Utilizing E-Portfolios to Enhance Science Cognition and Metacognition of Kindergarten Children

Dr. Ali M. H. Al-Kandari **Dr. Mousa M. Al-Gattan**

College of Education - Kuwait University
State of Kuwait

ABSTRACT

Science education seeks to employ the rapid technological development in the educational process, especially in the design of constructive learning environments that are focusing on creative thinking and its applications. This research explores the impact of utilizing e-Portfolios as a repository for children's academic concepts and scaffolding those concepts in assembling and reviewing e-task assignments. The primary data were collected (N = 25) by parents using observation forms that were designed to collect evidence on and indicators of students' metacognitive knowledge, experiences, and strategies. In addition, classroom teachers recorded data on students' performance, reviews, and perseverance. The researchers conducted a content analysis of students' e-Portfolio artefacts to gauge their mastery of the science curriculum content. Parent-child dialogues also underwent an exploratory content analysis. Boys and girls showed similar capacities for assembling e-Portfolio artefacts. However, the results were meaningfully affected by parental engagement in the e-portfolio learning environment. Moreover, scaffolding had a significant impact on children's post-intervention test scores.

Introduction

The literature demonstrates that information communication technology (ICT) products in general and learner e-Portfolios in particular can be used to enhance, support, assess, and evaluate learning environments. The literature particularly highlights how various features of an e-Portfolio and its actual or potential integration into classrooms can identify and assess a number of related teaching and learning issues among children. E-Portfolio is an essential tool to improve students' learning experiences and achieve learning outcomes (Ellis, Roehrer & Kelder 2013). E-Portfolios contain representative collections of students' works that illustrate their progress and achievement. Students are encouraged to add their own selections to their e-Portfolios to demonstrate the progress of their work and reflect their understanding of curriculum content knowledge.

A learning environment's metacognitive orientation is defined as the extent to which that environment supports the development and enhancement of students' metacognition. Metacognition is a natural mental activity that occurs daily without conscious awareness and is defined by Al-Kandari (2016), as the practice of rethinking and reflecting on our own and others' thoughts, words, and actions. Blackburn and Hakel (2006) affirm that e-Portfolio development is valuable for metacognitive development because it helps learners track and reflect on their learning. The personal e-Portfolio is unique to each student, and the content can focus on each student's specific interactions with his or her environment, materials, peers, and parents (Mantzicopoulos; Patrick and Samarapungavan, 2013). In this context, Brizuela and Gravel (2013) refer to representation as the cognitive process of forming an internal construct around these interactions as well as interpreting it in terms of other cognitive constructs; these authors stress "a laudable openness to the exploration of idiosyncratic representations produced by learners as they seek to understand or explain mathematics or scientific phenomena" (Brizuela & Gravel, 2013, p. ix). Kathryn and Zagal (2013) proposed that an intentional analysis of learners' choices and the arrangement of new media can help educators and researchers find additional evidence of metacognition beyond text within digital learning interventions such as e-Portfolio communities.

Akyol and Garrison (2011) stated that metacognition is not just a private internal activity but is also socially situated. In this context, these authors developed and validated a metacognitive construct that provided the opportunity to assess metacognition within learning context talks, dialogue, and discussions. Furthermore, the "community of inquiry" was used to provide conceptual coherence to construct, operationalize and interpret metacognition in collaborative inquiry. Their results provided evidence of cognitive and metacognitive indicators in student discussions and postings, and the frequency of these indicators increased over time. Presenting e-Portfolio artefacts can be used as a mechanism for students to show what they know and what they are able to do and to reflect on the process of expanding upon these abilities, thus becoming self-regulated learners. Self-regulated learners are metacognitive, motivated, and behaviourally active participants in their own learning (Zimmerman, 1986). As one of the self-regulatory abilities, metacognition is defined as knowledge about cognition and control and the regulation thereof (Schunk et al., 2008). Thus, two issues are important in metacognition: a person's awareness of his/her strengths and weaknesses using cognitive resources and his/her ability to regulate thinking strategies to maximize the intended outcomes of tasks. In this way, an e-Portfolio can be used as a showcase for students' artefacts that represent their knowledge of objects' entity and identity and embedded concepts, which Schneider (2008), refers to as "declarative knowledge." In addition, e-Portfolio artefacts such as texts, drawings, images, links, pictures, and video clips can be used as an authentic assessment tool based on children's actual performance within their regular real-world experiences or "procedural knowledge" (Schneider, 2008).

Teachers observe students interacting with ICT, with peers, and with e-Portfolio artefacts, which represent the children's knowledge, concepts and scientific skills and involve academic and scientific language. This process seems to be particularly natural and appropriate for pre-school teachers because pre-school children demonstrate growth and learning through activity (Wortham, 1994; Al-Defeeri & Al-Kandari, 2014). This field of research may indicate the extent to which teachers and parents can be expected to be sources of support for such a program as well as indicate children's perceptions of e-Portfolio artefacts and their relevance to the subject content, their classroom experiences, and their lives. This, in turn, gives a sense of the perceived importance of accessing and utilizing e-Portfolio in the information age, which may help justify educational efforts to integrate ICT into classroom environments.

The potential implications of such interpretations can be reasonably characterized in at least two distinct ways. First way is when students utilize and practice ICT skills as "real-life" skills, this may simply mean that these skills are part of the social landscape they inhabit on a daily basis. Second way, e-Portfolio use is an exceptionally common social activity and is becoming increasingly practical and necessary in educational settings. In this sense, building an e-Portfolio at home and presenting selective content in the classroom are useful ways of maintaining student engagement in the overall learning environment by connecting the subject matter of learning activities to concepts that are familiar and appealing to students in the short term.

Regarding what an e-Portfolio offers in terms of learning science through pictures, scientific conversations and inquiry, comments about the general relevance and usefulness of ICT skills and webpages and e-Portfolio building may refer to the practical implications of acquiring those skills rather than just their impact on the social lives and interests of students. That is, when students respond to ICT assignments or activities, at least some of them may be doing so because they recognize potential connections between these activities and potential future academic paths or practical skills. Leonie and Anne (2012) reported an ongoing investigation of e-Portfolios to improve student experiences and achieve learning outcomes. In this research, students used e-Portfolios as a mechanism to demonstrate their individual contributions to group assessment tasks. Either interpretation supports the idea that there is value for the student if a classroom further integrates ICT into its everyday learning activities. Children's personal interest in this technologically rich instruction underscores its practical benefit to students by keeping them engaged with their learning. Samarapungavan, (Patrick & Mantzicopoulos, 2011) provided descriptive data on the science behind learning and motivation among public kindergarten students who participated in a year-long implementation of a series of inquiry-based science lessons. The results demonstrated the extent to which patterns of conceptual development observed in the children who learned science through inquiry could be attributed to the features of a learning environment rather than other factors, such as maturation or mere exposure to any science instruction.

Siry & Kremer (2011) believe it is critical to take children's perspectives into consideration when designing any activities and, ideally, to design activities from their perspective and level of understanding. In particular, it is crucial to build on what children already know and can do and to use these emergent theories and considerations in designing a curriculum. Sanabria & Arámburo-Lizárraga, (2017) explain that younger people are overwhelmed with technological activities and skills from an early age and have naturally acquired greater familiarity with technology overall compared to their teachers and parents. However, if teachers and parents fail to see the importance of ICT or understand it for themselves, then they are poorly equipped to teach and scaffold curriculum-related topics and competencies to their children and students. To overcome this, they should increase their own competencies and accept the integration of ICT into their homes and classrooms in ways that help them monitor and guide children's technological development. Indeed, the integration of an e-Portfolio into the classroom gives students considerable opportunities to direct their own learning, with teachers/parents serving in something more like an advisory role, keeping students on task and connecting their assignment and activities to broader classroom curricula. This notion has been applied in education worldwide and, certainly, in Kuwait, which provides the context for the current research.

Parents also have a significant role to play, as existing literature indicates. O'Hara (2011) investigates students' ICT experiences at home and finds that examples of parental obstruction are quite common. Palaiologou (2016) argues that parents' involvement with ICT is often characterized by conscious but sometimes uncertain efforts to limit children's ICT opportunities and access in the perceived best interests of the children. One of the key findings is that parents feel that they are digitally literate and can use digital technologies as part of their everyday lives, including scaffolding their children's learning. If learning activities are well supported by teachers and parents, then higher levels of learning outcomes are likely to occur. According to Hyun and Davis (2005), exploratory talk is important to support students' construction of knowledge by allowing students to expand their learning experiences. Therefore, there should be a re-conceptualization of students' learning settings and pedagogy as they engage with digital technologies in the classroom and at home.

At this stage of development, students need continuous encouragement to be accountable for their learning and apply it to their everyday lives with the objective of instilling the spirit of cooperation, active participation, self-reliance, and self-confidence as well as helping them to gain social skills and establish appropriate attitudes towards the educational process. Academic knowledge is more than the subject-matter content that teachers convey to students. Specifically, students' abilities to search, analyse, and synthesize information using ICT has become increasingly important, while the belief that students should acquire relevant knowledge and abilities during their school years has become increasingly prevalent. Most of the studies that have been concluded provide an overall picture of the status (Al-Dhfeeri & Al-Kandari, 2014; Al-Maan & Al-Kandari, 2015) and usage of ICT in kindergarten classrooms (Ajlouni & Aljarrah, 2011; Safar, Al-Jafar & Al-Yousefi, 2017).

Interactions provide children with opportunities to express their thoughts and guide them to rethink their own understanding or metacognitive behaviours. If children are provided with a significant variety of real-life situations via interactions with more advanced peers who can provide help and support, their cognitive structures can be enhanced (Wagner, 2008; Harkema and Scout 2008). When children investigate, explore, discuss, and voice their opinions to each other, they practice expressing their thoughts clearly enough to be understood. They also gain experience in perceiving the ways other people think (Hyun & Davis, 2005; O'Hara, 2011). Interacting with others in a social learning context encourages more advanced thinking. If learning activities are well supported by the scaffolding of teachers, peers, and parents, then higher levels of learning are likely to occur (Sanabria & Arámburo-Lizárraga, 2017). According to Hyun and Davis (2005), exploratory talk is important to support children's construction of knowledge, as this process allows children to expand their learning experiences and knowledge. This conclusion is based on Vygotsky's (1978) notion of the Zone of Proximal Development (ZPD), which indicates that learning and development are social and collaborative activities (Hyun & Davis 2005). Bodrova & Leong (2001) used the Vygotskian approach to create a series of tools and strategies for teachers to use in supporting the development of early literacy, including metacognitive and other foundational literacy skills. The authors described the development and piloting of the project, including the creation of the Early Learning Advisor, a computerized assessment system that provides direct advice to teachers on the developmental levels of their individual students and gives them suggestions about how to apply the innovative teaching concepts in their daily work in the classroom. They also discussed an empirical evaluation of the project, which revealed that the strategies had a positive effect on literacy achievement in young children.

With this in mind, the integration of e-Portfolios into the typical learning environment has many positive implications for early childhood education professionals. Wozniak and Zagal (2013) stated that when researchers are looking for evidence of metacognition, they often limit themselves to written artefact analysis and ignore new media such as images, videos, links, and navigation schema.

Recently, the Kuwaiti national curriculum started to emphasize the integration of appropriate technology into the curriculum content areas, including emergent literacy, art, music, science, social studies, and mathematics (MOE 2015). This follows other educational practices and efforts in kindergarten classrooms where integrating e-Portfolios into the early childhood learning environment can engage children and help them achieve their optimal cognitive, metacognitive, social, and linguistic development (Land & Zembal-Saul, 2003; AlMaan et al., 2015). An implicit assumption is the expectation that availability, accessibility, and technology-competent teachers are enough to attain cognitive and metacognitive developmental outcomes. However, science teachers usually experience traditional science learning environment where teachers are considered as sources of knowledge that should be transmitted to students. The long history of traditional science learning experiences in kindergarten powerfully impact the way in which science teachers understand the nature of science and the way in which science should be taught. It's our assertion that while constructing a well-designed learning environment that integrates e-Portfolios into early childhood education settings will allow educators to encourage young children to use it productively, it remains questionable that current application of this new approach will be successful in Kuwait. Hence, our present study focuses on the extent to which each learner assembles his/her e-Portfolio based on the assigned tasks in order to validate responses in a class presentation form. Furthermore, we investigate gender differences and parental support in the success of e-portfolio integration in the classroom. More specifically, this research addresses the following questions:

1 - What is the impact of e-Portfolios on children's cognition and metacognition in kindergarten?

2 - Do children's cognitive and metacognitive performance using e-Portfolios differ according to gender?

3 - What roles can parents play in scaffolding their children's cognition and metacognition while building e-Portfolios?

Research Objectives

This research aims to achieve the following objectives:

1 - Establish whether and how an e-Portfolio can be used in building a challenging and supportive Vygotskian learning environment for kindergarten children to acquire academic knowledge and skills.

2 - Consider the impact of an ICT-aided e-Portfolio on the improvement of children's cognitive and metacognitive performance.

3 - Establish facts that may encourage parents to meaningfully contribute to home learning environments and scaffold their children's learning vis-a-vis e-Portfolio assignments.

4 - Infuse authentic learning and assessment into kindergarten curriculum content knowledge and practices.

Significance of The Study

Searching the impact of utilizing e-Portfolios cognition and metacognition Scaffold Science among kindergarten children, in which children socially construct required knowledge through collaborative effort to answer task question and produce digital artefacts, extends children's knowledge and skills in curriculum subjects. Thus, a technologically integrated curriculum design makes it possible to expand knowledge on and experiences with ongoing classroom themes. To optimize children's social interactions for constructive academic competencies, children must utilize ICT and personal e-Portfolio by themselves and/or with peers and parents. Moreover, realistic techniques for identifying evidence of learners' cognition and metacognition in their choices must be validated.

Research Method

Research Context

In this study, the learning environment was equipped with full access to technology (a projector, interactive board, teacher desktop PC, and wireless Internet connection). Children were able to log into a classroom website designed for this study either in the classroom or at home. Each child was provided with a tablet PC.

The national curriculum in Kuwaiti kindergartens, which is an "experience-based curriculum", was restructured and customized to meet the objectives of this research. This curriculum consists of 12 "experiences", among which this research focused on life science, physical science, and science. Science activities covered in kindergarten curricula are exemplars of "what, how, and why" that constitute "experiences" for kindergarteners (Al Defeeri & Al Kandari, 2014). The website was designed and integrated with digital resources and learning objectives to reflect the content of the curriculum. The classroom teacher created audio recordings presenting a task question every two weeks and uploaded it to the website, and students were expected to access it at home with their parents. (appendix C)

Home Context

What should parents expect to do at home? The home setup may not be the same as a typical classroom setup. For example, the student may sit on the floor or at a desk while doing homework. With a tablet PC and wireless connectivity, children can work on the task at anytime and anywhere. Their parents must be aware of 1) the ongoing research objectives, 2) the content of the tasks, 3) and the "experiences." At home, the children can log into the kindergarten website using their photos as IDs, along with a unique password. They click on task icons and listen to the teacher's voice describing the task of the week. For example, children might hear, "Watch the wildlife animal video clip and view the picture gallery. Select four pictures of predators and copy them into your e-Portfolio."

In this research leaning environment, parental guidance enhances children's learning in a variety of ways, including 1) deliberately accessing ICT, 2) listening and reading digital task assignments, 3) co-planning and searching for related information, 4) scaffolding children's performance of activities, 5) planning inquiries and exploring particular topics, and 6) creating science-centred dialogues. We held two group meetings and one training session to aid parents in understanding and practicing their roles in this research intervention. In addition, the classroom website offers practical examples. For example, teachers ask parents to watch the earth and sky video clip with their children and scaffold the children's questions in terms of what, how, and why. There were no right or wrong answers, which makes the task challenging.

In the classroom, the children log into the classroom website and access their e-Portfolios. Without being instructed to do so, the children demonstrate and share what they had learned and how they performed the task, and they reflect on their work.

Procedure

Data Collection and Analysis

This study was conducted in a public kindergarten in Kuwait for the academic year 2016-2017. The kindergarten was selected purposely for: a) has an appropriate physical learning environment; b) willing to adjust the curriculum to research intervention; and c) ease parents' participation and cooperation. One 2nd level classroom out of three was randomly selected and exposed to intervention, (N= 25 child; 15 boys and 10 girls; age range = 4.6-5.6 years; no factor that threat homogeneity of the subjects is found). For the first research question, the primary data were collected by the researchers using content analyses to count children's e-portfolio artefacts. To look for evidence in the e-Portfolio artefacts, the researchers created a descriptive index of all e-Portfolio content, including texts, links, images, and videos. The e-portfolios artefacts were then coded, quantified, and analysed. For metacognition, an exploratory content analysis applied to parent-child dialogues while completing assignments.

In addition, two teachers observed the children presenting and reviewing their e-Portfolios in the class. The teachers used a form during these presentations to collect indicators and evidence regarding what the learners knew, what they were able to do and how they did it. A sample student performance rubric is shown in appendix A. The researchers then coded, quantified, analysed, and reported the children's performance: low performance = 1 to less than 1.67, medium performance = 1.67 to less than 2.34, and high performance = 2.34 to 3.00. Pre-post *t*-tests were applied to evaluate changes in the children's performance. For the second research question, the *t*- test was used to test the difference between boys' and girls' performance using SPSS v. 23.

For the third research question, 25 parents participated as essential part of the home learning environment to enhance and scaffold their children's learning. We put Flavell's (1999) metacognition interpretation into practice, as shown in Table 6. Parents took part in a semi-structured interview and completed a self-report using a rubric designed to highlight their contribution to the home learning environments and scaffold their children's learning while they completed their e-Portfolio assignments. A sample rubric for assessing parents' scaffolding of children's performance at home is shown in appendix A.

Validity and Reliability

After the forms and rubrics have been developed, they were extensively revised to assure their reliability and validity. Three doctoral candidate reviewers, three supervisors, and three experienced teachers have assessed the methodology before and after the revisions. The forms were tested in a pilot study, and the reliability was established based on the degree to which the researchers and classroom teachers agreed on the assessment methods. Based on four weeks of pilot data, Pearson's correlation has been used to compare researchers and classroom teachers; this analysis showed $r = 0.70$ for the performance rubric. In addition, the rubric for the reliability of cognition and metacognition has been examined using Cronbach's alpha, which was found to be $\alpha = 0.73$.

Results

E-portfolio content analyses have been applied to count the "experience" tasks in 25 students' e-Portfolios. The results revealed 180 video clips, 450 pictures, and 120 links. All of the children's artefacts were related to the assignment tasks. In the 4^{th} week, on the second task, 4 children struggled to keep up with the rest of the classroom students. Preliminary data revealed that those children showed signs of slow learning and learning disabilities.

To answer the first research question (*What is the impact of children's e-Portfolios on the improvement of their cognition and metacognition in kindergarten?)*, the means were calculated for the teachers' notes regarding children's knowledge and performance. The results are presented in Tables 1-3.

Table (1)
Means and Standard Deviations of Teachers' Responses to Children's Metacognitive Strategy

No.	Phrase	Mean	Standard Deviation	Level
1.	Choose the method for presenting the task.	2.35	0.493	High
2.	Activate the e-environment related to presenting the task.	2.59	0.507	High
3.	Determine e-Portfolio task-related artefacts.	2.41	0.507	High
4.	Choose the file containing the required task to be presented.	2.35	0.493	High
Total		2.43	0.212	High

The results shown in Table 1 indicate that the teachers' estimates of the kindergarteners' relevant skills reached a total mean of 2.43 out of 3 degrees, with a standard deviation of 0.212. This result constitutes a high-level arithmetic mean with a relative importance of 81%. The standard deviation of 0.212 indicates how teachers' estimates of the children's skills were close to one another.

The results in Table 2 indicate that the teachers' estimates of the children's skills of reviewing and evaluating the relevant tasks reached a total mean of 2.40 with a standard deviation of 0.235 and a high-level arithmetic mean with a relative importance of 80%.

Table (2)
Means and Standard Deviations of Classroom Teachers' Assessments of Children's Task Review and Evaluation Ability (Meta-Cognition Experience)

No.	Phrase	Mean	Standard Deviation	Level
5.	Has the ability to present and explain the task to other children.	2.35	0.493	High
6.	Has the ability to explain the mechanism of accomplishing the task.	2.41	0.618	High
7.	Can clarify task-related information displayed on a screen.	2.59	0.507	High
8.	Displays self-confidence during the presentation.	2.71	0.470	High
Total		2.40	0.235	High

The results of Table 3 show teachers' estimation of students' skills displayed using ICT to complete their e-Portfolio assignments. These estimates showed a total mean of 2.25 and a high-level arithmetic mean, with a relative importance of 75%. The results shown in Tables 1-3 show the importance of children's e-Portfolio for improving their skills in fulfilling tasks.

Table (3)
Means and Standard Deviations of Teachers' Assessments of Children's Task Content Knowledge Performance (Meta-Cognition)

No.	Phrase	Mean	Standard Deviation	Level
9.	Has a full understanding of the task concepts.	2.47	0.624	High
10.	Determines artefact task-related concepts.	2.41	0.507	High
11.	Has the ability elaborate on the task concepts.	2.29	0.470	Medium

Cont/ Table (3)
Means and Standard Deviations of Teachers' Assessments of Children's Task Content Knowledge Performance (Meta-Cognition)

No.	Phrase	Mean	Standard Deviation	Level
12.	Presents the required task concept logically.	2.18	0.393	Medium
13.	Shows the ability to review task content knowledge.	2.18	0.529	Medium
14.	Shows the ability to answer quickly when asked.	1.65	0.606	Low
15.	Understands the implied concepts of the task.	2.24	0.437	Medium
Total		2.25	0.229	Medium

Table 4 shows the impact of the e-Portfolio learning environment on children's metacognitive performance. A *t*-test has been applied to compare the children's presentation of their artefacts and reflect on them at the beginning of the intervention. A pre-test was applied during weeks 1 and 2. The post-test was applied at the end of the intervention, in weeks 14 and week 15.

Table (4)
Descriptive Statistics for the Mean Score of Children's (n = 25) Presentation and Reflection on Their e-Portfolio Artefacts.

Pre-test		Post-test			
M	**SD**	**M**	**SD**	**t**	**P**
1.96	0.42	2.67	0.22	2.28	0.001

With regard to the second research question (Do children's cognitive and metacognitive performance using an e-Portfolio differ according to gender?), the t-test showed no significant difference in terms of e-Portfolio performance between boys and girls (Table 5).

Table (5)
Descriptive Statistics for the Mean Score of Children's (n = 25) Presentation and Reflection on Their e-Portfolio Artefacts.

Boys (n = 15)		girls (n = 10)			
M	SD	M	SD	t	P
2.41	0.47	2.49	0.43	1.28	.269

A *t*-test was used to evaluate the significance of the differences in the means of teachers' estimates of male and female children's e-Portfolio task performance. No significant effect of gender is found.

As for the third question (*What roles can parents play in scaffolding their children's cognition and metacognition while building e-Portfolios?*), parents in this study contributed positively to providing the physical and psychological conditions that make up a learning environment. In particular, they scaffolded the children's learning during the task completion and chose the desired artefacts to be put into the e-Portfolio. One concept related to watching a video clip about prey and predators, called "Eagle Hunting Salmon", serves as an example. The following dialogue captures a conversation between a child and her mother:

Mimi: "Why can't the salmon escape from the eagle?"

Mum: "Why do you think?"

Mimi: "Because the eagle has big, strong claws and flies quickly."

Mimi: "See, it missed. The salmon escaped."

Mum: "Wow, why do you think it could not catch the fish?"

Mimi: "The salmon saw the eagle flying toward him, so it swam faster and hid."

Mum: "That is why we call the eagle predators and the fish prey."

Mimi: "Why does the fish not escape deep into the water?"

Mum: "You tell me. Did the eagle catch it on the first attempt?"

Mimi: "The eagle flies quickly, and there are a lot of fish in the water."

Mum: “We ate salmon yesterday. See, the eagle has a big claw.”

Mini: “Yum, it has pink meat.”

Several data collection tools were used, including observation forms, interviews, and video recording. One of the researchers conducted two home observations and completed observation forms. The data are categorized and reported in Table 6.

Table (6)
Categories, Descriptions of Behaviours and Examples of Metacognition Dialogues

Category name	Description of behaviour and example dialogue
Metacognition (task content knowledge)	**Declarative knowledge:** (Mimi: What is Mactiria? Mum: Those are bacteria - small living things that can be seen only with a microscope.) Procedural knowledge: (Mimi: Are they inside my body? Mum: Your white blood cells fight off the bacteria; don’t worry.) **Contextual knowledge:** (Mimi: So the cells are stronger than bacteria? Mum: Yes, they eat the bacteria.)
Metacognition experience (Activities covered in the curriculum)	**Cognitive experience:** (The way a child learns, acquires knowledge and interacts mentally with his/her surrounding environment and digital multimedia.) “can eagles swim?” **Emotional experience**: (Enjoyment: “That’s funny”; Anxiety: “Does it hurt?”; Fear: “Is it inside my body?”)
Metacognitive strategies	**Planning**: (How to approach the task assignment and predict the outcome. Mum: “What are we looking for?” Mimi: “2 preys and 2 predators.”) **Monitoring:** (Putting a plan into action and observing the results of the action. Mum: “Which movie do we have to play?” Mimi: “This one” (pointing to the one with the animal picture). **Evaluation**: (What actually happened with respect to the predictions. Mum: “What do we have for Miss Hanan?” Mimi: “A salmon, eagle, lion, and deer.”)

To sum up, parents provided support for children at home. They scaffolded the children’s knowledge and concepts during task completion, especially as it related to the integration of e-portfolios in the home learning environment, which helped the children perform the required tasks efficiently.

Discussion

In this study, e-Portfolios have been used to expand children's science curriculum content and concepts. It is interesting that when children used their e-Portfolio to connect to other classroom curriculum activities, they were more likely to collaborate with peers, classroom teachers, and parents. The children also highlighted the scientific concept that was addressed in the assignment task, which highlights how the tendency to communicate and collaborate via ICT could help students support and scaffold one another's developmental and academic skills. E-Portfolios give children a means to present their content knowledge concept map and links among various concepts. Such metacognitive scaffolds and assists learners in reviewing and evaluating what they know and how they arrive at their current level of knowledge. Moreover, mental dialogues enable children to successfully engage in more complex processes, such as critical thinking and reflection. As seen from the results of this research, building e-Portfolio artefacts and presenting the process of how they are assembled has an influence on students' cognitive and metacognitive development, which is in line with (Kathryn & Zagal, 2013).

The content analysis of the e-portfolios showed how children went beyond attaining subject-related knowledge to better understand their situation in a learning community, the learning process, and the value of scaffolding and seeking help. The analysis of e-Portfolio content helps educators and researchers find additional evidence of metacognition within learning environments. Regardless of gender, all learners demonstrated cognition and metacognition through the creation, organization, and integration of the e-Portfolio content and their construction of the learning environment. This result aligned with those of other studies (Al-Defeeri & Al Kandari, 2014; Al Kandari, 2016; AlMaan; Al Kandari, & AlMansouri, 2015).

In the classroom, children presented the content of the e-Portfolio artefacts (cognition) and justified their choices of artefacts as well as the processes that led to those conclusions (metacognition). Thus, our research-learning environment aided in building children's knowledge structure, as did the resulting tendencies to share knowledge and communicate using both conventional methods and ICT and to collaborate intellectually. The e-Portfolio learning environment provides children with opportunities for networking and for mentally negotiating with others, and it helps develop children's concepts of personal responsibility, self-regulation, and collaboration.

Scaffolds aid this developmental process by guiding children as they engage in learning and/or performance activities. Scaffolds come in various forms, including conceptual, metacognitive, procedural, and strategic. Conceptual scaffolds assist learners in deciding what to consider by guiding and supporting them in recognizing relationships. Used in concurrent interactions or as reflective tools, conceptual scaffolds can be provided by teachers or parents. These experiences develop children's internal awareness and control over their learning. This result is consistent with those of other studies (O'Hara, 2011; Brizuela, & Gravel, 2013).

Parental engagement with pre-set objectives and clear roles not only helps children complete their assignments but also, and more importantly, establishes a home learning environment and helps promote daily learning practice. Reading, explaining new scientific terms and concepts as part of the day's task, categorizing and organizing (cognition), and discussing and negotiating on e-Portfolio artefact selection (metacognition) all serve to habituate students to appropriate means of accomplishing tasks. This is valuable because advocates of social constructivism explain that dialogue between children and their parents enriches children's internal mental negotiation, which helps to build children's conceptual maps. Such findings are in line with the findings of (Almaan & Alkandari, 2015; Sanabria & Arámburo-Lizárraga, 2017).

Conclusion

A guiding philosophy is needed for educational curricula and the effective uses of ICT. It is also essential to design a learning environment to enrich and support science curriculum concepts and competencies. The holistic goal of this effort is to highlight the importance of authentic learning and assessment approaches by applying the concept of ZPD. The current research illustrates a learning model of the integration of e-Portfolios into early childhood education and research paradigms. This is valuable because advocates of social constructivism explain that a dialogue between children and their parents enriches children's internal mental negotiation, which helps building children's conceptual maps. Evidence of metacognition in e-Portfolios is based on an analysis of 1) e-Portfolio artefacts, 2) student-parent dialogue in which the student is learning, and the parent is scaffolding, and 3) an analysis of teacher reports on students' presentation and reflection on their e-Portfolios-not only artefacts but also the process of their assembly (Blackburn and Hakel 2006; Al-Kandari 2016). Moreover, this approach can be used effectively to collect information about each child and his or her cognitive and metacognitive abilities. The challenge is to encourage, connect, and foster learning throughout a child's day, help learners make sense of all the knowledge and concepts and experiences in their lives, and ensure that all learners have the opportunity to reach their full potential in a competitive world in which twenty-first-century skills are the most important asset of the learning environment.

Rrecommendations

Considering the research results, the following elements are recommended:

- Train learners on how to use ICT to solve problems to improve their ability to perform as many tasks as they can in less time and with fewer errors.
- Promote the use of e-Portfolios in early childhood education.
- Enhance parents' communication with schools and teachers and inspire them to share and discuss ideas for developing their children's education.
- Hold training courses for parents on how to employ ICT and e-Portfolios to support children's understanding and learning, especially through scaffolding.
- Develop an intentional, long-term approach to metacognitive development in kindergarten by using e-Portfolios within the learning environment, such as the one presented in this research.
- Researchers and educators should continue to explore approaches to

metacognitive development with a focus on learners' creation and arrangement of new media elements in identity construction and collaborative learning environments.

- In alignment with above bulleted points, integrate of e-Portfolios into other curricula.

توظيف الملف الإنجازي الإلكتروني في تعزيز إدراك المعرفة العلمية وما وراءها لأطفال الروضة

د. علي محمد حبيب الكندري د. موسى محمد القطان

كلية التربية - جامعة الكويت

دولة الكويت

الملخص

تسعى التربية العلمية لتوظيف التطور التقني المتسارع في العملية التعليمية وخاصة في تصميم البيئات التعليمية البنائية التي تحفز التفكير الإبداعي وتطبيقاته. ومن هذا المنطلق سعت هذه الدراسة لتوظيف الملف الإنجازي الإلكتروني للأطفال، كحافظة لمنتجاتهم الإلكترونية لتجسير المفاهيم العلمية الواردة في المهام الإلكترونية المنزلية. ولمعرفة أثر الدعم المعرفي وما وراء المعرفي المتحصل من خلال تنفيذ الأطفال للمهام المنزلية وأثناء استعراضها ومراجعتها في الفصل الدراسي. تم استخدام المنهج المخلوط بين الكمي والنوعي، تم جمع استجابات الأطفال عينة الدراسة (ن=٢٥)، من قبل أولياء امورهم ومعلمي الفصل، وقد تم إعداد بطاقات ملاحظة واستخدامها بعد إجراء معاملي الصدق والثبات لها. كما تم تحليل استجابات الأطفال بعد رصدها ومن ثم معالجتها إحصائياً. بينت نتائج الدراسة نمو قدرات الأطفال على عرض محتوى ملفاتهم الإنجازية ومراجعتها والتأمل فيها بصورة دالة إحصائياً. ولم يظهر أثر للجنس في قدرات الأطفال على عرض محتوى ملفاتهم الإنجازية ومراجعتها والتأمل فيها بصورة دالة إحصائياً. ولم يظهر أثر للجنس في قدرات الأطفال. وأكدت النتائج أن هناك أثر إيجابي لمشاركة أولياء الأمور في دعم وتعميق المعرفة وما وراء المعرفة للمفاهيم العلمية لدى الأطفال.

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Appendix A

A Sample Student Performance Rubric

	Exceed (3)	Meet (2)	Poor (1)
Access e-Portfolio and present selected artefacts	- Goes to task immediately - Navigates the activity independently - Presents the selected artefacts - Finishes the task properly	- Completes portfolio - Takes time to navigate - Several trials necessary to identify the correct actions - Poor completion	- Struggles to complete portfolio alone - Loses focus while doing the activity - Has difficulty working alone - Cannot finish

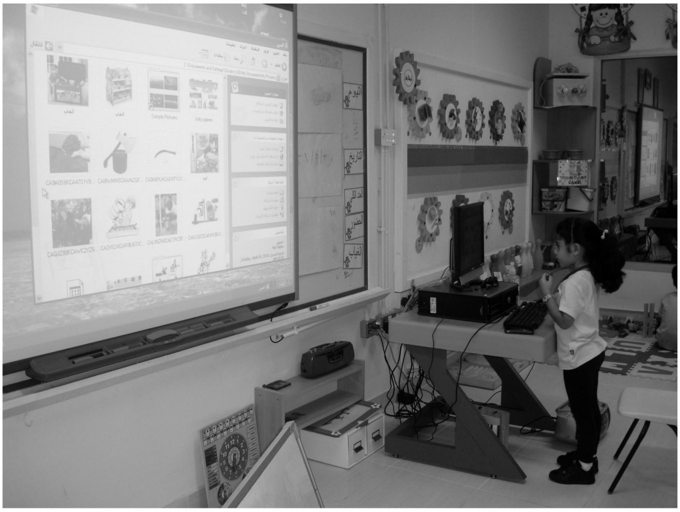
Appendix B

A Sample Rubric for Assessing Parents' Scaffolding of Children's Performance at Home

	Rarely (3)	Frequently (2)	All of the time (1)
Answering the child's questions on how to perform the required tasks	- Waits for the child to ask a question - Gives hints only - Takes action when the child is stuck - Suggests different techniques - Gives feedback: why did you do that?	- Asks for explanation - Always gives hints - Guides the child to take the correct action - Finish together	- Child struggles to work without help - Child loses focus and waits for my response - Has difficulty completing the artefact/ task alone - Child cannot finish

Appendix C

A child accessing and reviewing her e-Portfolio artefacts in classroom



Appendix D

Classroom teachers scaffolding children accessing and reviewing their e-Portfolio task assignment in classroom