skills were active with hands-on, personal use while in middle and high school compared to when it was passive interaction with a teacher modeling the use of technology. Of the seven questions related to respondents' personal use of 1-1 technology in middle and high school, the average correlation was .34 and 4 were highly statistically significant ($p<.01$). There was a total of 8 questions that related to the respondents' teachers use of technology in the classroom during their middle and high school education. The average strength of their correlation to the background question was .21, with just 1 being highly statistically significant ($p<.01$).

Discussion

This research study set out to answer a central question: Are pre-service teachers who graduate from a 1:1 technology environment more prepared in their career-ready technology skills or in their 4C skills? General findings from an earlier study (Artman et al., 2022) show that respondents did not rate themselves as confident in their technology skills simply by virtue of having attended of a 1:1 technology environment as secondary students. Respondents in this study do rate themselves as more confident in their ability to use their 4C skills. This indicates a higher level of preparation with the 4Cs compared to their technology skills. This higher level of comfort may be attributed to preferred teaching styles and learning activities that are more student-centered (group work, research projects, presentations, etc.). The increased comfort level may also be attributed to the technology tools used in classrooms or materials potentially embedded in the curriculum that aid in the development of the 4Cs, but not in the development of technology skills.

Overall findings suggest that respondents who identified technology as a central component of their middle and high school experiences felt more confident in their overall general ability to implement different technological components in their future classrooms. The strength of that confidence was greater in their ability on the 4C questions. Respondents showed that they are more comfortable with certain 4C skills than others. Questions aligned to the collaboration area showed the overall strongest correlation to the background question, with an average correlation of .462. This would indicate that respondents feel the most comfortable using technology when it is being used to collaborate with classmates and peers both in person and from a distance. The category with the second strongest average correlation to the background question was the area of creativity with an average correlation of .269. The final two categories with the weakest correlation to the background question were communication (.228) and critical thinking/problem solving (.162). Questions involving in-person communication and presentation to peers reported the lowest correlation. This would indicate that while technology can help facilitate collaboration and the expression of thoughts and ideas

through media, it does not help improve confidence in one's ability to orally present when done in person.

Of note is the fact that respondents felt more confident as middle/high school students in their use of technology tools than they did in their teachers' ability to teach with technology. This may be attributed to respondents' bias or their status as digital natives while their teachers were digital immigrants (Prensky, 2001). The results of the study also support the findings of the longitudinal Canadian study (Leger & Freiman, 2016) indicating students from 1:1 technology schools were more tech-savvy and better able to problem-solve with technologies.

The results have generalizable implications for the respondents and other students. The lack of preparation in career-ready technology skills has the potential to negatively impact student success in career and higher education endeavors. The respondents' increased confidence in their 4C skills, specifically critical thinking and creativity may help them compensate for their lack of technology skills. The confidence also had the potential to aid the respondents in their higher education or unknown career goals.

Further Research

Because the respondents attended middle/high school prior to the COVID-19 pandemic, it may be of interest to survey another group of pre-service teachers to see if 1:1 technology use in the middle/high school classroom has changed post-pandemic. Since respondents felt more confident in their technology use than that of their teachers, passive vs. active technology use in teacher education programs should be the focus of future research. This study was conducted at a regional mid-western university, it may be worthwhile to replicate the survey at a different university to account for regional differences in the use of instructional technology.

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Using Internet Reciprocal Teaching to Develop Second Graders' Online Text Evaluation Skills

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Abstract
The current study examined the actions and thought processes second grade students experience while reading online, implementing a research based teaching strategy for new literacies, and Internet Reciprocal Teaching (IRT). In particular, strategies for how to critically evaluate online text were introduced to second grade students. Through IRT, second graders were able to evaluate online texts for relevance and credibility. Participants used several different strategies in determining credibility of online texts. They sought out more information about the website or author, used background knowledge about a particular website, looked at the URL, identified the number of ads on a webpage, and used other miscellaneous criteria. The current study can contribute to existing literature by exploring evaluation strategies that young students may already possess and addressing any possible relationships between IRT and evaluation strategies used by students while reading on the internet.

Keywords*:* online reading, Internet Reciprocal Teaching, online text evaluation, online reading comprehension.

Classrooms today have more access to the internet and technology than ever before (Kuiper et al., 2008; Leu et al., 2017). Increased access provides opportunities for students and teachers to engage with different types of texts than what was previously available. However, this change in access also creates additional challenges in teaching literacy (Leu et al., 2017). As reading online texts becomes more prevalent both in and outside of the classroom, the need for instruction in online comprehension strategies also increases (Forzani, 2018; Kiili et al., 2018; Kuiper et al., 2008; Leu et al., 2017). Leu et al. (2017) encouraged researchers to examine further how students can be supported in developing the online reading comprehension skills and strategies required to be literate in the 21st century.

New literacies include the skills and strategies needed to comprehend online text (Coiro & Dobler, 2007; Leu et al. 2017). In the context of this study, online reading comprehension refers to the "new literacies of online research and comprehension" which includes a set of skills and strategies specific to reading on the internet (Leu et al., 2017, p. 7). New literacies researchers have determined that the skills and strategies needed to comprehend online texts are similar, yet more complex than traditional, or offline, reading comprehension skills (Coiro, 2011; Leu et al. 2017). There are four core skills that differ from traditional reading comprehension skills when applied in an online context: locating information, evaluating information, synthesizing information, and communicating information (Coiro, 2011; Forzani, 2018; Henry et al., 2012; Kiili et al., 2018; Leu et al., 2017; Sung et al., 2015; Wiley et al., 2009). While many traditional reading skills contribute to online reading comprehension, there are additional strategies needed to navigate the multiple dimensions of the internet (Coiro, 2011; Leu et al., 2017). For example, when reading online, readers often have to work with search engines, use hyperlinks, read in various text structures, and navigate texts with multiple media such as pictures, graphics, videos, and animations (Corio, 2011; Henry et al., 2012; Leu et al., 2014). In addition, the internet allows anyone to post regardless of biases or credibility. Readers of the internet then have to make important decisions about which websites or texts are reliable and which are not (Forzani, 2018; Kuiper et al., 2008; Wiley et al., 2009).

The added complexities of reading in an online environment present a unique need for instruction in new literacies for successful online reading comprehension (Coiro, 2011; Forzani, 2018; Kuiper et al., 2008; Leu et al., 2017; Wiley et al., 2009). While some students may have experience using computers and navigating the internet at home, others may not. Over the past two decades, there has been much conversation about the traditional, or offline reading achievement gap (Leu et al., 2014). The offline reading achievement gap refers to the difference between reading test scores on the National Assessment of Educational Progress (NAEP) for students from higher socioeconomic

status and students from lower socioeconomic status (Leu et al., 2014; National Assessment of Educational Progress, 2019). A gap in reading scores for students who qualify for the National School Lunch Program and those who do not qualify for the program has existed for many years (National Assessment of Educational Progress, 2019). With a lack of instruction in the area of online reading comprehension skills and strategies, an achievement gap separate from the offline reading achievement gap has emerged (Leu et al., 2014). In Leu et al.'s (2014) study, researchers found a separate achievement gap for online reading ability among the same groups as the traditional achievement gap. Researchers are calling for changes in policy related to online reading comprehension (Leu et al., 2014) as well as encouraging schools to begin teaching online reading comprehension skills and strategies at an earlier age (Forzani, 2018). Researchers have identified critical evaluation as one of the new literacies for online reading comprehension that students are lacking the most (Forzani, 2018; Leu et al., 2014; Wiley et al, 2009).

Researchers have made progress in outlining some of the skills and strategies required for online reading comprehension and advocate for additional instruction in these areas (Coiro, 2011; Forzani, 2018; Henry et al., 2012; Kiili et al., 2018; Leu et al., 2014; Sung et al., 2015; Wiley et al., 2009). Some studies have focused on specific instructional practices to teach online reading comprehension (Colwell et al., 2013; Henry et al., 2012; Kuiper et al., 2008; Leu et al., 2008; Wiley et al., 2009). These studies have included participants ranging from fourth grade to college students. One method for teaching online reading comprehension skills and strategies is Internet Reciprocal Teaching (IRT) (Colwell et al., 2013; Henry et al., 2012; Leu et al., 2008). IRT mirrors traditional reciprocal teaching in that teachers and students share the role of modeling strategies with students taking on more responsibility as their expertise increases (Leu et al., 2008). Henry et al. (2012) identified positive outcomes in terms of student strategy use and engagement through the use of IRT. Still, little research has been conducted to determine what teaching strategies may be effective for teaching the new literacies of online reading comprehension to younger students.

The current study examined the actions and thought processes second grade students go through while reading online, implementing a research-based teaching strategy for new literacies, Internet Reciprocal Teaching or IRT (Leu et al., 2008). In particular, strategies for how to critically evaluate online text were introduced to second grade students. The current study can contribute to existing literature by exploring evaluation strategies that young students may already possess and addressing any possible relationships between IRT and evaluation strategies used by students while reading on the internet.

Evaluating Online Text

Evaluating information in an online reading environment requires the reader to determine the reliability and relevance of the text they are reading (Coiro, 2011; Forzani, 2018; Henry et al., 2012; Kiili et al., 2018; Leu et al., 2014; Sung et al., 2015; Wiley et al., 2009). This is especially important in the online environment because of the plethora of texts created by an abundance of authors. Online texts can contain bias or inaccurate information and the reader must evaluate the trustworthiness of the author, web page, and information provided (Coiro, 2011; Leu et al., 2014; Kiili et al., 2018). Researchers have found that students frequently lack the ability to critically evaluate online text (Forzani, 2018; Leu et al., 2014; Wiley et al., 2009). Some other researchers observed that students lacked evaluation skills during their active research, but most were able to appropriately evaluate a website when directly asked (Colwell et al., 2013; Kuiper et al., 2008). Researchers have outlined several skills students need to be able to effectively evaluate online texts.

Kiili et al. (2018) identified two separate sub-skills within evaluating, "Questioning Credibility" and "Confirming Credibility" (p. 321). These sub-skills account for added complexities when evaluating commercial versus academic text and allow students to look beyond a domain name such as .com or .edu (Kiili et al., 2018). Questioning credibility refers to the practice of identifying potentially biased or persuasive statements or author's purposes and wondering about the trustworthiness of a particular author, article, or website (Kiili et al., 2018). Oftentimes young readers don't question the reliability of information they read on the internet and view it solely as a convenient information source (Kuiper et al, 2008). For this reason, modeling and practicing strategies for questioning credibility is important. Confirming credibility refers to the process of identifying indicators that a particular author, website, or information is trustworthy (Kiili et al., 2018). This could include reading several websites to find the same information or finding information about the author or website's credibility. These strategies may be new to young readers and thus require instruction. Colwell et al. (2013) suggests using open ended research tasks to promote the use of these critical evaluation strategies.

Forzani (2018) studied seventh graders' ability to evaluate the credibility of information within the context of an online science research task. This researcher describes knowledge-claim credibility, source credibility, and context credibility as main components included in credibility evaluation. The results indicated that students scored particularly poorly on the evaluation components—identifying the author, evaluating author expertise, evaluating author point of view, and evaluating web page credibility. The most common area students scored correctly on, however, was identifying the author. The least common area students completed correctly was evaluating the overall

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web page credibility. The author speculates that this may be because the evaluation process is not "well defined" and "thus not well taught" (p. 387). She suggests that evaluation be viewed as a process and students be taught to evaluate using the three tiers examined in this study, rather than learning skills in isolation. This study generally highlights the need for additional instruction in the area of evaluation. Because the seventh grade participants in this study struggled with evaluation skills, the researcher suggests beginning instruction for evaluation at a younger age. Other research also shows that many young readers lack evaluation skills in the online context (Coiro, 2011; Coiro & Dobler, 2007; Leu et al., 2014; Wiley et al., 2009). Therefore further research in the area of online text evaluation for young readers is required. While Forzani suggests continuing to teach and assess evaluation skills in conjunction with locating, synthesizing, and communicating skills because of their interconnectedness, certain evaluation skills may be more applicable to younger readers than to older readers. More research is still needed to determine what these skills specifically are (Kiili et al., 2018).

Internet Reciprocal Teaching

Reciprocal Teaching involves the teacher teaching a specific skill or strategy to a group of students, and then allowing students to work together in groups to model the strategy or teach one another (Henry et al., 2012; Leu et al., 2008). This model has been studied and used with print-based texts. Internet Reciprocal Teaching (IRT) builds off of this method in that students take on the role of modeling and teaching peers, but the focus is on skills and strategies needed when reading on the internet: locating, evaluating, synthesizing, and communicating information (Colwell et al., 2013; Henry et al., 2012; Leu et al., 2008). The IRT instructional model moves from teacher-led instruction to increasingly independent work with the majority of the instruction and meaning-making coming from peer collaboration (Colwell et al., 2013; Henry et al. 2012; Leu et al., 2008).

An exemplary description of IRT instruction by Henry et al (2012) explained three phases: "Phase I (teacher-led instruction) to Phase II (collaborative modeling) and Phase III (inquiry of the IRT model)" (p. 289). The teacher's lecture was minimized in their case to facilitate students' collaboration. Students were even allowed to select their own groups. The teacher's explicit instruction focused on essential strategies needed for online reading such as questioning, information search, critical evaluation of information, idea synthesis and communication in various formats. Their IRT model encouraged the students to assume experts' roles that support others' learning. For example, students who had expertise in a strategy were asked to demonstrate it to the classmates and were added to the classroom expert list for all students to know who can be a go-to person for the specific strategy.

Henry et al. (2012) examined three cases in which IRT and technology were used as motivating factors for struggling readers. This study was part of a larger study with a goal of observing how IRT impacts student roles in the classroom (Henry et al., 2012). In each case IRT was used and students selected their partners. The skills emphasized in the project were online reading comprehension skills: creating questions, locating information, evaluating information, synthesizing information, and communicating information. The researchers analyzed the data from interviews, observations, and screen and video recordings to find themes and patterns in "empowerment, engagement, and the development of new literacy skills" (Henry et al., 2012, p. 293). Results showed that two of the three students in these case studies improved in their online reading comprehension skills after the period of time using the IRT model. The third student, while not making academic gains, improved her attendance and her role within the classroom changed from watching and listening, to being actively engaged and viewed as a leader by her peers. All three students' attitudes toward learning were positively impacted by the IRT process as well. They were all observed having more positive interactions with peers. Due to the nature of IRT, each student was provided with opportunities to be identified as an expert and teach their peers skills they had mastered. This led to an increase in engagement and self-confidence for all three students. The researchers conclude that the IRT model could be a beneficial method to improve student empowerment and engagement in classroom learning activities while also teaching online reading comprehension skills, especially for struggling readers.

Colwell et al. (2013) studied the process of IRT to identify outcomes, obstacles, and suggestions for implementation. Colwell et al.'s (2013) study took place within the context of two seventh grade science classes. The teacher along with 48 seventh grade students participated in the study. Researchers observed the students and teacher, took field notes, and took on the teaching role during the teacher-led phase of IRT. They also collected data through a survey on prior internet experience and usage, video recorded activities, and interviews. The data were analyzed to identify themes that developed throughout the IRT process. The researchers found that the students were highly dependent on their teacher and many lacked the skills required to work independently and collaboratively in IRT. Additionally, when asked directly, students could identify strategies to locate and evaluate online text, but often did not use these strategies when working independently. After noticing this, the researchers adapted their method to include more group work. Temporarily this increased strategy use and reliance on peer collaboration rather than dependence on help from the teacher. However, after a few sessions, students again began to ask their teacher for help rather than their peers. Students also viewed the internet as a space to find information quickly, which may have contributed to their lack of using evaluation strategies.

Another theme that emerged from the Colwell et al.'s (2013) data was related to the structure of the inquiry projects. The researchers found that students were most successful at utilizing the skills and strategies for online reading and collaborating with peers when they worked in small groups with semi-structured open-ended inquiry projects. In this structure, the project itself was open ended, students could research a specific topic of their choice within a broader science topic, but there were guiding questions that helped students plan their research. Students also frequently reverted to the strategies they had learned through their own internet inquiry outside of school rather than the strategies that were taught during the IRT process. The researchers and teacher encouraged students to share and critique each other's strategies, which temporarily improved the use of the strategies taught in class, but students still often went back to the strategies they had used in their previous experiences. Still, in the interviews completed at the end of the IRT process, students were able to explain the strategies they should use when reading online, but did not consistently use them while actively engaged in online reading and research.

From the results of Colwell et al.'s (2013) study, the researchers had several recommendations for future use of IRT. First, the researchers suggest activities be structured in a way that encourages strategy application over a period of time, rather than solely immediately after the lesson. Second, structuring projects to be open-ended group work with students exchanging various roles for practicing online reading comprehension skills such as locating and evaluating could be most beneficial. Additionally, the teacher's role should be guiding rather than an information source. When students ask that teacher questions, the teacher should inquire about what strategies the students have used and help them modify their strategies to find the answers to their questions. Finally, the researchers suggest that beginning strategy instruction at the elementary level may be beneficial in preparing students for projects like the one conducted in this study. These suggestions are important to consider prior to implementing IRT in the classroom.

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Young Children Reading in a Digital Space

Of the research reviewed thus far, the youngest participants were fourth graders. Forzani (2018) encourages educators to begin online reading comprehension instruction at a younger age as research has noted a lack of skills in older readers. According to Duke & Cartwright (2021), many early literacy practitioners influenced by the Science of Reading overlook the development of strategic reading included in the Reading Rope model which the Science of Reading is originally based upon. Suggesting the Active View of Reading model, Duke & Cartwright (2021) emphasize that "readers must learn to regulate themselves, actively coordinate the various processes and text elements necessary for successful reading," (p. S30) which goes

beyond word-reading and language comprehension. Therefore, there is a need for additional strategy instruction in lower grades. Online reading, in particular, as it is different from print-based reading (Coiro, 2011; Bruner & Hutchison, 2023), necessitates additional strategy instruction regarding coordination of various processes and text elements for younger students to learn to locate, evaluate, synthesize, and communicate information. Digital texts that are often informal, multi-authored, interactive, and hyperlinked require readers' skills to verify the validity and reliability of them, which is an important disciplinary literacy practice for elementary students according to Bruner & Hutchison (2023).

There have been some studies that observe younger readers utilizing digital reading spaces. While these studies do not analyze young readers' online text evaluation, they do provide insights into how young learners' digital text comprehension and adequate instruction.

Two studies included observations of kindergarten students reading electronic books (Christ et al., 2019; De Jong & Bus, 2004). In the first, De Jong and Bus (2004) analyzed how kindergarten students interact with and comprehend electronic texts. They found that as students had more encounters with electronic books, their comprehension was not hindered by the often irrelevant animations in the electronic text. This indicates that children do not solely make meaning from visual cues in electronic texts. They also use narrative text within electronic stories just as with printed texts. The authors concluded that children who have developed to the point at which they are able to understand stories, can also retell a story that they read in an electronic format with similar accuracy to stories they heard read aloud by an adult. Kindergartners also participated in Christ et al.'s (2019) study on app books' impact on reading comprehension. Christ et al. (2019) examined the impacts of app characteristics (text, animations, etc.) and the reader's interactions with the app on reading comprehension. Researchers first taught the 53 kindergarten participants how to use app books on an iPad, and then analyzed how the features of the app book as well as students' interactions with the app book affected their reading comprehension outcomes. The authors found that students' comprehension went down when there were more than the mean number of hotspots (A hotspot means a clickable spot in an online document that links to another online document). They also found that students needed to know how to use the hotspots appropriately in order for them to have a positive impact on vocabulary and comprehension. Implications from this study relate to the need for explicit instruction in literacy skills beyond those taught with traditional printed text. The kindergartners in the study were successful after having been taught how to use the technology and having had more practice using the technology for the purpose of reading comprehension.

In sum, several researchers suggested online reading comprehension skills and strategies be taught in younger grades to prepare students for the types of online reading and research they will likely participate in as they progress through primary and secondary school (Cowell et al., 2013; Forzani, 2018; Zawilinski et al., 2019). There is a need for additional research particularly in the area of online text evaluation with younger students.

Methodology

The current study specifically explored the students' processes for evaluation while reading online texts, using a qualitative study method. The Internet Reciprocal Teaching (IRT) was implemented to examine any relationships between IRT and students' use of evaluation strategies. This section identifies the participants, procedure, data collection, data analysis, and steps taken to minimize researcher influence and bias. These methods were used to explore the following research questions:

1. Do 2nd grade students use evaluation strategies while reading online text?
2. How did Internet Reciprocal Teaching assist 2nd grade students' evaluation processes when reading online text?

Participants

This study utilized a convenience sample of twenty-four 2nd grade students. The study took place at a school in a suburban community in a Midwestern state. At the school, 32.5% of students receive free and reduced lunch as of the 2020-2021 school year. Of the 24 participants, 71% are White, 25% are Black, and 4% are Hispanic. Additionally, 42% of participants met the grade level benchmark for reading and 58% did not based on Fall 2021 benchmark assessments. Each student in the classroom had their own Chromebook to use at school. Of the 24 participants that took part in the study, seven participants were randomly selected for in depth data analysis. These participants' data were analyzed until saturation was reached (Corbin & Strauss, 2015; Glaser & Strauss, 2017). The seven participants selected for in depth data analysis are presented in Table 1. Table 1 also exhibits the mode of instruction such as online, hybrid, and homeschool for each participant.

Table 1 *Participants Selected for In-Depth Data Analysis*

Participant (pseudonyms)	**Reading Level as Determined by Fall Benchmarking Assessments** <56 wpm = Below Level 56-101 wpm = At Level	**1st Grade Learning Mode** Hybrid = ½ Week In Person, ½ Week Virtual Learning Online = 100% Virtual Learning

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	>101 wpm = Above Level	
Kate	Above Level	Online
Lucas	At Level	Hybrid
Ava	Above Level	Online and Hybrid
Noah	At Level	Online
Lily	Below Level	Online
Jayden	Below Level	Hybrid
Sami**	Below Level	Homeschool

* All children's names are pseudonyms.

** Sami's internet experience was different from the rest of the peers because students enrolled in a Homeschooling program and did not have access to their own computer throughout the first grade year as students enrolled in Hybrid or Online programs did.

As a final note, participants in this study (with the exception of Sami, who was homeschooled), participated in 100% online learning at some point during their first grade year due to the COVID-19 pandemic. Beginning with school closures in March 2020, the district of the school participating in this study provided Chromebooks to all students and hotspot internet access to those who needed it. During the participants' first grade year, families had the option to enroll in hybrid (half in-person, half online) learning or 100% online learning. Throughout the year, there were points when the district moved to 100% online learning for everyone. As a result of the various enrollment styles due to COVID-19, the participants in this study had over a year of experience using technology and the internet daily in their homes or in school, not including any additional experience they gained from technology related activities that were not associated with school. During the time of this study, all participants were enrolled in standard enrollment (attending school in person daily) and still had access to their own Chromebooks at school and at home daily.

Procedures for Using IRT with Second Graders

The IRT process took place in three phases: Phase One, Teacher Led Instruction; Phase Two, Collaborative Modeling; and Phase Three, Collaborative Inquiry (Leu et al., 2008). An example of a task completed is: "Find three websites that would give you more information about the moon's phases. How did you select those websites? How did you know those websites would be relevant to your question?" A task like this encouraged students to practice using relevant search terms, scanning search results, and evaluating the relevance of websites based on their content. Tasks in Phase Two in particular primarily focus on the online reading comprehension strategy of evaluation

since that is the focus of this study. Because many online reading skills and strategies are interrelated, some sessions also focused on location, synthesizing, and communication, however the majority of the lessons focused on evaluation in conjunction with the other skills.

The checklists recommended by Leu et al. (2008) were utilized as a guide to help determine when students were ready to move on to the next Phase in IRT (p. 343-346). The Phase One checklist included items related to student mastery of computer basics (logging on and off, copy and paste, opening new windows and tabs, saving files, etc.), web searching basics (locating a search engine, using keywords, using the address window, using the refresh, back, and forward buttons, etc.), and general navigation basics (opening and closing tools, minimizing and maximizing the webpage, and moving between tabs). The email basics section of the Phase One checklist was not used as part of this study as it did not pertain to the tools students used. The Phase Two checklist included skills related to the online reading comprehension skills: understand and develop questions, locate information, critically evaluate information, synthesize information, and communicate information.

The IRT sessions took place during the literacy or science block. Sessions ranged in time from approximately 20-60 minutes. All research tasks related to the science and writing curriculum used at the school. During each session, students had access to their own Chromebook. Each Chromebook included the extension Google Read & Write. The “Hover Speech” tool on Google Read & Write allowed students to hover over text with their cursor and hear it read aloud if they chose. This tool was used to assist students in reading text that may have been above their reading level.

Participants used the web browser Google with the Safe Search setting turned on for all internet research tasks. The search engine Google with the Safe Search setting enabled was selected in order to provide the most access to a variety of search results and promote evaluation skills while also filtering content that is appropriate for children. Anuyah et al. (2019) found that child-oriented search engines such as KidzSearch and Kidrex, limited the amount of results when students attempted to locate information related to their coursework. Limited results can lead to frustration from young students if they can’t find the information they were searching for (Anuyah et al., 2019; Druin et al., 2009).

Google with Safe Search included results to websites that are less reliable such as Wikipedia in addition to educational websites (Anuyah et al., 2019). In the context of this study, the inclusion of more and less reliable websites was not a drawback because it allowed students to practice evaluating for relevance and reliability. Google with Safe

Search, in addition to other search engines such as KidzSearch, Kidtopia, and Kidrex, also allow for ads. Ads were also not a drawback within the context of this study because students learned how to identify bias in the author's purpose, which is another key skill within online text evaluation. While Google with Safe Search does not include elements that may make searching easier for young children such as larger font and icons, less search results presented on a page, and easier options to enter search terms (Druin et al., 2009), it does provide features that match better with the context of this study than other child-centered search engines. Google with Safe Search is an appropriate tool for this study because it offers the benefits of a larger variety of search results, opportunities for evaluation, and assistive searching while also increasing the filter of inappropriate content compared to standard Google search (Anuyah et al., 2019).

Data Collection

Data sources included interviews, observations, video recordings of whole class sessions, video and screen recording of student work sessions, and artifacts of student work. The study was approved by the Institutional Review Board (IRB) to ensure ethical standards were maintained throughout the research process. Informed consent forms were obtained from all participants prior to beginning data collection. Data was collected over a period of about eight weeks in the Fall 2021. In addition, a research journal was kept to record details regarding procedure, data collection, and data analysis.

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Semi-structured interviews were conducted with each participant prior to beginning the IRT process as well as following the final IRT phase and project completion (Corbin & Strauss, 2015). All interviews were recorded and transcribed prior to analysis. The purpose of the initial interview was to gain insights into students' experience with using the internet and the evaluation strategies they may or may not have employed while reading on the internet to answer a research question. During the interview, students were asked to use the internet to answer two questions pertaining to the science curriculum, “What are the names of the different types of clouds?” and “What is the difference between cirrus and stratus clouds?” Students were asked to think aloud (Afflerbach, 2000; Pressley & Afflerbach, 1995) as they try to answer these questions using the search engine, Google with Safe Search enabled, in order to observe the actions they took and processes they went through while completing the task. Students had access to the Google Read & Write extension which allowed them to use the “Hover Speech” feature to assist with reading. Screencastify was also used to record students’ actions on the computer. The purpose of the final interview was to hear students’ perceptions of the IRT process and project as well as provide another opportunity to observe the strategies students use while researching a topic on the

internet after having been provided instruction on using the strategies. All interviews were transcribed for analysis.

The participants were grouped heterogeneously based on their internet reading skills and reading levels. Internet reading skills were assessed through the initial interview as well as classroom observation. Reading levels were determined using the results from the school's reading screening assessment: Fastbridge CBMreading. Fastbridge CBMreading is a screening assessment that measures students' word recognition and fluency on a grade level reading passage.

Observations took place during small group work time in all phases of the IRT process to record descriptive reflections regarding student participation in the IRT process, evaluation strategies employed while reading on the internet, and other observations related to students' interactions with each other, the teacher, and paraprofessionals while reading online. In combination with field note reflections from observations, whole class instruction as well as participants' individual and small group work processes were video recorded. The video and screen recordings were recorded using Screencastify.

Data Analysis

Data were analyzed using the grounded theory approach to explore the processes and actions students take while participating in the IRT model for teaching online reading comprehension strategies (Corbin & Strauss, 2015; Glaser & Strauss, 2017). Data were coded in three phases and the constant comparative method were utilized. Data analysis began immediately during data collection to allow for theoretical sampling. Analytic memos were also created to support data analysis (Corbin & Strauss, 2015; Glaser & Strauss, 2017; Miles et al., 2020). The data were analyzed until saturation is reached.

In the first phase of coding, the teacher researcher analyzed data through open coding (Corbin & Strauss, 2015; Glaser & Strauss, 2017; Miles et al., 2020). All data was transcribed to allow for coding to take place. The purpose of this phase was to analyze data line by line to identify concepts in the data (Corbin & Strauss, 2015; Glaser & Strauss, 2017; Miles et al., 2020). Corbin and Strauss (2015) recommend analysis take place concurrently with data collection. Therefore, coding began as soon as the first interview was completed and transcribed. This was to allow for theoretical sampling (Corbin & Strauss, 2015; Glaser & Strauss, 2017). Analytic memos were recorded to describe concepts, how concepts are related to one another, and the researcher's thinking about concept relationships (Corbin & Strauss, 2015; Glaser & Strauss, 2017; Miles et al., 2020).

The second phase of coding focused on axial coding, which develops and provides additional explanation and examples of each concept (Corbin & Strauss, 2015). Concepts were compared to other concepts to determine similarities and differences (Corbin & Strauss, 2015; Glaser & Strauss, 2017). This allowed the teacher researcher to develop each concept further and make connections between concepts. As in the first phase of coding, analytic memos were used to describe the process for analyzing concepts and pose questions for future theoretical sampling and analysis (Corbin & Strauss, 2015; Glaser & Strauss, 2017). This phase of analysis continued until the teacher researcher believed saturation had been reached because no new concepts emerged from the data (Corbin & Strauss, 2015; Glaser & Strauss, 2017).

In the final phase of coding, the teacher researcher identified core categories based off of the concepts already outlined (Corbin & Strauss, 2015). These core categories summarized the main idea of the research on using the IRT model to teach evaluation strategies to second grade students. The teacher researcher then reviewed previous memos and concepts and described a possible theory to explain the relationships between concepts and core categories. All coding categories are described in the Code Book in Appendix.

Findings

An analysis of data from interviews, observations, class videos, screen-recordings, and artifacts took place in three phases. From this analysis, several themes emerged related to IRT's relationship with students' use of evaluation strategies while reading online text, the criteria students' use to evaluate for credibility, and students' roles and level of comfortability while teaching and learning from peers.

Second Grade Students' Use of Evaluation Strategies for Relevance and Credibility

The data show that students did possess some evaluation strategies prior to beginning IRT. For instance, Lucas used the link title to evaluate which link would be relevant to click on in order to find the answer to the research questions during the initial interview. However, no students demonstrated evaluation for credibility during the initial interviews. The data that were analyzed provide insights into how students' evaluation strategies increased during and after IRT resulting in the first theme to emerge from this data: IRT may be related to an increase in students' use of evaluation strategies while reading online text.

When comparing data from the initial interviews, IRT sessions, and final interviews, the frequency in which participants used evaluation strategies while reading online text increased. During Phase 1 and 2 of IRT, students received instruction on evaluation strategies along with other online reading comprehension strategies. During these

phases as well as Phase 3 and the final interviews, students were observed implementing evaluation strategies to evaluate for both relevance and credibility.

Evaluating for relevance following IRT: Comparing the research question and the title.

During the instructional phases of IRT, students were taught to ask themselves, "Is it helpful?" when reading online text or when determining which link to click. Throughout the IRT phases and in final interviews, students were observed evaluating for relevance by using link titles, relevant search terms, and reflecting on their research question.

Throughout the IRT process students continued to use link titles as a way to evaluate for relevance prior to selecting a webpage to read. Students scanned search results and read link titles before clicking on a link. Students used these link titles to determine if the website would provide helpful information. Many times, the link titles that participants determined were relevant, aligned with the search terms a student used. For instance, in the final interviews, Lily searched "Blizzards for kids" to find more information about blizzards. The link that she selected matched closely with those search terms.

Participants showed the use of evaluation strategies to determine the relevance of a link based on its title prior to the final interviews as well. For example, in Phase 2 Lesson 1, Noah, AJ, and PK used the link title to evaluate the relevance of a website they tried to use to answer their research question, "What is the wind speed in a tornado?"

> **Teacher Researcher (TR)**: And why would that one be helpful?
>
> **Noah**: Because it says what is the average wind speed inside a tornado.

In the final interview, Noah explained how he selected one website over others by using the link title and evaluating its relevance for answering his research question about what causes a blizzard.

> **Noah**: [scrolls down results page] I go down to…Blizzards Causes and Effects [points to link with this title], What Makes a snowstorm a blizzard…[points to link with this title], [scrolls up page, clicks link titled "How Do Blizzards Form?"]
>
> **TR**: What made you decide to click that?
>
> **Noah**: Because it said, "How do blizzards form?" and that is the same thing as- that's the same thing as "What causes blizzards?" because it's how it's made.

At times, students also determined a website was not helpful. One way they did this was by reflecting on their research question. In Phase 1 Lesson 4, Lucas and Noah were searching for more information about lightning. They clicked on a link

> to a website called “Lightning Forms” which described a software titled “Lightning Forms” rather than the weather event. : [reading information from webpage] Lightning forms help you to… [continues reading in head]
>
> **Noah**: Well, that wasn’t helpful.

Noah immediately recognized that the website was not talking about the type of lightning he intended to research. By evaluating for relevance, Noah did not spend much time reading the website, and was able to go on and find other helpful websites.

Evaluating for credibility: Examining the URL, ads, author(s) and background knowledge of the website

Strategies for evaluation of credibility also increased following instruction in IRT. In the initial interviews, no participants demonstrated evaluating for credibility while completing the research task. However, in the final interviews, each of the seven participants whose data were analyzed in depth evaluated for credibility in some way. For example, Ava who stated she had “never thought about [evaluating for credibility]” in the initial interview, explained why she looks into the author or website to determine if the information is trustworthy.

> **TR**: What about what tips would you give a friend to decide if a website is helpful or trustworthy?
>
> **Ava**: Look for the About Us and it will tell you what it is all about and who the author is.
>
> **TR**: And how will that help you know if something was trustworthy?
>
> **Ava**: Because if it said like- something like that one website we looked at, that it would let people change like anything on the website, like that would tell you that it’s not trustworthy because people might have changed that and you’re just reading the wrong thing.

To evaluate for credibility, participants used several different types of criteria. They sought out more information about the website or author, used background knowledge about a particular website, looked at the URL, identified the number of ads on a webpage, and used other miscellaneous criteria.

Confirming Author or Website Credibility. During Phase 2 and 3, students demonstrated strategies for evaluating for credibility by confirming the author or website credibility.

> **TR**: Anything else you learned?:
> **"**Um, well, uh [opens new tab] Well like uh, I'm just going to go to a website like a random one. [clicks search history suggestion "tsunami destruction for kids," clicks Britannica link"] I'll go on this one. Like, I never really knew you would have to click that before you read [points to hyperlink titled "About Us"]
>
> **TR**: What is that?
>
> **Ava**: About us. See if you click on it [clicks link] it tells you stuff about it. It tells you that it's helpful or trustworthy.

This included looking for the "About" section of a website or looking for the author on a webpage. As seen in the above excerpt, Ava explained this strategy during the final interview as something that she had learned through the IRT process.

Analyzing URLs. One strategy that participants used frequently to evaluate for credibility was analyzing the URL endings. During Phase 1, students received some instruction on the meanings of URL endings such as .com, .org, .edu, and .gov. This became a strategy that they used while scanning search results pages and determining which link to click on.

> **Ava**: [scrolls down page] I'm going to see if there's any with .edu. Oh there! [clicks link titled "How do blizzards form?" from UCAR.edu]
>
> **TR**: So how does .edu help you again?
>
> **Ava**: Uh it's from a college or university that normally means it's from someone that knows a lot about it.

For instance, as seen in the above excerpt, Ava also scanned the URL endings on the results page as a way to quickly evaluate for credibility before selecting a website in the final interview. She described how she was specifically looking for a website with a .edu ending.

Questioning Credibility of Websites with Ads. Along with evaluating URL endings, using the number of ads on a website to evaluate for credibility was one of the more

frequent strategies that participants used in Phase 3 and the final interviews. Participants frequently questioned the credibility of a website if there were multiple ads on a page.

> **TR**: How do you know if these websites are trustworthy?
>
> **Noah**: Sometimes if they have a lot of ads, that can mean they're not trustworthy. Questions about the credibility of a website with multiple ads did not just come up during the final interviews, but were also common during Phase 3 of IRT, when students searched for websites that could help them answer their research questions. Many dialogues were similar to this example between Lucas, Lily, and KJ during Phase 3 Lesson 6 in which they discuss whether or not the website they have selected is reliable based on the number of ads it has. As with this case, the number of ads was not always the sole criteria with which a group deemed a website not trustworthy, but did bring up questions that prompted the group to evaluate for credibility further or select a new website.
>
> **KJ**: This has a lot of ads, are you sure it's trustworthy?
>
> **Lucas**: No, this is a lot of ads. Definitely not. Mine only has one ad.
>
> **KJ**: Mine had way more than one ad.
>
> **Lucas**: Mine has one. [Looks at Lily's computer] Yours has two! Yours has two ads.

In the final interview, Noah discussed how ads help him determine the trustworthiness of a website. In addition, most students equated numbers of ads to mean that the website was not trustworthy.

Using Background Knowledge of the Website. As participants gained more experience on the internet, they began to recognize some websites that they had previously evaluated and found to be credible. For example, National Geographic Kids' and NASA's websites were frequently used in Phase 1 and 2 of IRT to practice online reading comprehension strategies. Through these activities, the teacher researcher explained why these websites were trustworthy. Later, in Phase 3 and in the final interviews, participants used this background knowledge of these websites to evaluate for credibility. Because they had previously discussed that these websites were reliable, they intentionally chose them to get more information on their topic. Other times, students saw a familiar website name in the link title on the search results page. This

led them to select a link based on their previous experience with the website. National Geographic was another website that was frequently used and discussed in class.

> **KJ**: Geographic [clicks link titled “Blizzard National Geographic Society”]
>
> **TR**: Okay so why'd you pick that?
>
> **KJ**: Because National Geographic is helpful for me.

In the final interviews when KJ noticed the words “National Geographic” in a link title, she associated it with the website that she had previously had success with in terms of relevance and credibility. The website she selected was actually Blizzard National Geographic Society, not the National Geographic she had previously worked with. Still, because she made the association, she evaluated the credibility of the website before clicking the link, but did not look into the credibility any further after having clicked the link.

Other Strategies for Evaluating for Credibility. There were a few instances in which participants used or mentioned other strategies for evaluating the credibility of a website. In Phase 1 and 2, students received instruction on strategies to use to evaluate for credibility. One of these strategies was to confirm information on one website with another website. While no students were observed using this strategy unprompted, some students, including Lily, Kate, and Sami did suggest it as a strategy that could be used to evaluate for credibility when asked in whole group or interview settings. Here, Lily describes this strategy during the final interview.

> **TR**: How would they know if a website is trustworthy?
>
> **Lily**: Um, you could look on it and you could go to a different website and see if that one says the same thing.

In the final interviews, one other strategy was observed that had not been taught, but was similar to a strategy students used to evaluate for relevance. When looking for information about blizzards during the final interview, Lucas used the link title to evaluate for credibility. He determined that the link must lead to a reliable website because it had “Trusted Choice” in the title, but did not evaluate any further.

> **Lucas**: [clicks link titled “How does a Blizzard Form? - Trusted Choice”] It says T rusted Choice.

TR: So, what does that make you think?

Lucas: It might be trustworthy.

The language that Lucas uses in this example suggests that he is going to look into the trustworthiness of the website further, as he did not seem to indicate that the title completely determined the credibility of the website. However, in this instance and in many cases throughout Phase 3 and the final interviews, when participants evaluated for credibility on the search results page (using link title, URLs, or website familiarity) they often did not continue to evaluate for credibility once they were in the website, except when they noticed many ads on the page.

Discussion

The current study built upon research by Colwell et al., (2013), Henry et al. (2012), and Leu et al. (2008) by further exploring IRT as a strategy for teaching online reading comprehension skills. The study also explored Forzani (2018)'s recommendation to begin online reading comprehension instruction at a younger age. Finally, this study was designed to collect additional information about the current online reading comprehension skills of second grade students as well as provide insights into teaching online reading comprehension skills, specifically evaluation, at this age. The results from this study showed that second grade students already possess some evaluation strategies and that IRT may be an effective way to teach evaluation strategies to second grade students.

Positive Change of Students' Evaluation Skills Through IRT

In the initial interviews, many participants noted that their experience using the internet in an educational setting had primarily included clicking links provided by their teachers, but none indicated having completed an online reading research task in the past. This indicates that they likely received little to no online reading comprehension skill instruction prior to this project and thus may not know how to implement online reading comprehension strategies fully. Some participants also mentioned that they occasionally searched for videos or games on the internet using a search engine. This seemed to align with the skills some participants showed in the initial interviews including locating information and evaluating the relevance of information. For example, Lucas typed search terms and read the title of links to decide if he should click them to find information to answer the research question. However, other students like Lily, were not able to complete the task beyond typing search terms in Google or Sami, who knew she could use the internet to find the answer to the research question, but did not know how. This is similar to Druin et al. (2009)'s findings that many young children were familiar with using Google, but were not always able to complete a research task using Google

prior to instruction on how to read online text. In the final interviews, all students demonstrated the ability to use search terms to find information to answer their research question in addition to other strategies for evaluating for relevance such as reading the link title and scanning web pages.

In the initial interviews, no students evaluated the online texts for credibility. From this data it may be inferred that students did not evaluate for credibility in the initial interviews because they may not have learned how to use this strategy yet. Following instruction, all students were able to demonstrate some level of evaluation for credibility during the final interviews. Examples from final interviews in which students evaluated for credibility include: Ava locating the “About Us” section of a website to examine reliability of the author/website, Ava using URL endings to evaluate credibility, and Noah and Lucas pointing out ads on a webpage as a reason they were questioning credibility of the source. Prior to IRT, none of the participating students expressed or demonstrated any understanding of how to evaluate for credibility. Following IRT, all seven of the students selected for in depth data analysis demonstrated this skill in some way. Participants’ use of evaluation strategies following IRT aligns with previous research findings that show instruction on online reading comprehension strategies improves strategy use (Henry et al., 2012; Kuiper et al., 2008; Wiley et al., 2009)

Students participated in three phases of IRT which taught all online reading comprehension skills, but primarily focused on location and evaluation. The instructional scope in this study aligns with Forzani’s (2018) suggestion of teaching all online reading comprehension skills together, rather than teaching them in isolation. During the phases of IRT and in final interviews, the teacher researcher observed participants evaluating for relevance and credibility as well as modeling these skills for their peers and helping their peers evaluate themselves. In the final interviews, each of the participants selected for in depth data analysis evaluated for relevance and credibility during the online research task portion of the interview. This data shows that IRT may be an effective way to teach online text evaluation skills to second grade students with some internet experience. This aligns with previous research by Leu et al. (2008) and Henry et al., (2012) who used IRT as a method to teach online reading comprehension skills to older students.

Popular Evaluation Strategies: Analyzing the Website URL and Looking for Ads

During the phases of IRT and in final interviews, students used multiple criteria for evaluating for credibility. The most popular criteria students used were analyzing the website URL, looking for ads, seeking out information about the author or website, and using background knowledge about a website. The two most common strategies were analyzing the website URL (for example, noticing the URL ending is .edu and knowing

that that means the website comes from an educational institution and is likely trustworthy) and looking for ads (for example if a student saw many ads on a website, they may deem it not trustworthy). URL endings were taught in one lesson of IRT, but looking for ads was not.

Students brought up the concern of multiple ads on a webpage and began using this as a common criteria for evaluating for credibility during the rest of the sessions and in the final interviews. Other criteria such as seeking out more information about the author and using background knowledge about a website were less popular. Primarily students who had more internet experience and read at a higher level in offline text used these strategies. Kate, Ava, and Noah were the only participants to mention one of these strategies in the final interviews and only Ava modeled how to find more information about an author or website through the "About" section of a website. One explanation for why criteria like analyzing URLs and looking for ads may be more common, is because they are more straightforward and easier to identify when looking at a website. To find the "About" section, students have to go through a series of steps and navigate throughout the website to find the "About" section. Then they must understand what the about section means and have some prior knowledge about the organization or background of the author.

Another possible explanation for the less frequent use of seeking out more information about the author or website as criteria for evaluating for credibility could be that the use of this strategy may be related to offline reading level or internet experience. Previous research found that high internet experience was often a more accurate predictor of the use of online reading comprehension strategies than prior knowledge on a topic (Coiro, 2011). Kate, Ava, and Noah were the only participants to mention looking into the author's credibility as an evaluation strategy in their final interviews. Ava was the only participant to model the use of this strategy in the final interview, though Kate and Noah also used this strategy during Phase 3 of IRT. Kate and Ava both read above level in offline texts and Noah read on level. Ava demonstrated higher internet experience in the initial interviews, and Noah and Kate both expressed having used the internet to search for content prior to IRT. All three were enrolled in the all-online program for at least part of first grade. It is possible that their experience or reading level may have been related to their use of this strategy, however there is not enough data to confirm this.

Implications

Prior to this study, the majority of online reading comprehension studies included older participants in fourth grade or above. The results from this study provide some initial insights into younger students' thought processes and interactions with online text. Previous research suggested beginning to teach online reading comprehension skills at

a younger age (Cowell et al., 2013; Forzani, 2018; Zawilinski et al., 2019). In this study second grade participants were able to successfully learn some online text evaluation skills, which is an important part of online reading comprehension. Considering that critical evaluation has been lacking the most in the new literacies for online reading comprehension (Forzani, 2018; Leu et al., 2014; Wiley et al., 2009), the results of this study give significance to the necessity of the strategy teaching at a younger age, which was emphasized by Duke & Cartwright (2021) in their Active View of Reading model. It was also a way of supporting the second grade participants' development of disciplinary literacy skills as suggested by Bruner & Hutchison (2023).

Further research in the area of online reading comprehension studying younger students may be beneficial to provide a clearer understanding of teaching online reading comprehension in younger grades. In this study, students improved their location and evaluation skills throughout the IRT process. However, synthesizing and communication remained difficult due to reading level impacts. Future research may focus on what supports are necessary for younger learners to successfully and fully comprehend online text. Additionally, researchers may consider studying which skills are beneficial to learn prior to becoming a fluent reader, and which skills may develop alongside offline reading comprehension.

Additionally, this study took place over the course of eight weeks from the initial interviews to the final interviews. It is not clear whether students retained the skills they learned during IRT beyond the eight-week period. Colwell et al. (2013) noticed that students did not continue using the strategies they had learned long after instruction and required reteaching and further practice. Future research may follow up with younger participants in the weeks and months following the IRT sessions to see which skills are retained and which skills are not.

Finally, researchers could continue to examine the impact of the COVID-19 pandemic on students' internet and technology skills. All participants in this study (with the exception of Sami, who was homeschooled), participated in 100% online learning at some point during their first grade year due to the COVID-19 pandemic and had access to their own Chromebook at home. As a result of the COVID-19 pandemic, these participants could have had more experience using the internet and technology for school related purposes than other second graders who did not experience online learning or attend school during the COVID-19 pandemic. Researchers could compare the technology and critical analysis skills students bring to the classroom from their prior experiences between students who attended school during the COVID-19 pandemic as compared to those who did not. Additionally, this research may include examining the digital skills of children who are "digitally native," or have grown up surrounded by

technology and access to the internet. This information may help inform the prerequisite skills that need to be taught prior to beginning instruction on online reading comprehension skills.

Limitations

There are several limitations of this study. First, all participants in this study have access to their own school-provided Chromebook both at school and at home. In addition, all participants, with the exception of Sami, had participated in 100% online learning at some point during their first-grade year due to the COVID-19 pandemic and its effect on the district's learning models. This prior experience and access to Chromebooks and the internet could have affected the skills they possessed before participating in IRT. Also, there was likely less time spent on instruction about basic navigation of the computer and internet with these participants than may be required with participants who have not had the same technology experience. The results may not be generalizable to populations with less access to a computer on a regular basis.

Additionally, the IRT process only took place over the course of six weeks, not including time for initial and final interviews. Students may be more likely to apply skills to online reading research tasks with exposure to these practices over a longer period of time (Colwell et al., 2013). Another limitation is that the teacher researcher had to intervene more than recommended by Leu et al. (2008) in Phase 3 of the IRT process. Many students needed support with vocabulary and staying on task. It is possible that students may not have been able to complete the research task to the same degree without the assistance from the teacher researcher. Finally, this study included a relatively small sample of students. In order for the results to be more generalizable, a larger sample may be needed including a more diverse participant population in terms of internet and technology experience, reading levels, and more.

Conclusion

Overall, IRT was effective in improving second grade students' location and evaluation skills. There may be additional tools or teaching needed to support students at this age with synthesizing, communicating, and collaborating. Previous research noted that older students struggled with the online reading comprehension skills: locating, evaluating, synthesizing, and communicating (Forzani, 2018). It is possible that with instruction in these skills beginning at a younger age, students will be able to demonstrate these skills more effectively as they get older and they become more necessary as part of their regular classroom instruction. As researchers continue to explore the area of teaching online reading comprehension to younger students, further guidance on how to most efficiently teach and navigate the challenges of teaching these skills at younger ages may be helpful so that teachers can plan instruction that will benefit students as they continue to read on the internet throughout their education.

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APPENDIX

CODE BOOK

The following codes were used during the data analysis process to code video, screen-recording, and interview transcriptions.

Appendix A
Codes Used in Initial Interviews Only

Code	Definition	Examples
First Grade Learning Mode	Mode of 1st Grade Learning (Hybrid-Half in-person, half online; Online-100% online schooling; Homeschool)	● **Sami**: I was doing school at home in my books. (Initial Interviews) ● **Noah**: I was all online. (Initial Interviews) ● **Jayden**: I was hybrid. (Initial Interviews)
Internet Experience-Educational Use	Student mentions experience with using the internet to complete school-related activities.	● **Ava**: I read the Superkids magazine and that's literally like all I read on here. (Initial Interviews) ● **Lucas**: We had like Prodigy and ABC Ya. (Initial Interviews) ● **Jayden**: I play Prodigy, Dreambox, Typing Club. Let's see Lexia. (Initial Interviews)
Internet Experience-Recreational Use	Student mentions experience with using the internet to complete non-school-related activities	● **Lily**: YouTube (Initial Interviews) ● **Ava**: Sometimes I do YouTube, and sometimes I do these games (Initial Interviews) ● **Lucas**: Play games on it. Watch like Netflix and stuff. (Initial Interviews) ● **Kate**: I type my stories and watch cake videos. (Initial Interviews)
Comfortability	Student mentions their level of comfortability with using the internet	● **Lucas**: Not that much…Because I don't really use it a lot (Initial Interviews)

	or teaching others to use the internet.	• **Ava**: If good was like the highest I would say good. (Initial Interviews) • **Noah**: Pretty comfortable. (Initial Interviews)

Appendix B

Codes Used Throughout all Interviews and Sessions

Code	Definition	Examples
Adult Assistance with Internet/Technology	Student receives or mentions receiving assistance from an adult to navigate the internet or use technology.	● **TR**: How do we copy it into the Padlet? Do you remember? You got to click up here on the link. [clicks in address bar]. Control, c to copy. (11/9 Phase 1 Lesson 4) ● **TR**: [closes and reopens Google Read & Write. Demonstrates how to use Hover Speech] (11/4 & 11/8, Phase 1 Lesson 2 ● **TR**: You have to talk really clearly into it. (12/3 Phase 3 Lesson 2)
Location	Student displaying or discussing location skills such as using the search bar, typing in the search bar, finding links, clicking links, etc.	● **Sami**: [clicks voice-to-text search feature] Blizzards for kids. (Final Interviews) ● **KJ**: [opens new tab, clicks in search box, types “blizzards”] (Final Interviews) ● **Noah**: [scrolls to the bottom of the page, clicks on suggestion link at the bottom titled "How do earthquakes happen?"] (12/3 Phase 3 Lesson 2) ● **Ava**: Let’s see if this works. [clicks link titled “How is a Tsunami formed?”] (12/3 Phase 3 Lesson 2)
Evaluating Next Steps	Student evaluates progress toward research goal to determine what they should do next (finished, go back, re-search, adjust	● **Kate**: We should probably go on to the next website. (11/29 Phase 2 Lesson 5) ● **Noah**: Okay, I think we’re done. (11/4 & 11/8 Phase 1 Lesson 3) ● **Lucas**: Guys I think we should write this. (12/6 Phase 3 Lesson 3)

	search terms, etc.)	
Evaluating for Relevance	Students determining whether or not a link or website is or will be helpful for them to answer their research question.	● **Lucas**: There was nothing else that was helpful so I decided to go to a new one. (Final Interviews) ● **Ava**: Let's see. That one didn't answer our question it was just how snow forms. (Final Interviews) ● **TR**: What made you decide to click that link? ● **Lily**: Because it says blizzards for kids. (Final Interviews, Lily) ● **Kate**: We could try this one. [points at search result titled "Thunder and Lightning"] (11/9 Phase 1 Lesson 4)
Evaluating for Credibility	Students determining whether or not a website or author is trustworthy. This includes using various strategies for evaluating for credibility including using the website URL, using ads, confirming credibility of the author/website, using prior knowledge, or other miscellaneous strategies.	*Using Website URL:* ● **Ava**: [scrolls down page] I'm going to see if there's any with .edu. Oh there! [clicks link titled "How do blizzards form?" from ucar.edu] (Final Interviews) *Using Ads:* ● **Noah**: Sometimes if they have a lot of ads, that can mean they're not trustworthy. (Final Interviews) *Confirming Author/Website Credibility:* ● **Ava**: Wait, first, first scroll down to the bottom. About us. [clicks link to "About Us" page] First we need to see if this is trustworthy before we do it. (12/10 Phase 3 Lesson 6) ● **Noah**: Oh yeah, this is good. It says scientist, national geographic, teachers. [organization title is National Science Teachers Association] (11/22 & 11/23 Phase 2 Lesson 2-3) *Miscellaneous Strategies:*

		• **Lucas**: [clicks link titled “How does a Blizzard Form?- Trusted Choice”] It says Trusted Choice. (Final Interviews)
Navigation	Definition: Student engages in physical actions associated with navigating the internet (i.e. scroll, back button, "x" out, etc.)	• **Lucas**: [opens new tab] (11/4 & 11/8 Phase 1 Lesson 3) • **Ava**: [highlights address, presses Ctrl + C] Okay, now go back to this [switches back to Padlet tab, pastes link into Padlet by pressing Ctrl + V] (11/19 Phase 1 Lesson 4) • **Noah**: [scrolls down results page] (12/3 Phase 3 Lesson 2)
Synthesizing	Student brings information together from multiple sources.	• **Ava**: To make a blizzard, the warm air must be on top of the cold air. (Final Interviews) • **Noah**: Earthquakes underwater can make a tsunami. (12/6 Phase 3 Lesson 3) • **Ava**: Tsunamis can destroy villages and towns. (12/10 Phase 3 Lesson 6) • **KJ**: A hurricane is made by moist warm air. (12/3 Phase 3 Lesson 2)
Communication	Student demonstrates communication skills (i.e. verbally stating the answer or writing on the response sheet).	• **Kate**: That blizzards are big snowstorms [writes on graphic organizer] (Final Interviews) • **Jayden**: [writes on graphic organizer] (11/19 Phase 2 Lesson 1)
Reading Image Results	Student gathers information from a picture rather than text-based source or student pauses at and discusses picture.	• **PK**: Look, the tsunami did this. (12/6 Phase 3 Lesson 3) • **Jayden**: Yeah, I think this is Japan. It was a little circle anyways, but until it got bigger and bigger and bigger. (12/1 Phase 3 Lesson 1)

		● **Noah**: Whoah! Look at that [pointing to animated image] (11/9 Phase 1 Lesson 4)
Peer Questioning	Student asks for help from a peer.	● **Kate**: Which link are we supposed to be on? (12/10 Phase 3 Lesson 6) ● **Lily**: Can you tell me what it says? (12/6 Phase 3 Lesson 3) ● **AJ**: How do you spell question? (11/22 & 11/23 Phase 2 Lesson 2-3) ● **Sami**: What do I press to make it go back? (11/22 & 11/23 Phase 2 Lesson 2-3) ● **Noah**: Okay, how did you get to this? (12/6 Phase 3 Lesson 3)
Adult Questioning	Student asks for help from an adult or asks an adult a question.	● **Lucas**: So should we put this un-under unrelevant? (11/9 Phase 1 Lesson 4) ● **Lily**: How do you stop it? (11/19 Phase 2 Lesson 1) ● **Ava**: I do have a question. Why do you have to put it in your own words? (Final Interviews)
Providing Help to a Peer	Student is providing modeling or assistance to a peer in a collaborative small group activity (not whole group).	● **Kate**: Oh that's not how you do it. [helps Jayden] Up, you, microphone, then, okay…Let's see. [clicks voice-to-text search feature on Jayden's computer] Effects of earthquakes. (12/6 Phase 3 Lesson 3) ● **Noah**: Um, you could do Moon phases for kids and we got good stuff there…Go up. And if you keep going up, like right here [scrolling for Jayden and Lily] We did "What are the Moon Phases?" right here [points to link with this title] then that should bring you to pretty cool stuff. (11/22 & 11/23 Phase 2 Lesson 2-3)

		• **Sami**: You're supposed to look up "How does lightning form?" (11/9 Phase 1 Lesson 4)
Collaboration	Students working together to complete a task (students asking questions about what they want to do, students delegating roles, etc.).	• **Sami**: Which one do you want to press? (11/9 Phase 1 Lesson 4) • **Jayden**: So what do we search about? (12/6 Phase 3 Lesson 3) • **Ava**: Mine didn't pop up like that. We typed the same thing. (12/6 Phase 3 Lesson 3) • **Sami**: Guys, let's listen to this. I'm putting it on recording. (12/6 Phase 3 Lesson 3) • **Lucas**: So now we have to go to a website, remember? (11/4 & 11/8 Phase 1 Lesson 3)
Prior Knowledge	Student references Prior Knowledge about a topic. The prior knowledge could be accurate information or inaccurate.	• **Ava**: I remember that stratus clouds are low. (Initial Interviews) • **Lily**: Okay. Because when it gets really cold outside it makes snow. I think. (11/4 & 11/8 Phase 1 Lesson 3) • **Kate**: But you know what? There is like a fire under in San Francisco, but there was a really huge gigantic earthquake. (12/1 Phase 3 Lesson 1) • **Noah**: Well, frozen rain is hail. So that's, and I think snow is like one step higher. It's like really crunched up ice. (11/4 & 11/8 Phase 1 Lesson 3) • **TR**: What is a blizzard? • **Sami**: Uh it's like a sandstorm but instead of sand it's uh snow. (Final Interviews)

Developing Research Questions	Students discuss or create research questions for online research.	● **Lucas**: How is a hurricane made? (12/1 Phase 3 Lesson 1) ● **Noah**: So, research question, what do you want? I think our research question should be "What causes earthquakes?" (12/1 Phase 3 Lesson 1) ● **Ava**: Research question two. Can a tsunami kill? ● **Sami**: No! ● **Ava**: Why? It's a question I want to know. ● **Sami**: Of course it can. If it's a tsunami then it probably can. (12/1 Phase 3 Lesson 1)
Troubleshooting	Students work to fix a problem they have encountered while reading online.	● **KJ**: [scrolls down on webpage, subscription pop up comes up] Oh my gosh. [clicks back button, clicks link again.] (12/3 Phase 3 Lesson 2) ● **Ava**: [closes search tab, opens new tab] Okay, let's redo this. (11/22 & 11/23 Phase 2 Lesson 2 & 3) ● **Jayden**: [accidentally clicks link to another part of website, clicks back button] (Final Interviews)
Spelling Strategies	Strategies students use to compensate for not knowing how to spell a word.	● **Jayden**: I'm going to search for it first so we can see. [using voice-to-text search feature to get correct spelling before writing in packet] (11/19 Phase 2 Lesson 1) ● **Ava**: [writes on graphic organizer while using website to help with spelling] (12/3 Phase 3 Lesson 2) ● **Lucas**: [copies KJ's graphic organizer packet] (12/1 Phase 3 Lesson 1)

Reading Level Impact	Instances when student reading level impacts ability to understand or read a text they encounter.	• **Noah**: I think it's kind of tricky to read, and sometimes it doesn't make that much sense. (Final Interviews) • **PK**: [closes tab, opens new tab, types “sownomes for siuens kids” (intending to type “tsunamis for science kids”) in search box, searches] (12/3 Phase 3 Lesson 2) • **Kate**: It’s Something, something scale. Something something scale. [reading “Enhanced Fujita scale”] (11/19 Phase 2 Lesson 1)
Teacher Interaction	Teacher asks questions, prompts, or checks in with students. Does not include when the teacher assists with technology.	• **TR**: Why are you looking for one that’s .edu? (12/3 Phase 3 Lesson 2, Ava & Sami & PK, B69) • **TR**: How are we doing? What’s your question? How does snow form? Good. What do you think for search terms? (11/4 & 11/8 Phase 1 Lesson) • **TR**: [Pseudonym Lily] do you have any other suggestions for search terms for, “How big is a hurricane?” (12/10 Phase 3 Lesson 6) • **TR**: Okay, well I see more about how earthquakes happen on there so I think you should go back and read that first paragraph again and see what else you can add. (12/10 Phase 3 Lesson 6)
Reading Online Text	Students are engaged in reading online text or having it read to them by a peer, adult, or Google Read &	• **KJ**: A blizzard is a dangerous weather event bringing with the frigid temperatures, howling winds and decreased visibility. (Final Interviews) • **Google Read & Write**: Blizzard Kids Britannica Kids Homework

	Write's Hover Speech feature.	Help. https://kids.britannica.com-kids article. Blizzard. A blizzard is a powerful snowstorm. Low temperatures, strong winds, and large amounts of snow together create this dangerous weather condition Blizzards for kids from kidsbritannica.com. (Final Interviews) ● **Google Read & Write**: 11 Facts About Blizzards. A blizzard is a severe snow storm with winds in excess of 35 mph and visibility of less than a ¼ mile for more than three hours. (Final Interviews) ● **Kate**: It says "How deep the snow gets," "How do blizzards occur?" (Final Interviews)
Off Task	Students engaging in discussion or work on the computer that is off task.	● **Lucas**: [drawing on screen, clears screen, clicks black pen] Black pen. [draws on screen] But you can't even see the black pen. See? You can't- (11/9 Phase 1 Lesson 4) ● **Noah**: Oh yeah, let's play some games guys. How about Funny Fill-In? (11/29 Phase 2 Lesson 5) ● **Sami**: [types random letters in search box] (12/6 Phase 3 Lesson 3) ● **Noah**: What team were you on? ● **PK**: We were good. We only lost one game (12/3 Phase 3 Lesson 2)
Technology Obstacle	Technology does not work in the way the student expected it to or thinks it should, causing difficulty with task completion or	● **Kate**: [clicks voice-to-text search feature] Blizzards for kids. [searches "presents for kids"] What? It doesn't work. (Final Interviews) ● **Lucas**: It doesn't show that. [clicks repeatedly on page] This is frozen. (12/3 Phase 3 Lesson 2)

	possibly frustration.	• **Ava**: I'm just trying to make it read it to us. I don't want to read it…It's not working…I just want you to work. (11/4 & 11/8 Phase 1 Lesson 3).

Appendix C

Codes Used in Whole Class Sessions Only

Code	Definition	Examples
Student Modeling (Whole Group)	Student Models an online reading comprehension strategy on the interactive white board in front of the whole class.	• **P5**: Can I show you what we did? [demonstrates how to use voice-to-text search feature, demonstrates clicking on Google Read & Write Hover Speech] So we would press that and then it would read to us. (Class Video Transcription, 11/19) • **Ava**: "We also scrolled down and still couldn't find a lot of things that really helped us, so we typed something different (Class Video Transcription, 11/8) • **Jayden**: We can't use this one. Look how many ads are on there. (Class Video Transcription, 11/19) • **Jayden**: I'm going to do this one. [clicks voice-to-text search feature] Moon size for kids. (Class Video Transcription, 11/22) • **Noah**: [scrolls to the bottom of the page] And then we went down here and it says it's National Science Teachers… (Class Video Transcription, 11/23) • **TR**: How did you know it was not helpful? • **P4**: Because one of them, we were just scrolling through and it just was comparing it to other earths and it wasn't showing the phases. (Class Video Transcription, 11/22).
Teacher Questioning (Whole Group)	Teacher asks the whole class a question or poses	• **TR**: Where are the website URLs? (Class Video Transcription, 11/5)

	a question to a group of students modeling for the whole class.	• **TR**: What could you add to make sure you're getting websites that are made for kids or easier to read? (Class Video Transcription, 11/5) • **TR**: Can you tell us how you decided that it was not trustworthy (Class Video Transcription, 11/23) • **TR**: So what could they have done if they weren't sure if this one was trustworthy? (Class Video Transcription, 11/19)
Teacher Modeling (Whole Group)	Teacher is Modeling a strategy for students in a whole group setting. (Think alouds, walking through steps, etc.)	• **TR**: Remember when you're searching on a search engine, you're thinking "What do I want to learn?" and "What search terms will help?" (Class Video Transcription, 11/5 • **TR**: It's the address, the URL. So this one is from kidsbritannica.com. Down below the link is a little preview. So I can read this, to see, is this going to be helpful for me? This is the first time I might be evaluating the relevance of this article. Is it helpful? Remember my question was, "How does snow form?"... Is this going to be helpful? "Like rain, snow is made from tiny crystals that fall to earth. The crystals are called snow. A crystal is a solid substance with a flat surface and sharp corners." If you're not sure, then you might even just go in, and read a little more. So far this sounds helpful to my question "How does snow form?" because it says "Snow is made of tiny crystals" so I know they're going to be talking about this. So I might click the link. I'm going to read more. Just because the little preview seems like it's going to be

		helpful, doesn't mean it is. I still need to evaluate if the article is helpful by reading it. (Class Video Transcription, 11/9) ● **TR**: I could just type “moon” and then look through the information to find how big the moon is. What about- would "moon size" work? (Class Video Transcription, 11/22 ● **TR**: National Geographic Kids…They are a well known website, magazine, book maker. They are well known for having trustworthy, science information. So do you think I can trust what they say about the moon? (Class Video Transcription, 11/23).

Appendix D

Codes Used in Final Interviews Only

Code	Definition	Examples
Uncertainty	Student expresses being unsure about a question or concept.	● **Sami**: I forgot what to click. (Final Interviews) ● **Lucas**: I don't know. (FInal Interviews)
Technology Tip	Student describes a tip, trick, or strategy that they use to make online reading comprehension easier (could be related to any of the online reading comprehension skills).	● **Kate**: Well, it's easier to read if you type in "for kids." And you can use the microphone to make it easier. (Final Interviews) ● **Ava**: Because now I can use my voice, so I'm just going to do it to show you. [clicks voice-to-text search feature] Tsunami destruction for kids. [Google searches "Tsunami Destruction for Kids] Like if you didn't do this then I would just be writing this- I would just be typing this…I don't have to type it just tells me it. (Final Interviews) ● **Sami**: We could, go on this [points to Google Read & Write] So that way if you need help to read it, it can help you. (Final Interviews)

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An In-Depth Literature Review of E-Portfolio Implementation in Higher Education: Steps, Barriers, and Strategies

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Abstract
This literature review examines the implementation of e-Portfolios in higher education, with a focus on the implementation process, potential barriers, and strategies for overcoming challenges. This review seeks to provide instructional designers and higher education instructors with design strategies to effectively implement e-Portfolios. Through an analysis of seventeen studies, we identified six common steps in the implementation process, including identifying a purpose, stakeholders, platform, conducting workshops, creating e-Portfolios, and evaluating the project. The implementation process also raised eight concerns, including concerns related to technology, policy, pedagogy, artifact quality, privacy, student motivation, academic integrity, and teacher workload. To address these concerns, existing strategies suggest that successful implementation requires training and policy support, student-centered pedagogy, criteria for assessing artifacts, privacy and data protection, feedback, anti-plagiarism measures, and shared successful models.

Keywords*: literature review, e-Portfolio, implementation, higher education*

The concept of e-Portfolios stems from the traditional portfolio format. Portfolios are purposeful collections of various documents and artifacts that provide an impression of how tasks were fulfilled and how competence has developed, showcasing an individual's skills, accomplishments, and progress through tangible evidence (Van Tartwijk et al., 2007). The shift to electronic or digital portfolios, known as e-Portfolios, emerged with the advent of digital technology. E-Portfolios build upon the foundational idea of portfolios by incorporating digital elements such as multimedia files, hyperlinks, and interactive features that allowed for a more comprehensive representation of an individual's skills, achievements, and experiences (Barrett, 2007). E-Portfolio is used as a digital tool for managing learners' learning process and fostering deep and continuous learning (Jenson & Treuer, 2014). In the higher education context, the emergence of web-based e-Portfolio platforms, open-source platforms, and commercial packages in the late twentieth and early twenty-first centuries led to widespread adoption and hyperbolic enthusiasm and educators began to define, theorize, and research e-Portfolio (Farrell, 2020).

E-Portfolios serve as versatile tools in higher education, empowering students to exhibit achievements, drive self-improvement, improve employability, and foster professional growth (Gutiérrez-Santiuste et al., 2022; López-Crespo et al., 2021; Thanaraj, 2012). E-Portfolios in higher education offer students a platform to showcase academic achievements, extracurricular experiences, and future capabilities, tailored for specific applications. Acting as repositories for work collection and reflection, these portfolios foster continual improvement and serve as comprehensive tools for monitoring progress, linking curriculum elements, and nurturing identity development (Thanaraj, 2012). They visualize growth, enhancing confidence and learning progression from education to employment (Thanaraj, 2012). Moreover, in student-centered environments, e-Portfolios stimulate idea exchange, reflective learning, and increased engagement (López-Crespo et al., 2021). Additionally, e-Portfolios significantly aid in enhancing employability, aiding workforce planning, fostering professional learning communities, and facilitating pre-employment reflection and digital identity cultivation (Gutiérrez-Santiuste et al., 2022). E-Portfolios also benefit faculties in several aspects. E-portfolios play a crucial role in supporting faculty in their educational roles, fostering student learning, and enhancing professional development by offering a dynamic tool for reflection, collaboration, documentation, and showcasing achievements (Wensveen, 2009). Specifically, e-Portfolios promote reflective learning, personalized assessment, and research opportunities, empowering faculty to guide students in goal setting and reflective practices (Cheng & Chau, 2013).

However, implementing the use of e-Portfolios effectively is not an easy task. Faculty concerns persist regarding technical support, instructional design assistance, and their

own technological proficiency in blended learning initiatives (Ismail, 2023; Paulson & Campbell, 2018; Wensveen, 2009). Student-related challenges encompass varying computer skill levels, difficulties integrating e-Portfolios into the curriculum, and ensuring active student engagement. Limitations such as stakeholder commitment, cost considerations, integration complexities, and uncertainties about employer acceptance of e-Portfolios serve as significant obstacles (Reese & Levy, 2009). Additionally, faculty resistance to change, the diverse needs based on program size and communication dynamics, insufficient training and support, and the necessity for a clear purpose in implementation stand out as prominent challenges (Ismail, 2023; Paulson & Campbell, 2018; Swan, 2009). Yet with these potential issues with the implementation of e-Portfolios, there remains a lack of a comprehensive guide for its implementation in existing literature. The present review seeks to resolve that need.

Previous Reviews

There are several literature reviews on e-Portfolios. Bryant and Chittum's (2013) literature review on the effectiveness of e-Portfolios in higher education identified four trends in e-Portfolio research, including theory-based arguments, descriptive accounts, original data on users' feelings and opinions, and original data on student outcomes. It suggested a shift in e-Portfolio research towards a focus on data collection and presentation, particularly on the attitudes and perceptions of instructors and students using e-Portfolios. Wan and Metcalfe (2015) discussed the requirements and methodology for maintaining e-Portfolios in medical practice and found that e-Portfolios were important in demonstrating competence and continuing professional development, as mandated by the General Medical Council. Wan and Metcalfe (2015) discussed a "Do, Reflect, Plan, Act" framework (p.32), which is to enhance understanding of the e-Portfolio as a learning tool to improve medical practice. Beckers et al. (2016) provided a systematic analysis of the factors that influence the development of self-directed learning skills with e-portfolios, aiming to provide insights into how e-Portfolios can be optimally utilized to enhance students' self-directed learning. These factors included institutional, curriculum, learning process, personal, and portfolio factors. Wilson et al. (2018) focused on reviewing the digital ethics and guidelines when creating e-Portfolios to prevent negative impacts and improve the quality of artifacts. Raja Harun et al. (2021) explored the pedagogical affordances of e-Portfolio in teacher education programs which identified the positive impact of e-Portfolio in documenting student teachers' learning experiences and also highlighted the need to address issues such as instructions, technological skills, time constraints, reflective practice, as well as social pressure and privacy concerns for successful implementation of e-Portfolios in teacher education programs. These reviews provide valuable insights into different facets of e-Portfolios. However, for instructional designers and instructors, there remains no comprehensive review addressing the implementation procedures, potential barriers,

and effective strategies to provide novice and seasoned instructional designers and instructors with guidance and actionable suggestions on e-Portfolio usage.

Present Study

This systematic review fills the aforementioned gap by examining studies that focus on e-Portfolio implementation in higher education from three perspectives: the process of e-Portfolio implementation, potential barriers of implementation, and the strategies to overcome the challenges. This review seeks to address the following research questions:

1. What are the steps involved in integrating an e-Portfolio system within higher education institutions?
2. What specific potential barriers might hinder the effective implementation of e-Portfolios in higher education settings?
3. What actionable strategies can be employed to overcome the identified barriers for the successful adoption and utilization of e-Portfolios in higher education?

Through an in-depth exploration of the implementation steps, challenges and strategies associated with e-Portfolios in higher education, this literature review seeks to furnish precise guidance and actionable suggestions tailored for instructional designers and higher education instructors. The goal is to equip them with targeted insights and practical methodologies for proficient e-Portfolio design and implementation within higher educational contexts.

Method

Literature Search and Inclusion Criteria

Our systematic literature review involved three rounds of searches and the screening of titles, abstracts, and full-texts of relevant studies. We did not limit our search to a specific timeframe so as to capture all relevant published studies on e-Portfolios. In the first two rounds of searches, we used the following three search queries: (*E-portfolio AND higher education*), (*Undergraduate study AND E-portfolio*), and (*Graduate study AND E-portfolio*). The first search was conducted using the search queries in two major academic databases: Educational Resources Information Center (ERIC), and Academic Search Complete. These two databases are reputable and valued research sources for educators that contain a vast collection of scholarly articles, research papers, and educational resources. The second search was conducted in Google Scholar using the same search queries. Finally, in the third round, we examined the reference lists of the eligible studies from searches one and two to identify additional relevant studies. Conducting these three searches ensures a comprehensive collection of literature.

To be included in the review, eligible studies had to meet the following criteria:

1. The study focuses on the implementation and design process of e-Portfolios in higher education.
2. The study can be empirical, longitudinal case studies, or survey and interview studies regarding the implementation of e-Portfolio in higher education.
3. The study is published in a peer-reviewed, English-language academic journal. Conference proceedings, dissertations, and book chapters were not included in this literature review.

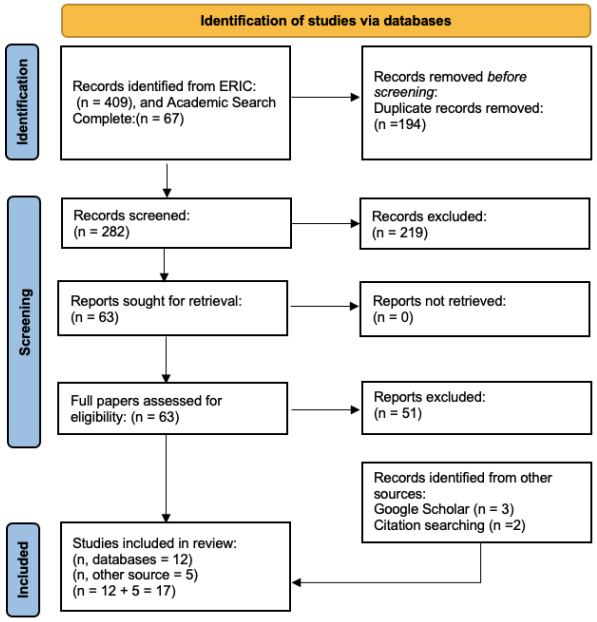
Details of the Screening Phase

The first search was our database search which was conducted in ERIC and Academic Search Complete. This search returned 476 studies. We downloaded the 476 studies and labeled them by authors' last names, year of publication, and title of the article. After removing duplicate studies based on the screening of authors' last names, year of publication, and title, 282 studies remained. We meticulously screened the 282 peer-reviewed articles based on our inclusion criteria in two phases. In the first phase, the titles and abstracts of the 282 articles were screened. A total of 63 articles met our criteria and were included for further review in the second phase. In the second phase, we downloaded and reviewed the full texts of the 63 studies, once again applying our inclusion criteria.

The second screening phase returned 12 eligible studies.

The second search was conducted in Google Scholar. While this search yielded a total of 46,400 results, the authors agreed that not all results from Google Scholar were relevant and screening 46,400 results would be unproductive. Thus, we began by screening the first 60 search results from Google Scholar (first three pages of results on Google Scholar). This yielded three eligible studies based on the screening of their titles, abstracts, and subsequently, full texts. Importantly, these three studies were not retrieved from our database search. We screened 40 additional results on Google Scholar (two additional pages of results); however, no additional eligible studies were identified. Thus, we concluded our search on Google Scholar with the inclusion of the three additional studies. Together with the 12 studies retrieved from the ERIC and Academic Search Complete databases and the three articles from Google Scholar, we identified a total of 15 studies for our review. Finally, we conducted backward citation searching by examining the reference lists of the 15 eligible studies to identify additional studies that met our inclusion criteria. We reviewed the titles and abstracts of potentially relevant articles from the reference list. This process led to the identification of two further articles, bringing the total number of eligible studies to 17. We included a PRISMA flowchart to outline our process (see Figure 1).

Figure 1
Identification of Studies via Databases



Codebook Development and Data Extraction

Our investigation into the implementation of e-Portfolios involved a meticulous three-phase coding process across the 17 articles. In the first phase, our aim is to identify and code for keywords relating to the e-Portfolio implementation steps, barriers, and strategies. To identify potential implementation steps, while reading hard copies of these articles, we underlined sentences or paragraphs, and annotated keywords such as “identifying the purpose”, “identifying the platform”, “providing workshop” etc. beside the sentences or paragraphs. Simultaneously, we created a Word document codebook featuring three tables, with each table addressing each research question (see Tables 3, 4 and 5). For example, for the first research question, which focused on the steps involved in implementing e-Portfolios, we listed the 17 articles in the first column in the order of authors’ last names, then we added the annotated keywords in the first row for the respective articles. In the table, we used the asterisk sign and page numbers to note the articles that addressed the relevant steps, forming a matrix table prototype akin to Table 3 in our study. This process was replicated for the subsequent research

questions, resulting in Tables 4 and 5 in this paper. Appendix A presents the detailed information of this coding step.

Moving to the second phase, based on the keywords associated with steps, challenges, and strategies we identified in the first phase, we collated relevant excerpts from studies, compiling them in a separate Word document under categorized headings. These excerpts were labeled by authors' last names, year of publication, and page number. For instance, for the step of "identifying the purpose," we copied and pasted relevant sentences about e-Portfolio purposes from the 13 studies and complied them under the heading of "Identifying the purpose". Then we reviewed and analyzed these excepts to identify the subtopics under each heading for further synthesis in the third phase. For example, under the heading of "Identifying the purpose", we further identified subtopics such as "formative learning tool," "summative folders," and "employment marketing portfolios". Table 1 below provides an example of our organization and coding process for two implementation steps.

Table 1
Example of Organization and Coding of the Data

Implementation Step	**Excepts Examples**	**Article and Page Number**	**Subtopics Identified from the Excepts**
Identifying the purpose	"Because of their flexibility and variety of learning and teaching tools and artefacts they offered, ePortfolios might be a valuable instrument to support students' learning experiences",	Morales et al. (2016) p. 1740	Formative assessment tool
	"For the purpose of this article we define a Web 2.0 ePortfolio system as a distributed Internet-infused virtual container of evidence of learning."	Stephensen & Dillon (2013) p. 164	Summative folder
	"ePortfolios had the potential to assist students become reflective learners, conscious of their personal and professional strengths and weaknesses, as well as to make their existing and developing skills more explicit, with an associated	Hallam & Creagh (2010) p. 186	Employment marketing portfolios

	value apparent in the graduate recruitment process."		
Choosing a platform	"Based on these identified needs and priorities and a review of available platforms, five ePortfolio solutions were chosen for in-depth analysis: Desire2Learn, PebblePad, Digication, Pathbrite, and TaskStream."	Posey et al. (2015) p.77	Types of platforms
	"The ePortfolio tool of choice, as identified by survey participants, had a number of key requirements: it was to be a user-friendly, template-driven tool integrated within the university's technological environment, that would support the storage of documents, images and video files. Lifelong access to the tool or content portability were considered essential for engagement of academics and students."	Coffey & Ashford-Rowe (2014) p.288	Features of platform

In the third phase, based on the categorized excepts and their subtopics identified in phase two, we critically examined, distilled, and synthesized the content to create comprehensive academic results descriptions with relevant citations. This synthesis resulted in nuanced insights into the steps, challenges, and strategies involved in implementing e-Portfolios in higher education, as shown in the results section in this paper.

Results

Dataset Overview

The 17 studies analyzed in this review were all empirical studies and published in 13 different journals. Of these journals 10 had titles that included at least one word related to education, computers, technology, or e-Portfolio, which are closely related to the theme of this review regarding e-Portfolio in higher education (see Table 2). The remaining three journals were focused on topics such as career development, student services, and distance learning. The International Journal of e-Portfolio was the most common publication source (n = 3).

Table 2
Overview of the 17 Studies

Article	Source Location
Balaban et al. (2013)	Computers & Education
Berbegal Vázquez et al. (2021)	Tuning Journal for Higher Education
Cheng (2008)	Journal of Educational Technology Systems
Coffey & Ashford-Rowe (2014)	Australasian Journal of Education Technology
Hains-Wesson et al. (2014)	International Journal of ePortfolio
Hallam & Creagh (2010)	Higher Education Research & Development
Lambert & Corrin (2007)	Australasian Journal of Education Technology
Lumsden (2007)	New Directions for Student Services
McCowan et al. (2005)	Australian Journal of Career Development
Morales et al. (2016)	Education and Information Technologies
Peacock et al. (2010)	British Journal of Educational Technology
Posey et al. (2015)	International Journal of ePortfolio
Rowley & Bennett (2016)	International Journal of Education & the Arts
Shepherd & Bolliger (2014)	Online Journal of Distance Learning Administration
Stephensen & Dillon (2013)	Journal of Music, Technology & Education
Wells et al. (2018)	International Journal of ePortfolio
Wilhelm et al. (2006)	TechTrends

Results Relevant to RQ #1: Implementation Steps

To address research question 1, we examined the 17 eligible studies and identified seven steps crucial for the implementation of e-Portfolios. We present these steps in the order of their occurrence during the implementation process as shown in Table 3. These steps were: identifying the purpose (76%, 13 of 17 studies), identifying the stakeholders (41%, 7 of 17 studies), choosing a platform (76%, 13 of 17 studies), providing workshops (52%, 9 of 17 studies), creating e-portfolios (41%, 7 of 17 studies), assessing e-portfolios (11%, 2 of 17 studies), and evaluating the project (29%, 5 of 17 studies).

Table 3

E-Portfolio Implementation Process.

Study	Identify the Purpose	Identify the Stakeholders	Choose a Platform	Workshops	Create e-Portfolios	Assess e-Portfolios	Evaluate the Project
Balaban et al. (2013)		*					
Berbegal Vázquez et al. (2021)			*				
Cheng (2008)		*	*		*		*
Coffey & Ashford-Rowe (2014)			*				
Hains-Wesson et al. (2014)	*	*	*	*			*
Hallam & Creagh (2010)	*	*					
Lambert & Corrin (2007)	*		*	*			*
Lumsden (2007)	*	*	*	*	*		*
McCowan et al. (2005)	*		*	*	*		
Morales et al. (2016)	*	*		*	*	*	
Peacock et al. (2010)	*						
Posey et al. (2015)	*	*	*		*		*
Rowley & Bennett (2016)	*		*				
Shepherd & Bolliger (2014)	*		*	*	*	*	

Stephensen & Dillon (2013)	*	*	*	
Wells et al. (2018)	*	*	*	*
Wilhelm et al. (2006)	*	*	*	

Identify the purpose. To effectively implement e-Portfolios in educational settings, it is important to define their purpose. Barrett (2007) has identified three general purposes of e-Portfolios, namely learning formative portfolios, assessment summative portfolios, and employment marketing portfolios. In this literature review study, we found that the studies aligned with Barrett's three general purposes.

Three studies used e-Portfolios as a formative assessment tool to monitor students' study process and professional development. Morales et al. (2016) found e-Portfolios to be a valuable instrument for monitoring students' learning experience, providing appropriate feedback and support. Hains-Wesson et al. (2014) used e-Portfolios for reflective practice and assessment, while Shepherd & Bolliger (2014) allowed students to track their learning progress, share ideas with peers and instructors, and engage in reflective practice.

Two studies used e-Portfolios as a summative folder to showcase final learning products. Stephensen & Dillon (2013) used e-Portfolios to showcase students' final creative art products, while Wells et al. (2018) used them to document learning and mastery and aid program evaluation.

Five studies used e-Portfolios for career services. Lumsden (2007) sought to develop a program to help students integrate curricular and cocurricular experiences, supporting the connection of learning opportunities with employer needs. Additionally, four studies identified e-Portfolios as aiding in professional development, career planning, and future employment (Hallam et al., 2010; Lambert & Corrin, 2007; Peacock et al., 2010; Rowley & Bennett, 2016).

Three studies included all three types of purposes identified by Barrett (2007). McCowan et al. (2005) stated that e-Portfolios should be flexible enough to encourage students' capability development, showcase their achievements, and serve as an employment-orientated tool. Wilhelm et al. (2006) used e-Portfolios for professional development, formative and summative assessment, and employment supporting

materials. Posey et al. (2015) noted that e-Portfolios could serve multiple purposes, including facilitating students' learning, evaluating individual and program performance for accreditation, supporting job searches, and aiding course and program planning.

Overall, the studies in this literature review aligned with Barrett's three general purposes of e-Portfolios in educational settings.

Identify the Stakeholders. The stakeholders in the utilization of an e-Portfolio system include individuals such as students and teachers, institutions, employers, system developers, administrators, internet communications technology staff, academics, general staff, academic managers, ICT managers, learning technologists, learning designers, careers and employment advisors, and professional bodies (Balaban et al.,2013; Cheng, 2008; Hains-Wesson et al., 2014; Hallam & Creagh, 2010).

Different stakeholders have various needs and goals in the implementation of e-Portfolios. While a comprehensive study of e-Portfolios from all stakeholders' perspectives is beyond the scope of a single research study, most research focused on assessing e-Portfolio deployment from the perspective of individual students (Balaban et al., 2013; Morales et al., 2016; Posey et al., 2015). However, Lumsden (2007) emphasized the importance of faculty, staff, and administrators in marketing the e-Portfolio project, as they play a critical role in the success of the program.

Choose a Platform. Thirteen studies described the platforms used for documenting e-Portfolio artifacts (see Table 2) (Berbegal Vázquez et al., 2021; Cheng, 2008; Coffey et al., 2014; Hains-Wesson, 2014; Lambert & Corrin, 2007; Lumsden, 2007; McCowan et al., 2005; Posey et al., 2015; Rowley & Bennett, 2016; Shepherd & Bolliger, 2014; Wilhelm et al., 2006). Most of these studies focused on the types of platforms and the features of the platform, as well as the final platforms chosen for documenting e-Portfolio artifacts.

Regarding the types of platforms, most studies opted for open-source or commercial systems. Five studies explicitly stated that they preferred open-source systems due to their extendibility, flexible interfaces and functionality, active community of practice, or cost-effectiveness (Cheng, 2008; Hains-Wesson, 2014; Shepherd & Bolliger, 2014). The program staff in Wells et al.'s study (2018) used Edublog, a WordPress-based educational blogging system, to enable trainees to transition to a free Wordpress.com site. Rowley & Bennett (2016) reported that Griffith University chose an e-Portfolio platform from freely available open-source software for music technology students. In contrast, some universities preferred commercial systems, such as those selected by the committee in Posey et al.'s study (2015), who chose three commercial platforms

based on their own criteria and the vendor's demonstrations and conducted hands-on usability tests to evaluate the end-user experience. Wilhelm et al. (2006) reported that universities invited vendors to present the platform features, services, and pricing structures to facilitate decision-making. Furthermore, some studies chose to create and develop their own unique platforms for their universities, such as the Career Portfolio Program (CPP) developed by the Florida State University Career Center (Lumsden, 2007) and the "iPortfolio" platform used by students at Curtin University (Rowley & Bennett, 2016).

Regardless of the types of platforms, the studies share commonalities in terms of the features of the platforms or the criteria used to choose a platform. Key features include ease of use and development, support for versatile forms of artifacts, shareability, and lifelong accessibility (Berbegal Vázquez et al., 2021; Cheng, 2008; Coffey et al., 2014; Hains-Wesson, 2014; Posey et al., 2015). Additionally, individualized privacy options for users to control their privacy are important considerations (Posey et al., 2015; Shepherd & Bolliger, 2014). Importantly, the e-Portfolio platform should be a customized system that can be integrated with the university's learning management system (Hains-Wesson, 2014; Lambert & Corrin, 2007; McCowan et al., 2005; Posey et al., 2015).

The final platforms chosen by the studies to support e-Portfolio development include Mahara (Hains-Wesson, 2014), Digication, PebblePad, and PathBrite (Posey et al., 2015), a new Blackboard e-Portfolio tool for Vista (Lambert & Corrin, 2007), Google Sites (Shepherd & Bolliger, 2014), LiveText for Drake University and TaskStream for Arizona State University (Wilhelm et al., 2006). Additionally, the technologies identified for the Griffith academic community include Expo Lx, Dreamweaver, Google Sites, Graduate Attributes Toolkits, Standout Resume Creator and Career Board. (Coffey et al., 2014).

Workshops. Nine studies implemented a workshop prior to e-Portfolio use by addressing its necessity and the specific strategies. Workshops are crucial for preparing participants to create their own e-portfolios (Lambert & Corrin, 2007; Morales et al., 2016; Wilhelm et al., 2006). Participants require training in the e-Portfolio tool and its purpose (Lambert & Corrin, 2007; Morales et al., 2016; Wilhelm et al., 2006). Early orientation can address the basics (Wilhelm et al., 2006) while later follow-up sessions and support documentation can assist those who need help using the tool (Lambert & Corrin, 2007). To ensure proper functioning, students can provide feedback via survey (Hains-Wesson et al., 2014). Offering sample e-Portfolios as references (McCowan et al., 2005; Shepherd & Bolliger, 2014) and showing examples of good practices in the system (Hains-Wesson et al., 2014) can also support students. Some workshops can focus on employment skills (Lambert & Corrin, 2007; Lumsden, 2007), while others

emphasize support and feedback from instructors (Morales et al., 2016) or one-on-one training (Stephensen & Dillon, 2013). Faculty training, communication, and coordination are crucial for successful implementation of e-portfolios (Wilhelm et al., 2006). Monthly reflections can monitor trainees' perceptions and skills (Wells et al., 2018).

Create e-Portfolios. The process of creating e-Portfolios involves specific activities that were identified in seven studies. Cheng (2008) presented four activities that students should carry out, which include identifying a specific purpose and audience for the e-Portfolio, selecting artifacts to demonstrate their competence, reflecting on why they chose specific artifacts, and giving feedback on at least two users' e-Portfolios. Lumsden (2007) provided a skill matrix for students to enter information into, which records their skill development and encourages them to reflect on how their experience led to career skill development. Morales et al. (2016) emphasized the importance of teachers' guidance and tips to keep students engaged in the learning process and the use of e-Portfolios during the creation stage.

In terms of the content of e-Portfolios, Lumsden's (2007) study relied on a skills matrix that included nine types of skills developed through five experiences. McCowan et al. (2005) included a framework with "four settings (academic, work, community and personal) and nine skill areas (communication, teamwork, problem solving/critical thinking, life management/lifelong learning, technical/professional/research, managing, social responsibility, leadership, creativity/design and initiative)" (p. 45). Posey et al. (2015) showed that students in the Nursing Master program created a capstone e-Portfolio that comprised multiple assignments and professional works completed throughout their program to demonstrate essential competencies. Wells et al. (2018) required similar e-Portfolio content, including professional philosophy and goals, resume, and artifacts such as papers, posters, speeches, and videos. Shepherd and Bolliger (2014) included additional components, such as a course timeline, personal evaluation, and program evaluation.

Assess e-Portfolios. After creating e-Portfolios, the next step is to assess the work done in them. Morales et al. (2016) identified two aspects of e-Portfolio assessment. First, students reflect on their personal experience and provide their honest opinions. Second, instructors grade the work based on the criteria established at the beginning of the course. In Shepherd et al.'s (2014) study, instructors first conduct peer reviews among students using the same grade criteria as the instructor. Then, instructors provide formative feedback to each student, allowing for additional revisions before a summative evaluation. Additionally, Shepherd & Bolliger (2014) used the e-Portfolio as a component for doctoral students' comprehensive examination, which was taken at the end of their course work.

Evaluate the Project. Five studies (Cheng, 2008; Hains-Wesson et al., 2014; Lambert & Corrin, 2007; Lumsden, 2007; Posey et al., 2015) used questionnaires at the end of their research to gather students' and teachers' perceptions of e-Portfolios. The themes of the questionnaires included interface design, instructional design, learning difficulty, envisioned capability, and user satisfaction (Cheng, 2008). Other studies focused on understanding issues and support around e-Portfolio use (Hains-Wesson et al., 2014; Lambert & Corrin, 2007), the effectiveness of e-Portfolios as a career development tool (Lumsden, 2007), and reflection on coursework and reviewing artifacts across a curriculum or program from the perspective of students and teachers (Posey et al., 2015).

Results Relevant to RQ #2: Potential Implementation Barriers

The 17 studies were reviewed to identify the primary barriers associated with implementing e-Portfolios. Of the eight concerns examined as shown in Table 4, technology was the most frequently mentioned (82% 14 of 17 studies), followed by students' self-motivation (41%, 7 of 17 studies), teachers' workload (29%, 5 of 17 studies), policy (24%, 4 of 17 studies), privacy (24%, 4 of 17 studies), pedagogical considerations (12%, 2 of 17 studies), artifact quality (12%, 2 of 17 studies), and academic integrity (12%, 2 of 17 studies).

Table 4

E-Portfolio Implementation Barriers

Study	Technology Barriers	Students' Self-Motivation	Teachers' Workload	Policy Barriers	Privacy Barriers	Pedagogical Barriers	Artifacts Quality Barriers	Academic integrity Barriers
Balaban et al. (2013)	*						*	
Berbegal Vázquez et al. (2021)	*			*				
Cheng (2008)	*		*		*		*	*
Coffey & Ashford-Rowe (2014)	*							

Hains-Wesson et al. (2014)	*	*	*					
Hallam & Creagh (2010)			*	*		*		
Lambert & Corrin (2007)	*	*						
Lumsden (2007)								
McCowan et al. (2005)	*			*				
Morales et al. (2016)	*	*						
Peacock et al. (2010)	*	*	*		*			
Posey et al. (2015)	*				*			*
Rowley & Bennett (2016)	*	*				*		
Shepherd & Bolliger (2014)		*	*		*			
Stephensen & Dillon (2013)	*			*				
Wells et al. (2018)	*	*						
Wilhelm et al. (2006)	*							

Technology Barriers. Fourteen studies addressed technology barriers. Among these studies, Posey et al. (2015), Morales et al. (2016), and Wells et al. (2018) simply mentioned technology issue was the common challenge without providing further details. In general, the technology concerns discussed in these fourteen studies can be broadly categorized into two main categories. The first category pertains to technical issues concerning the e-Portfolio system itself, while the second category focuses on challenges related to people's usage of the system.

Technical issues with the system and challenges related to its use were the main areas of concern. The technical specifications of the system, such as data processing capabilities, ease of use, and system reliability, should be considered (Balaban et al., 2013). Wilhelm et al. (2006) emphasized that it is crucial that the system is suitable for the unique factors present in the specific university situation. Other barriers included poor navigability, data limits on uploaded materials, and lack of storage capacity (McCowan et al., 2005; Rowley & Bennett, 2016). Additionally, the chosen e-Portfolio platform may require specific computer configurations and have limited potential for personalization (Berbegal Vázquez et al., 2021; Lambert & Corrin, 2007).

Learning and adapting to new technology was a concern for both students and teachers, who expressed fear of change and a lack of support to meet their individual needs (Cheng, 2008; Coffey & Ashford-Rowe, 2014; Peacock et al., 2010; Hains-Wesson et al., 2014). Implementation, technical issues, and policy can also impact students' adoption and use of e-Portfolio features (Stephensen & Dillon, 2013). Additionally, some users lack motivation to take advantage of the versatility of artifact use (Berbegal Vázquez et al., 2021).

Students' Self-Motivation. Seven studies examined students' self-motivation towards e-Portfolios from the aspects of buy-in difficulty, time consumption and the hardship to sustain after program.

The difficulty with buy-in includes the lack of a portfolio culture (Lambert & Corrin, 2007) or an appropriate learning environment where the e-Portfolio should be clearly integrated (Morales et al., 2016). Additionally, some students did not fully understand the value of e-Portfolios (Peacock et al., 2010) or its relevance to their self-development or career (Rowley & Bennett, 2016). Furthermore, some participants expressed that the e-Portfolio was not their preferred mechanism to showcase their artifacts, and some felt that creating an e-Portfolio was extra work for them (Wells et al., 2018). During the process, students did not want to spend extra time transferring what they had already done on paper into online artifacts, which hindered their progress (Peacock et al., 2010). Students in Rowley and Bennett's (2016) study also expressed that unless e-Portfolios were assessed, they did not have the time or motivation to complete them because they had many other mandated tasks. Moreover, a lack of clear direction for the process was a contributing factor for students' reluctance to engage during the process (Hains-Wesson et al., 2014; Rowley & Bennett, 2016; Wells et al., 2018). After completing the course or program, students quickly discontinued the development and tasks for their e-Portfolios, which caused difficulties in sustaining their use in the long term (Shepherd & Bolliger, 2014).

Teachers' Workload. The amount of workload for teachers is another barrier for implementing e-Portfolio in the course or program. According to Hains-Wesson et al. (2014), during the early stages of implementation, tutors may experience an increase in workload due to the learners' initial difficulties with technology and reflective learning. Peacock et al. (2010) conducted interviews with teachers and found that embracing technology can lead to initiative fatigue and extra workload. Furthermore, supporting students in using e-Portfolios can increase the workload for teaching staff and requires effective pedagogical and technological support (Hallam & Creagh, 2010). Some teachers who are accustomed to traditional assessment methods may find viewing and grading e-Portfolios on a computer screen burdensome (Cheng, 2008). The workload associated with e-Portfolios can also lead to faculty members with heavy advising loads rarely discussing e-Portfolio goals with their students, and the e-Portfolio tasks being rarely discussed in courses as they are not required course assignments (Shepherd & Bolliger, 2014).

Policy Barriers. E-portfolio implementation policies have raised several concerns among scholars. Stephensen & Dillon (2013) found that the "access and control" policy negatively impacted students' uptake and use of the e-Portfolio system because non-university participants were not allowed access to the e-Portfolios and students did not have full control of their own e-Portfolios. McCowan et al. (2005) noted that while students had the freedom to include whatever they liked in their e-Portfolios, the university had to endorse the final product, and the system administrator had access to every student e-Portfolio and could cancel any that varied from the protocols. These restrictions were put in place to ensure that the e-portfolios met certain quality standards. Berbegal Vázquez et al. (2021) discussed how the user-centered e-Portfolio method is related to financial and meritocratic policies, as well as power distribution within the organization, and how it could lead to the resignification of the curriculum. They argued that this innovative method has the potential to challenge traditional power structures and transform the way curricula are designed and implemented. Hallam & Creagh (2010) highlighted policy issues surrounding e-Portfolios, including questions of both government policy and academic policy within the institution. These policies address student mobility and their academic credits across institutions, underscoring the importance of developing and managing e-Portfolios in a way that aligns with these policies.

Privacy Barriers. Privacy barriers regarding implementing e-Portfolios include issues related to intellectual property and personal data protection (Peacock et al., 2010; Posey et al., 2015). Participants in these studies expressed concerns about sharing their artifacts without their consent, with some worried that sharing online artifacts might lead to plagiarism and affect the fairness of assessment (Cheng, 2008). However, some

students reported that sharing their artifacts was not a concern, as they aimed to showcase their work to a specific audience (Peacock et al., 2010). Shepherd and Bolliger (2014) found that students could use Google Sites to create e-Portfolios, which provided the option to keep their sites private by sending invitations to view their e-Portfolio sites. However, this process was time-consuming and cumbersome. The study highlights the need for effective privacy controls that are easy to use and manage for both students and instructors.

Pedagogical Barriers. The introduction of e-Portfolio as a learning or assessment activity would require teachers to reconsider their pedagogical methods and learning goals to ensure consistency between learning activities, assessment, and learning outcomes (Hallam & Creagh, 2010). According to Rowley and Bennett (2016), embedding e-Portfolio into degree programs requires curriculum design changes, including adapting existing assessments and assignments and changing learning and teaching practices.

Artifacts Quality Barriers. Balaban et al. (2013) addressed barriers about artifacts by noting that it can be challenging to capture and measure the quality of information contained in artifacts because it is not always clearly distinguishable. Cheng (2008) suggested that if coursework is included in the e-Portfolio system, it should be converted into an electronic format because manually converting handwritten work into electronic format can be time-consuming.

Academic Integrity Barriers. Posey et al. (2015) addressed academic integrity barriers during the committee's collaboration process. Some participants expressed concerns about student plagiarism because it is easy to copy and paste English language artifacts or steal others' ideas from the internet (Cheng, 2008).

Results Relevant to RQ #3: Strategies for Successful Implementation

We attempted to identify strategies that address the concerns outlined in the second research question. Across the studies analyzed, we found various strategies that correspond to each concern as shown in Table 5. Training support was the most commonly identified strategy, appearing in 82% (14 out of 17) of the studies. This is followed by overall feedback (35%, 6 of 17 studies), shared models (29%, 5 of 17 studies), policy support (18%, 3 of 17 studies), privacy and data protection (12%, 2 of 17 studies), student-centered pedagogy (18%, 3 of 17 studies), artifacts assessment criteria (18%, 3 of 17 studies), and anti-plagiarism (6%, 1 of 17 studies).

Table 5

Strategies for E-Portfolio Implementation

Study	Training Support	Overall Feedback	Shared Models	Policy Support	Privacy and Data Protection	Student-Centered Pedagogy	Artifacts Assessment Criteria	Anti-plagiarism
Balaban et al. (2013)			*				*	
Berbegal Vázquez et al. (2021)	*	*						
Cheng (2008)	*				*		*	*
Coffey & Ashford-Rowe (2014)				*				
Hains-Wesson et al. (2014)	*	*						
Hallam & Creagh (2010)	*	*	*	*				
Lambert & Corrin (2007)	*	*						
Lumsden (2007)	*					*		
McCowan et al. (2005)	*	*	*	*		*		
Morales et al. (2016)	*	*				*	*	
Peacock et al. (2010)	*							
Posey et al. (2015)	*		*					
Rowley & Bennett (2016)	*							
Shepherd & Bolliger (2014)	*							

Stephensen & Dillon (2013)	*		*
Wells et al. (2018)	*		
Wilhelm et al. (2006)		*	

Training Support. Training support is common before implementing e-Portfolios, as evidenced by 14 studies that provided such support to address concerns about technology. Lambert and Corrin (2007) discussed the requirements of potential employers and rated students' current skill levels, while Rowley and Bennett (2016) held a class-based discussion on the applicability of e-Portfolios for career development. Hains-Wesson et al. (2014) provided workshops in a seminar room or computer laboratory, while Berbegal Vázquez et al. (2021) included tutorials for students and instructors within the digital space. During the training process, Cheng (2008) provided typical answer templates and online animated tutorials, and Hallam and Creagh (2010) used international information standards and an e-Portfolio toolkit. Other studies emphasized the importance of peer support (Posey et al., 2015; Wells et al., 2018) and follow-up sessions (Lambert & Corrin, 2007; Rowley & Bennett, 2016; Stephensen & Dillon, 2013). At the end of training, Hains-Wesson et al. (2014) invited new users to provide anonymous feedback via a survey.

Overall, the training covered a range of topics, including benefits of e-Portfolios, online resources, and good examples of e-Portfolio creation. Lumsden (2007) provided tours for each option and focused on the topics to be included in the e-Portfolio for students to develop their skills. Shepherd and Bolliger (2014) found that instructors also need periodic follow-up training sessions and practice to increase their comfort levels in supporting students. Finally, the trainees in the study of Wells et al. (2018) reflected that they preferred sessions focusing on learning by doing and providing opportunities for practice and skill acquisition.

Overall Feedback. Overall, six studies focused on feedback for students' e-Portfolos, encompassing feedback from instructors, self-assessment, and peer feedback to address the concern of students' lack of self-motivation in using e-Portfolios. First, students preferred consistent and effective feedback from supervisors and mentors (Hains-Wesson et al., 2014; Lambert & Corrin, 2007). Strategies for instructors to provide feedback were provided by Morales et al. (2016), including introducing initial grading and assessment to give students a clear picture of their upcoming progress, organizing and facilitating class discussions to clarify doubts related to course work, scheduling individual feedback sessions to clarify students' individualized and specific

concerns, and providing timely, continuous, constructive, and reflective feedback to motivate students to develop critical assessments for their own work and self-regulate their progress. Second, McCowan et al. (2005) and Berbegal Vázquez et al. (2021) both implemented self-assessment, allowing students to determine how to build their skills and create a feasible plan for the future. In addition, Hallam and Creagh (2010) and Berbegal Vázquez et al. (2021) emphasized peer feedback for peer learning by establishing social networks, forums, work groups, and communities of practice in which students could share experiences and give feedback to create high-quality e-Portfolios.

Shared Models. As teachers need to provide tutorials for students during the whole process which leads to extra work for the teachers, a shared model might have the potential to address this issue. The successful implementation of e-Portfolios can be ascribed to the adoption of a cohesive shared vision as a guiding model among faculty, students, and administration. This encompasses a consensus on a conceptual framework, robust administrative backing, and a structured approach for students (Posey et al., 2015; Wilhelm et al., 2006). The implementation and usage of e-Portfolios can be further improved by applying the e-Portfolio success model, which involves delivering enhancements based on the basic system (Balaban et al., 2013; McCowan et al., 2005).

Hallam and Creagh (2010) provided four reference models for e-Portfolios, including the national e-Portfolio model, locally driven model, web 2.0 model, and zero-action model. The national model is a government-owned and government-driven approach for all learners. The locally driven model is developed within higher education and encompasses academic policies for individual learners, teaching staff, mentors, and employers, and it focuses on embedding e-Portfolios into the curriculum. The web 2.0 model is informal and provides opportunities for high levels of innovation, but it may be challenging to align the process with specific learning objectives. The zero-action model lacks policy and strategy and is suitable for innovation.

Policy Support. Regarding the policy issue of access and control, Coffey and Ashford-Rowe (2014) recommends providing students with lifelong access to their e-Portfolios, which would allow them to transfer their portfolio content from one system to another as they move between universities. This would support their employability and alumni connections. Hallam and Creagh (2010) suggests the adoption of international information standards for e-Portfolio practice in order to facilitate the exchange of information and data across institutions and jurisdictional boundaries. McCowan et al. (2005) introduced a disclaimer at the bottom of each student e-Portfolio and established a system for the administrator to access and potentially delete portfolios not adhering to QUT's IT protocols.

Privacy and Data Protection. Protecting privacy is a concern for students, and three studies suggest possible solutions to address this issue. Cheng (2008) suggests that users should have the ability to share their e-Portfolios and feedback with preset groups, such as teachers, peers, and the public. This way, students could protect their privacy by controlling who can view their e-Portfolios and peer feedback. Stephensen and Dillon (2013) agree that students should have control over where and how to store their artifacts and how they are exhibited; and the university could provide "an index system that can reference external data storage and websites and a unique storage facility for sensitive and ethically private materials" (p. 175).

Student-Centered Pedagogy. Regarding concerns about pedagogy change, student-centered pedagogy might be useful to address the problem as this approach places the student at the center of their learning experience. By empowering students to take ownership of their learning and progress, they become more engaged and motivated to succeed (Kaput, 2018). Three studies highlight the importance of constructing e-Portfolios that are student-centered. McCowan et al. (2005) suggest that each student should be responsible for managing their own work and e-Portfolio. Lumsden (2007) provides specific strategies from the perspective of students, suggesting that the program should allow students to plan, select, and pursue learning activities to construct their e-Portfolio within and outside of their formal curricula. This would be beneficial for their personal and professional goals throughout their undergraduate and graduate academic careers. Morales et al. (2016) address the student-centered strategies from the perspective of teachers, suggesting that instructors should act as mentors and coaches to ensure students take responsibility for their coursework and do not lose direction and teachers should also minimize direct teaching from instructors but organize individual and collaborative work such as student-led presentations and group discussions.

Artifacts Assessment Criteria. Three studies have proposed assessment criteria to address concerns about the quality of artifacts. In Cheng's study (2008), teachers developed an online assessment rubric consisting of three criteria - English language proficiency, quality and quantity of work, and reflection - to evaluate students' e-Portfolios and provide them with a performance indicator. Balaban et al. (2013) found that some researchers used existing scales to evaluate the quality of e-Portfolio artifacts, while others developed their own scales based on factors such as relevance, accuracy, completeness, usability, conciseness, and importance. Morales et al. (2016) addressed artifact quality by presenting and explaining specific artifact examples to ensure students had a clear understanding of expectations and by clarifying the course syllabus, assessment process, and grading system.

Overall, the assessment criteria for e-Portfolio artifacts should align with the goals and objectives of the evaluation. Criteria should be comprehensive, clear, and transparent to ensure that students understand the expectations and goals of the assessment.

Anti-Plagiarism. Out of the 17 studies reviewed, only one addressed anti-plagiarism measures to address the academic integrity concern. In Cheng's (2008) study, students were required to select a declaration checkbox confirming that the files they were uploading were their own work and free from plagiarism. If students failed to make this declaration, their artifacts could not be uploaded to the system. Additionally, teachers were advised to monitor students' performance regularly to identify any unexpected performance that may indicate plagiarism.

Discussion

This systematic review seeks to provide an in-depth understanding the implementation steps, challenges and strategies associated with e-Portfolios in higher education. Specifically, results from this review guidance and actionable suggestions tailored for instructional designers and higher education instructors, equipping them with targeted insights and practical methodologies for proficient e-Portfolio design and implementation within higher educational contexts.

What is the process of implementing e-Portfolio in higher education?

This review identified seven key steps for implementing e-Portfolios in higher education. First, defining the e-Portfolio's purpose-whether for assessment or employment-ensures alignment with user expectations. Second, identifying stakeholders like students, teachers, and developers ensures their needs are considered. Third, selecting an appropriate platform based on cost, functionality, and compatibility is crucial. Fourth, conducting workshops helps users become proficient in using the e-Portfolio effectively. Fifth, students create their e-Portfolios, guided by frameworks, to organize content logically. Sixth, assessing student work against set criteria ensures the e-Portfolios' effectiveness for assessment purposes. Lastly, evaluating the project through surveys helps identify areas for improvement and aligns with the project's goals for future enhancements.

The process identified in this literature review highlights similarities with Gulzar and Barrett's (2019) exploration of essential factors for e-Portfolio implementation, emphasizing planning, tool selection, and device integration. Similarly, Buzzetto-More and Alade's (2008) Pentagonal E-Portfolio Model outlined a structured approach through five levels: Identifying Needs, Determination, Assessment, Budgeting, System Selection, Strategic Planning, Development, Implementation, and Continuation.

Understanding the process of implementing e-Portfolios in higher education is crucial as it provides a structured roadmap for educators and instructional designers. It streamlines the integration process, enhances user adoption, and elevates the overall quality of educational experiences, making it a fundamental guide for successful e-Portfolio implementation in higher education context.

What are potential barriers and concerns when implementing e-Portfolio?
The implementation of e-Portfolios in higher education is likely to encounter multiple potential barriers and concerns. Foremost among these is the technological challenge encompassing system functionality, navigability, and stability. What's more, student resistance due to lack of self-motivation poses a substantial hurdle, demanding additional support and increased workload for teachers. Pedagogical concerns arise, necessitating adjustments to curricula and assessments. Safeguarding intellectual property and privacy rights, ensuring academic integrity, improving the quality of student artifacts, and addressing policy coherence among stakeholders further add complexity to successful e-Portfolio implementation in higher education.

The barriers of implementing e-Portfolio identified from this systematic literature review align well with the findings of Ismail's (2023) questionnaire study. Ismail (2023) conducted questionnaire research among undergraduates, specifically focusing on identifying the barriers with the implementation of e-Portfolio, including learner' limited knowledge and understanding of e-Portfolios, time management challenges and workload overload, as well as attitudinal barriers and technological hurdles. Paulson and Campbell (2018) found some other barriers, including a lack of coordination due to the size of programs and the number of online instructors, resistance from faculty members and reluctance from stakeholders to use e-Portfolios due to the coordination, time, effort, and commitment required for adoption, implementation, and assessment.

Understanding the barriers in implementing e-Portfolios in higher education is crucial as it enables stakeholders to anticipate challenges, allocate resources effectively, make informed decisions, and foster continuous improvement. Recognizing these barriers, instructors and instructional designers can proactively design learning experiences that address student resistance and technological complexities, fostering student engagement and motivation. Instructional designers can integrate appropriate scaffolding and support structures within the e-Portfolio framework, ensuring its usability and effectiveness. Moreover, this understanding allows instructors and designers to collaborate in developing comprehensive training programs, empowering both faculty and students with the necessary skills to navigate the technology and maximize its educational potential barriers.

What are strategies for successful implementation?

To address these barriers and concerns discussed in question two, the researchers identified corresponding strategies for each barrier. To address technology concerns, training support in the form of orientation, just-in-time instruction, and follow-up training sessions can be helpful. Feedback from instructors, peers, and self can motivate students to engage in constructing their e-Portfolios. Using a shared version of the model can reduce instructors' workload and save time. To address policy concerns, adopting international standards of e-Portfolio practice and providing lifelong access to e-Portfolios can be useful. Students should have control over whom they share their work with to protect their intellectual property rights. To address potential pedagogical change concerns, a student-centered pedagogy can enhance the learning experience for students and promote a more holistic approach to assessment. Clear criteria, including accuracy, content, language quality, and visual appeal, can help improve the quality of students' artifacts. Finally, to prevent plagiarism, teachers can monitor students' performance and require them to declare no plagiarism when submitting their work. Paulson and Campbell (2018) suggested that addressing the diverse challenges and opportunities of implementing e-Portfolios in higher education requires coordination and collaboration among administrative, instructional, and technological stakeholders.

The practical importance of these strategies for instructional designers and instructors lies in their ability to navigate and surmount potential challenges in implementing e-Portfolios effectively within higher education. For instructional designers, these strategies offer a blueprint for creating a seamless integration plan, ensuring comprehensive training, and devising support mechanisms for educators. They serve as a roadmap to anticipate hurdles and proactively design solutions, streamlining the process of incorporating e-Portfolios into the curriculum. For instructors, these strategies provide essential tools to facilitate student engagement, foster a student-centered learning environment, manage workload efficiently through shared models, and ensure fair assessment practices. By implementing these strategies, both instructional designers and instructors can elevate the quality of education, promote student success, and transform the learning experience into a more interactive, holistic, and technology-integrated process.

Conclusion

This literature review aims to examine the implementation process, potential obstacles, and successful strategies for integrating e-Portfolios into higher education to provide a general framework for instructional designers and instructors. The identified seven-step process provides a clear roadmap for educators and instructional designers to follow when designing and integrating e-Portfolios into higher educational institutions. The identified barriers help educators foresee potential pitfalls, and the identified practical and specific strategies address each identified barrier, thereby enhancing the likelihood of successful integration. Overall, this synthesis of findings in this literature review serves as a practical guide for both educators and instructional designers for streamlining the implementation of e-Portfolios in higher education and ensuring a smoother adoption process.

Future Research

Future research should investigate the different e-Portfolio platforms available and compare their features, ease of use, and effectiveness in achieving learning outcomes as choosing an appropriate platform is one of the key steps. Furthermore, as providing sufficient training and support to both faculty and students is a critical component for the successful implementation, further research should investigate effective training and support strategies for faculty, including the types of training that are most effective and the factors that contribute to successful implementation. Future research should also examine the ethical and legal concerns related to the use of e-portfolios, such as privacy and intellectual property rights, and develop policies and guidelines to address these issues. Finally, investigating the potential of using artificial intelligence and machine learning to improve e-portfolio assessment and feedback is another area for future research.

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Appendix A. Coding for Keywords

Research Question 1

What are the steps involved in integrating an e-Portfolio system within higher education institutions?

	Coding Process	**Examples from Eligible Studies**
Steps	We focused on identifying the actions, stages, or phases that need to be taken or completed in a sequential manner to successfully set up or execute the e-Portfolio system. The coded keywords for e-Portfolio implementation steps are:	*Identifying the purpose* 13 studies addressed the purpose of e-Portfolio. Selected examples: "ePortfolios [help] students prepare for the process of job seeking" (Lambert & Corrin, 2007; p.3). "a teaching and learning tool, to be a reflective tool, to be a showcase tool, to be a career planning and employment-oriented tool with potential employer requirements in mind" (McCowan eta l., 2005; p.44).
		Identifying the stakeholders 7 studies addressed identifying stakeholders. Selected examples: "ePortfolio implementations must take into account three different stakeholders: individuals (students and teachers); institutions; and employers" (Balaban et al., 2013, p.398). "key ePortfolio stakeholders, such as those who had influenced the test phase, and staff members such as internet communications technology staff, administrators, academics, general staff, and one student representative" (Hains-Wesson et al., 2014, p.147).
		Choosing a platform 13 studies addressed selection a platform. Selected examples: "the new Blackboard ePortfolio tool for Vista has been identified as the tool that meets all current ePortfolio requirements, is tightly integrated with the University's learning management system and also has a range of other features attractive to ePortfolio users" (Lambert & Corrin, 2007, p.8). "The Career Center … decided to develop a portfolio system specific to FSU, leveraging existing technology, such as the student online security system, and integrating existing student databases" (Lumsden, 2007, p.44).
		Providing Workshops 9 studies addressed providing workshops for implementing e-Portfolio. Selected examples: "Students were provided with detailed ePortfolio instructions, a paper-based tutorial, and a fictitious sample ePorfolio in the course management system. A copy of the tutorial was also made available in online student handbooks. Google also provided online tutorials and forums" (Shepherd & Bolliger, 2014, p.76).

		"The one-on-one in-depth training sessions lasted from 30 minutes and one and a half hours … organized by the interaction designer" (Stephensen & Dillon, 2013, p.171).
		Creating e-Portfolios 7 studies addressed matters of creating e-Portfolio. Selected examples: "students build their portfolio by documenting the experiences that have contributed to the development of the nine skill areas identified above, plus additional skill areas of the student's choice" (Lumsden. 2007, p.49). "These tasks included: creating and editing the structure of a basic portfolio, uploading and managing files, inserting and manipulating images and video, and adding and formatting text-based content" (Posey et al., 2015, p. 78).
		Assessing e-portfolios 2 studies addressed about matters of assessing e-Portfolio. Selected examples: "last stage in the process … includes the final assessment of the work done in the ePortfolios, in which students receive their grades in line with the criteria established at the beginning of the course" (Morales et al., 2016, p.1743). "the instructor assigned peer reviewers to share feedback via e-mail using the same grading criteria as the instructor. After peer review and revisions, the instructor provided formative feedback to each student, allowing for additional revisions prior to a summative evaluation in each course" (Shepherd & Bolliger, 2014, p.76).
		Evaluating the project 5 studies addressed evaluating the e-Portfolio project. Selected examples: "the ability to reflect on Graduate Attributes and Professional Skills and the opportunity to learn new technology skills were worthwhile student outcomes of using the ePortfolio." (Lambert & Corrin, 2007, p.7). Lumsden (2007) also used surveys to evaluate the project to ask, "students to rate the program's effectiveness and indicate how they intend to use their portfolio" (p.57).
Research Question 2 What specific potential barriers might hinder the effective implementation of e-Portfolios in higher education settings?		
	Coding Process	**Examples from Eligible Studies**
Barriers	We focused on to find the	*Technology* 14 studies addressed the technology barrier. Selected examples:

	obstacles, challenges, or factors that impede or hinder the successful adoption, integration, or use of e-Portfolios within higher educational institutions. The coded keywords for e-Portfolio implementation barriers are:	"Technology concern—These concentrates on how much time it takes to be comfortable with the Web-based system. Around 60% of the interviewees were worried that a lot of time would be spent on learning how to operate the ePortfolio system and becoming familiar with it" (Cheng, 2008, p.108). "The top challenges of ePortfolio implementation […] availability of sufficient support when adapting the ePortfolio tool to the individual needs" (Coffey & Ashford-Rowe, 2014, p.288)
		Students' self-motivation 7 studies addressed the lack of students' self-motivation as a barrier. Selected examples: "Factors respondents felt might impede their ePortfolio making included self-motivation and a lack of clear direction" (Hains-Wesson et al., 2014, p.149). "trainees expressed that the ePortfolio was not their preferred mechanism for documenting and sharing experiences. Others felt the ePortfolio was just one more assignment and was redundant with other program components" (Wells et al., 2018, p.94).
		Teachers' workload 5 studies talked about teachers' workload as a barrier. Selected examples: "[…] concerns about the increased workload for teaching staff undertaking, implementing and supporting their students using ePortfolios" (Hallam & Creagh, 2010, p.187). "faculty members with heavy advising loads rarely discussed ePortfolio goals with their students" (Peacock et al., 2010, p.7).
		Policy 4 studies mentioned policy is one of the barriers. Selected examples: "individual students had the freedom to include whatever they liked in their student e-Portfolio, yet it was to be marketed as a QUT-endorsed product" (McCowan et al., 2005, p.44). "institutional policy did not allow non-university access to his ePortfolio, and he was unable to provide the key stakeholder with an ePortfolio website address that the potential key stakeholder could access via the Internet" (Stephensen & Dillon, 2013, p.173).
		Privacy 4 studies talked about the privacy of e-Portfolio. Selected examples: "Privacy concern—This is about the access control of one's own ePortfolios. Over 90% of the interviewees indicated that they minded sharing their own showcases and feedback with their peers or the public without their prior consent. Some interviewees with good academic performance believed that sharing online showcases

		with other peers might induce plagiarism which could jeopardize the fairness of portfolio assessment" (Cheng, 2008, p.107). "Protection of personal data held within an ePortfolio system" and "ownership and intellectual property rights of the material contained in the ePortfolio system" are the privacy issues addressed by Peacock et al. (2010, p.843).
		Pedagogy 2 studies talked about pedagogy barriers for instructors. Selected examples: "The introduction of ePortfolios as a learning or assessment activity requires academic staff to consider the learning goals for the subject and to subsequently evaluate the congruence between learning activities, assessment and learning outcomes" (Hallam & Creagh, 2010, p.187). "Embedding ePortfolios into degree programs is a form of curriculum design and adapting existing assessment and assignments into ePortfolio tasks demonstrates ways in which the inclusion of ePortfolio work leads to changes in learning and teaching practices" (Rowley & Bennett, 2016, p.9).
		Artifact quality 2 studies talked about concern for artifact quality. Selected examples: "The quality is reflected in terms of whether the artifacts can be verified and whether the artifacts or views are concise, readable, and up to date" (Balaban et al., 2013, p.399). "Artifact concern-This refers to the electronic representation of students' good work" (Cheng, 2008, p.108).
		Academic integrity 2 studies talked about academic integrity barrier. Selected examples: "With the use the Web as a tool for writing portfolios by students, a few interviewees (20%) were worried that student plagiarism would become a more serious problem because it is often easy to steal English language artifacts and ideas from other authors on the Internet by simply copying and pasting. How to prevent students from unauthorized use of online materials in their ePortfolios would become a subject of attention" (Cheng, 2008, p.113). Committee members worked together to "address administrative and educational issues, such as academic integrity considerations" (Posey et al., 2015, p.81)
Research Question 3 What actionable strategies can be employed to overcome the identified barriers for the successful adoption and utilization of e-Portfolios in higher education?		

	Coding Process	**Examples from Eligible Studies**
Strategies	We focused on to find deliberate plans, or tailored approaches that aimed specifically at overcoming obstacles or challenges that hinder the successful adoption or integration of e-Portfolios. The coded keywords for e-Portfolio implementation strategies are:	*Training support* 14 studies provided training support as a strategy to address the technology barriers. Selected examples: "online animated tutorials are also provided to demonstrate how to prepare electronic artifacts and use the system effectively for various purposes" (Cheng, 2008, p.108). "This selection is intended to provide an introduction and overview of the system and motivate students to become involved in the program. This ten-step "tour" also provides information about the nine career and life skills and the five experience categories through which students develop their skills: courses, jobs/internships, service/volunteer work, memberships/activities, and interests/life experiences" (Lumsden, 2007, p.47).
		Overall feedback 6 studies supported to provide overall feedback to the students. Selected examples: "The instructor should offer comments and guidelines to give students more comprehensive feedback on their work. Some initial grading and assessment should now be introduced, as this will give students a clear picture of their progress, as well as highlighting the importance of working on their ePortfolios and giving them a chance to address areas of weakness" (Morales et al., 2016, p.1743). "Self-regulation and formative assessment (direct and personalised feedback)" (Berbegal Vázquez et al., 2021, p.48).
		Shared models 5 studied proposed to use models to improve the efficiency. Selected examples: "Learner-centred models of pedagogy can offer accessibility, adaptability, flexibility and personalisation and support individual, social and collaborative processes" (Hallam & Creagh, 2010, p.189). "The committee addressed the strategic level by creating an ad hoc interdisciplinary group to develop a shared vision and innovative approach to implementing ePortfolio use across the university and effectively communicating the potential use of ePortfolios in capturing complex constructs of the strategic plan, including interdisciplinary innovation and the development of leadership and global citizenship" (Posey et al., 2015, p.82).
		Policy support 3 studies mentioned to provide policy support to address policy barrier. Selected examples: "a disclaimer was placed on the bottom of each student e-Portfolio and a process was developed to enable a system administrator to have access to every student e-Portfolio, as well as the capacity to cancel one if it varied from IT protocols at QUT" (McCowan et al., 2005, p.45).

		"International information standards for ePortfolio practice be adopted as an Australian technical framework, in order to facilitate the exchange of information and data across institutional, sectoral and jurisdictional boundaries" (Hallam & Creagh, 2010, p.188).
		Privacy and data protection 2 studies addressed privacy protection. "All users in the system are permitted to select the audience for their own ePortfolios from either one of the preset groups-private, teachers, teachers and peers, and the public. This is called the access control in the portfolio level" (Cheng, 2008, p.109). "the responsibility for access and control should ideally fall to the student who can make choices about where and how they store and disseminate their own artistic product and how it is exhibited" (Stephensen & Dillon, 2013, p.175).
		Student-centered Pedagogy 3 studies addressed student-centered pedagogy. Selected examples: "Be student-centered, based on learning activities throughout the undergraduate and graduate school years" and "Be initiated and sustained by student involvement" (Lumsden, 2007, p.45). "Students should be monitored, and their work assessed to allow them to develop their own skills and encourage them to take control of their own education and become self-regulated learners" (Morales et al., 2016, p.1746).
		Artifacts assessment criteria 3 studies proposed to set artifacts assessment criteria to measure e-Portfolio quality. Selected examples: "Three criteria are included to facilitate the evaluation of students' English language, quality and quantity of work, and reflection in the ePortfolio system" (Cheng, 2008, p.113). "students should be given clear explanations of the assessment and grading process. Specific examples of the kind of work to be developed in the ePortfolio should also be presented and explained to students to ensure they have a clear idea of the kind of work that they are expected to do" (Morales et al., 2016, p.1744).
		Anti-plagiarism Only 1 study talked about anti-plagiarism to address academic integrity: "For every artifact intended to be uploaded to the ePortfolio system, students are first asked to read information about what plagiarism is and then select a declaration checkbox to declare that the files are their own work in which no plagiarism is contained" (Cheng, 2008, p.113).

		"On the other side, teachers are suggested to monitor the students' progress regularly so that any unexpectedly good performance can be easily identified in the teacher level" (Cheng, 2008, p.114).

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A Review of My Secret #EdTech Diary: Looking at educational technology through a wider lens

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Abstract

Technology has come to play an integral part in the educational process of students around the world. School administrators and teachers rely on technology to gather real-time data, provide meaningful feedback, and assess student learning. In 2020, school personnel across the globe needed to provide services to students despite limitations put in place by the COVID-19 pandemic. In My Secret #EdTech Diary: Looking at Educational Technology Through a Wider Lens, Al Kingsley analyzes post-pandemic lessons in the educational technology (EdTech) field from various viewpoints. Using his experience as the CEO of an educational software company and a member of a school board of governors, Kingsley describes lessons from the rapid development and use of educational technology during and after the COVID-19 pandemic.

Structure & Content

Kingsley uses his first chapter, “Unpicking EdTech,” to provide readers with a background in educational technology. Histories of the first research projects and research scientists describe how student experiences with teaching machines in the 1920s and programmed tutoring in the 1960s affected learning. This chapter also provides a table of common three-letter acronyms (TLA) and a glossary of standard EdTech terms used in the educational systems of the United States and the United Kingdom.

The chapter “Lessons Learned” contains viewpoints of educators and educational administrators regarding their experience during school closures and distanced learning. Kingsley describes how the COVID-19 pandemic provided an outlet for a revolution in educational systems and the educational technology field. Software developers seized on this need for methods and tools to reach students. Throughout the chapter, Kingsley (2021) describes the importance of developmentally appropriate pedagogy to implement learning, and he even highlights this idea by stating, “Pedagogy

trumps the medium" and emphasizes the concept with textual features (p. 57). To support this, Kingsley uses Mishra and Koehler's technological pedagogical content knowledge framework, and he discusses how the widespread use of online learning has impacted the relationship between content, technology, and pedagogy. Throughout the Lessons Learned chapter, Kingsley expands on research and resources to discuss the lessons from the mass utilization of online learning during the COVID-19 pandemic. With his background as a CEO of an educational software company, Kingsley finds it critical to include the perspective of technology vendors in his book. Various software and hardware components support students, teachers, and educational administrators daily, and vendors must compete to fill the needs of those parties. Vendors strive to create systems that maximize the user experience and support. As technology develops and enters the market, consumers choose products based on problems currently faced by educational systems. Still, as those problems find solutions, new problems occur to cause disruptions in the market. Kingsley describes how this disruption connects to Clayton Christensen's innovator's dilemma and can impact the growth of educational technology businesses (2013).

Strengths

In each chapter, Kingsley utilizes a variety of frameworks to connect the research and the practice of education. These connections create a meaningful discussion on how the COVID-19 pandemic expanded research on online learning and impacted education. He explains how the closure of schools and extensive use of technology to facilitate learning during the pandemic allowed for the rapid growth of the educational technology industry. Kingsley uses a variety of perspectives to describe the lasting impact on the field. Vendors, innovators, teachers, students, administrators, and instructional designers have a voice in Kingsley's book, generating a comprehensive list of lessons learned in the wake of the 2020 school closures.

Weaknesses

Kingsley frequently refers to organizations or concepts throughout the book through their respective acronyms. Some acronyms throughout the book need to be clearly defined or explained. Kingsley wants to encompass a wider audience, and he utilizes acronyms from the educational systems of the United Kingdom and the United States. Adding a glossary or appendix to define commonly used acronyms may increase readers' comprehension of the book.

In terms of his arguments, Kingsley's background as an educational technology vendor and a member of a school's board of governors gives him a unique insight into how the governance of educational technology changed following the COVID-19 pandemic. This, in turn, limits Kingsley's understanding of the effects of educational technology and

the COVID-19 pandemic from the classroom perspective. Providing insight from practicing educators may provide an additional lens to Kingsley's understanding of educational technology development. While the chapter of his book "Voices Aligned" features some teachers, Kingsley leaves these perspectives from his "Lessons Learned" chapter.

Conclusions

In his book, My Secret #EdTech Diary: Looking at Educational Technology Through a Wider Lens, Al Kingsley describes how the field of educational technology has changed following the global COVID-19 pandemic. During this time, technology's role in education rapidly expanded to allow access to learning despite ongoing conditions. Kingsley used his experience as a CEO of an educational technology company and a member of a school board of governors to provide a detailed explanation of how technologies have shifted to fill the new roles necessary to continue learning. The lessons described in the book include ties to current research, and Kingsley provides an explanation of how models about innovation, pedagogy, and technology directly relate to his learned lessons. While Kingsley uses the voices of educators to show alignment in all parts of the field, his lessons do not include the perspective of practicing classroom teachers.

References

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