

Electronic Portfolios: Motivation, Self-Regulation, and Academic Achievement in Primary and Secondary Schools

Carrie Blaustein
Yiping Lou
University of South Florida
United States
blaustein@usf.edu; ylou@usf.edu

Abstract: This systematic literature review synthesized empirical quantitative and qualitative studies published in 2004-2013 that examined the impact of e-portfolios on student academic motivation, self-regulation, and performance. Peer-reviewed publications that focused on electronic, digital, web or online portfolios were examined and coded using Motivational Strategies and Learning Strategies (Pintrich & De Groot, 1990) as a framework. Findings suggest: 1) Both the process and product portfolios were associated with motivation and self-regulation. 2) Numerous studies have demonstrated the benefits of e-portfolios for increasing learning strategies, motivation strategies, academic achievement, and technical aptitude. 3) E-portfolios must be student-centered, offer some user control, and require full commitment and planning. This review provides evidence that e-portfolios can have an impact on self-regulation and academic performance at the K-12 level.

Introduction

The benefits of portfolios have been well established in universities and in professions such as fine arts, health and education (Dorn, 2006, Butler, 2006, Weir & Connor, 2009). The term portfolio represents more than a collection of works that document achievement and learning. Paulson, Paulson, and Meyer (1991) describe a portfolio as “a meaningful collection of student work that demonstrates progress and/or mastery guided by standards and includes evidence of student reflection.” The electronic portfolio (e-portfolio) adds new dimensions to the traditional portfolio. An e-portfolio is a digital record that can be composed of documents, pictures, video, sound, games, web applications, and other electronic interactions. EDUCAUSE (Cambridge, 2004) describes an e-portfolio as, “a collection of authentic and diverse evidence drawn from a larger archive representing what a person or organization has learned over time, on which the person or organization has reflected and that is designed for presentation to one or more audiences for a particular rhetorical purpose.”

E-portfolios appear to be useful in encouraging self-regulated learning (Nicolaidou, 2012). Zimmerman (2008) describes self-regulated learning as “the self-directive processes and self-beliefs that enable learners to transform their mental abilities, such as verbal aptitude, into an academic performance skill, such as writing.” Self-regulation includes the cyclic process of forethought, performance, and self-reflection (Zimmerman, 2008). Pintrich and De Groot (1990) recognized three components characteristic of the definitions of self-regulated learning: (1) “metacognitive strategies for planning, monitoring and modifying their cognition,” (2) “management and control of their efforts on classroom academic tasks,” and (3) “the actual cognitive strategies that students use to learn, remember, and understand the material” The expectancy-value model of motivation helps frame the theoretical basis of student motivation (Pintrich & De Groot, 1990). Motivation has an expectancy component in which students ask “Can I do the task?”; a value component in which students ask, “Why am I doing this task?”; and an affective component in which students ask, “How do I feel about this task?” Students with higher levels of self-regulation often achieve well academically and have higher interest in learning (Zimmerman, 2008). E-portfolio design, implementation, and assessment play key roles in influencing self-regulated learning.

E-portfolios vary in effectiveness depending on the design of the portfolio. There are two main types of portfolios: process and product (Barrett, 2007). Process portfolios show the changes over time and product portfolios are meant to demonstrate a learner’s best work. Assessment and reflection can be features of both process and product portfolios. E-portfolios can help a child achieve academically, problem solve, and reflect to enhance metacognition (Barrett, 2007). These benefits can be realized by students who pay proper attention to design, planning, and implementation, along with reflection, feedback, and revision (Chang, 2009). E-portfolios showcase individuality while at the same time conforming to essential standards demanded by readers judging the end product. Because the process of making quality e-portfolios produces connections between the school setting and real life situations, they are considered tools for life-long learning (Cambridge, 2010). Feedback is an important aspect of this learning (Chang, 2009; Chang, Tseng, & Lou, 2012). Feedback might include student, peer, teacher, or other types of assessment. Thus feedback is also an important aspect in improving self-regulation.

Prior reviews highlight key differences in design and use of e-portfolios. Butler (2006) lists over 90 studies and book chapters but does not unify the findings under a particular framework. Butler searched ERIC and web of science to locate the studies included in the review. The characteristics and benefits of e-portfolios are summarized at a surface level. The findings suggest that e-portfolios encourage skill development; advanced learning, reflection, psychological benefits, assessment and feedback; richer use of artefacts; maintenance, and portability; sharing and access; audience analysis; and better organization, storage, cost, standardization, and privacy. Limitations include difficulty in authenticating the portfolio; technical aptitude and technical requirements of the e-portfolios; lack of assessment criteria; problems keeping students motivated and engaged; managing data, access, and security; balance between too much or too little structure; and demonstrating practicality of the e-portfolios. The review does not limit discussion to a particular theme or topic nor does it narrow down the education levels of participants in the studies.

Alawdat (2013) provides insight on the use of e-portfolios by second language learners. It discusses 11 studies within a narrow timeframe of 2010-2012. The review highlights many benefits including improvements in writing, language learning, assessment, and technical skills. The review follows Vygotsky's socio constructionist theory to depict e-portfolios as tools for growth and social influence. It discusses results study-by-study indicating some studies were conclusive and others were less demonstrable. Students were able to follow their growth and writing development, gain proficiency of oral performance and grammar, vocabulary, and structure. Compared to paper portfolios, e-portfolios were easier to access, manage, present, and organize. However, there was not a significant difference in writing development between paper-based portfolios and e-portfolios. Assessment was unreliable among students, peers, and instructors. Neither review focuses on primary and secondary school students.

This systematic literature review examines both quantitative and qualitative studies on the use of e-portfolios among primary and secondary students. This review departs from other reviews in that it focuses on the relationship between motivation and self-regulation as measured by Motivated Strategies of Learning Questionnaire (MSLQ) (Pintrich & DeGroot, 1990). This review expands the notion of e-portfolios as tools and makes recommendations for designing an effective e-portfolio system. Three research questions are addressed:

1. What are the unique types and features of e-portfolios that are associated with different aspects of self-regulated learning?
2. How do these unique features impact or interact with aspects of self-regulated learning to facilitate academic performance?
3. How can e-portfolios be designed, implemented, and assessed in order to enhance self-regulation and student achievement?

Method

Inclusion-Exclusion Criteria

All studies included in this review had to meet the following criteria:

- The study was published in peer-reviewed journals in 2004 or later.
- The study was conducted with primary or secondary school students.
- The study reported data from empirical research on actual implementation of e-portfolio use.
- Data are collected prospectively.
- Research questions and objectives are described clearly and precisely.
- Portfolio is clearly described.
- Sample size is given.

Search Strategies

The term e-portfolio is also known as digital, web, or, online portfolios. Web of Science yielded 133 articles using "e-portfolio" as a search term, all of which were reviewed. The search term for ERIC included: "Portfolio and (electronic or digital or web or online) -education level: "Higher Education" -education level: "Adult Education" -education level: "Early Childhood Education" journal articles since 2004" which yielded 183 articles. Articles that were germane to self-regulated learning and that were directed at the primary and secondary level were included and those that were *non-sequitor* or that did not center on e-portfolios were excluded. References mentioned in literature reviews or in retrieved articles were also used if they met the above inclusion criteria.

Study Features Coding

Demographic features: grade level, subject matter, country where study participants lived.

Study features: research design (could be classified as quasi, quantitative, qualitative, and mixed method, depending on rigor of experiment), type of outcome (achievement, attitude, perception, self-regulation, motivation), outcome measure source (instrument or type used), treatment and control, sample size, key findings, and ratings of external and internal validity (low, medium, and high).

Portfolio features: format (proprietary versus non-proprietary, freely available, desktop publishing), e-portfolio type (developmental, reflective, showcase, assessment, or comprehensive), type of feedback/assessment (student, instructor, peer, parent, etc.), focus (how instrumental to the course were the e-portfolios), self-regulation aspect (motivation, self-efficacy, anxiety, reflection, metacognition, etc.), structure/design (how e-portfolio is designed), user control (how much flexibility student has in creating e-portfolio, and student perceptions (how users felt about e-portfolio). An overarching framework for organization follows the two themes in the MSLQ: Motivational Strategies and Learning Strategies.

Results

A total of twenty-six studies that met all inclusion criteria were included in the review. Each study addressed motivation and self-regulation. Studies conducted at the primary level were distinguished from those at the secondary level because the dynamics for student participation, user control, and academic expectations are different for each age group. Table 1 lists the research question, the author(s) of each study, the grade level addressed, and which study is most significant to the corresponding motivation or learning strategy. The aspects addressed were not mutually exclusive, but the studies could be organized based on their major emphasis.

Table 1. *Study Organized By Research Questions and Type of Strategy at Primary and Secondary Level*

| Research Question | Motivation Strategies (intrinsic value, self-efficacy, test anxiety) | | Learning Strategies (Cognition, Metacognition-self-regulation, resource management) | |
|--|--|--|--|---|
| | <i>Primary</i> | <i>Secondary</i> | <i>Primary</i> | <i>Secondary</i> |
| 1. What are the unique types and features of e-portfolios that are associated with different aspects of self-regulated learning? | Heredia & Icaza (2012) | Chang, Tseng, Liang, & Liao (2013); DeBruin (2012); Barak (2012); Weir & Connor (2009) | Wall (2006) | Or Kan (2011); Acker & Halasack (2008); Chang & Tseng (2009); Williams (2012) |
| 2. How do these unique features impact or interact with aspects of self-regulated learning to facilitate academic performance? | Nicolaidou (2013); Nicolaidou (2012) | Chang (2009); Tezci & Dikki (2006) | Meyer, Abrami, Wade, Aslan, & Deault (2010); Abrami, Venikatesth, Meyer, & Wade (2013); Davies, Collier, & Howe (2011) | Guzeller (2012); Dorn (2006); Chou & Chang (2011); Chang, Tseng, & Lou (2012) |
| 3. How can e-portfolios be designed, implemented, and assessed in order to enhance self-regulation and student achievement? | Meyer, Abrami, Wade, & Scherzer (2011) | Barrett(2007); Chang, Wu, & Ku (2005) | Kim & Oloaciregui (2008) | Van Aalst & Chan (2007) |

Research Question 1. What are the unique types and features of e-portfolios that are associated with different aspects of self-regulated learning?

Electronic Portfolios can be grouped into two main types: process and product (Barrett, 2007). Process portfolios are formative and occur as the student progresses through a course or activity. Process portfolios may involve reflection on attitudes and perceptions over time. Product portfolios are summative and are usually used to demonstrate the result of the activity or course usually by assessed by an evaluator. A product portfolio can have reflection aspects and a process portfolio can have assessment elements, but the general pattern is depicted below.

Table 2. *Type of E-portfolio and Characteristics*

| E-portfolio Type | Description | Strengths | Limitations |
|------------------------|---|--|--|
| Process: Developmental | Documents process of studying topic, and creating and compiling portfolio | Shows incremental progress over time, helps student build on drafts | Does not show final evidence of learning, assess overall performance |
| Process: Reflection | Developmental but with added reflection that allows student to express attitudes and feelings | Allows self-regulated learning by having student realize and improve on how they learn | Can be burdensome and perfunctory if quality of reflection is not emphasized |
| Product: Showcase | Displays best work or personal profile | Shows finished product | Does not reflect student progress or provide full picture of student |
| Product: Assessment | Will be assessed for grade or other measure based on knowledge or performance | More authentic learning that is hands on and demonstrates problem solving | This assessment may not have the same rigor as standardized test |

Table 3 lists a synopsis of the studies and descriptions that address the types of portfolios and their affordances related to motivational and learning (self-regulation) strategies. Each study includes the results and whether the student reaction to the portfolios was positive or negative.

Table 3. *Characteristics of Studies Addressing Question 1*

| Author/ Year | S/L | Origin | Res Des | N | Type | MSLQ Aspect | Meas. Source | Results | Stud Rxn. |
|---|-----|-------------|--------------------|-----|-------------------|--|--|--|--------------|
| Heredia & Icaza (2012) | M/P | Mexico | Qual | | Develop mental | Self-eff. | Content analysis, survey | Increase in achievement | + |
| Barak (2012) | M/S | Israel | Qual | 53 | Showcas e | Int. Val. Self. Eff. | Survey | More flexible and timely than paper | + |
| Chang, Tseng, Lian, & Liao (2013) | M/S | Taiwan | Quasi | 40 | Reflectiv e | Goal Setting | Pre/post | Better SRL than paper | + |
| DeBruin, van der Schaaf, Oosteraan & Prins(2012) | M/S | Netherlands | Mixed Method | 156 | Reflectiv e | Self-reg metacogni tion | MSLQ/ content analysis | No correlation between motivation and level of reflection | +/- |
| Weir & Connor (2009) | M/S | Ireland | Qual | 31 | Showcas e | Metacogn ition | Observe/Int erview | Good coverage of material | + |
| Wall (2006) | L/P | England | Qual | 200 | Reflectiv e | Metacogn ition | Observe/ Content analysis | Students were able to think about how they learn | + |
| Acker & Halasack (2008) | L/S | US | Qual | 41 | Assessm ent | Cognition | Pre/Post Content Analysis | Improvement in essays, personal growth | + |
| Chang & Tseng (2009) | L/S | Taiwan | Quasi | 60 | Reflectiv e | Cognition /Metacog nition | Pre/Post | Reflection performance higher for exp group | + |
| Or Kan (2011) | L/S | Malaysia | Qual | 20 | Compre hensive | Coop Learning (Learning Mgmt) | Survey | Blogs enhance cooperation and foster community | + |
| Williams (2012) | L/S | New Zeal | Action Research | 94 | Assessm ent | Cognition /Learning Mgmt | Analytical and comparativ pairs | Electronic portfolio assessment is valid for evaluating engineering performance | + |

Notes: S/L=Strategy/Academic Level , M=Motivation Strategy, L=Learning Strategy, P=Primary level S=Secondary level, Res. Des. = Research Design, Qual=Qualitative, Quasi=Quasi experiment, Quant=Quantitative, N= Sample Size, Meas. Source=Measurement Source Stud Rxn. = Student reaction to portfolios

Motivational strategies include intrinsic value (intrinsic goal orientation, extrinsic goal orientation, task value), self-efficacy (control of learning beliefs, self-efficacy for learning and performance), and test anxiety. Chang, Tseng, Liang, & Liao (2013) found that goal setting and following through could be accomplished through the use of an electronic portfolio. In Weir and Connor (2013), students had greater motivation to complete their physical education class because they were able to set their own goals while showing creativity.

Another motivational aspect is self-efficacy or a feeling of control over one's situation. Students who feel in control of their situation are more likely to do well despite setbacks (Bandura, 1986). Self-efficacy is addressed by Herdia and Icaza (2012), in which students with low control over their situation began to thrive with the advent

of computers in their village. Barak (2012) also witnessed evidence of increases in self-efficacy as students who completed the electronic portfolio experienced greater control and were more likely to attempt problem solving.

The third aspect of the MSLQ deals with test anxiety. Electronic portfolios can help ameliorate test anxiety because they offer an alternative assessment to taking high stakes exams that provide little opportunity to demonstrate actual performance. In DeBruin, van der Schaaf, Oosterbaan, and Prins (2012), students varied in their motivation level to complete reflection portfolios with some students actually preferring an exam, while other students were more motivated to complete their portfolios. However, the researchers found that the motivation to complete reflections in their portfolio did not necessarily correspond with a deeper level of reflection.

Learning strategies include cognition, metacognition (self-regulation), and learning management. Focusing on metacognition, reflection, and motivation, Wall (2006) used templates to gather student reactions to creating electronic portfolios that included text, pictures, audio and video. Students enjoyed developing the portfolios while at the same time conceptualizing about how and what they learned.

In the secondary school realm, Acker & Halasack (2008); Williams (2012); and Chang and Tseng (2009) focused on cognition and self-assessed regulatory performance. Or Kan (2011) studied the use of electronic portfolios to enhance cooperative learning. Students learned about themselves and others and this aided in their successful completion of the course.

Research Question 2. How do these unique features impact or interact with aspects of self-regulated learning to facilitate academic performance?

Table 4 provides a synopsis of the articles that address increases in motivation, self-regulation, and academic performance.

Table 4. *Characteristics of Studies Addressing Question 2*

| Author/ Year | S/L | Origin | Res Des | N | Type | MSLQ Aspect | Meas. Source | Results | Stud Rxn. |
|---|-----|---------------|--------------|-------|------------------------|--|----------------------|---|-----------|
| Nicolaidou (2012) | M/P | Greece | Mixed Method | 61/83 | Reflective | Goal setting/Self-efficacy | Pre/post | Increase in self-efficacy | + |
| Nicolaidou (2013) | M/P | Greece | Mixed Method | 20/20 | Reflective | Self-eff./Cognition | Pre/post | Increase in test scores | + |
| Chang (2009) | M/S | Taiwan | Quasi | 30 | Reflective | Motivation | Pre/post | Increase in motivation | + |
| Tezci & Dikki (2006) | M/S | Turkey | Mixed Method | 17/35 | Reflective | Goal setting/test anxiety | Pre/post rubric | Increase in performance | + |
| Guzeller (2012) | M/S | Turkey | Quasi | 60 | Developmental | Cognition/Motivation | Pre/post | Increase in test scores | N/A |
| Abrami, Venikatesth, Meyer, & Wade (2013) | L/P | Canada | Quasi | 319 | Comprehensive | Cognition/Metacognition | Pre/post | Increase in test scores/self-efficacy | +/- |
| Davies, Collier, & Howe (2011) | L/P | US | Mixed Method | 263 | Developmental/Showcase | Cognition/Metacognition | Survey/Pairs judging | Motivation, Empowerment and increased inquiry skills | + |
| Meyer, Abrami, Wade, Aslan (2010) | L/P | Canada | Quasi | 16 | Comprehensive | Goal setting/metacognition | Pre/post | Increase in test scores, motivation, metacognition | +/- |
| Chang, Tseng, Lou (2012) | L/S | Taiwan | Mixed Method | 72 | Showcase/Assessment | Metacognition | Test | Inconsistent peer assessment, consistent student, teacher, exam | N/A |
| Chou & Chang (2011) | L/S | Taiwan | Mixed Method | 45 | Showcase/Assessment | Peer reflection/ (Resource Management) | Content Analysis | Correlation with quality of reflections and grade not category | N/A |
| Dorn (2006) | L/S | United States | Quasi | 178 | Showcase | Cognition/Metacognition | Pre/Post | Assessment in actual and digital are equal | + |

Notes: S/L=Strategy/Academic Level , M=Motivation Strategy, L=Learning Strategy, P=Primary level S=Secondary level, Res Des = Research Design, Qual=Qualitative, Quasi=Quasi experiment, Quant=Quantitative, N= Sample Size, Meas. Source=Measurement Source Stud Rxn. = Student reaction to portfolios

Each study provided insight on motivation and self-regulation strategies. Self-efficacy improvements by a class are best typified by Nicolaidou (2012) and Nicolaidou (2013). Nicolaidou used Bandura's theory of self-efficacy as a model to demonstrate that student self-efficacy and writing performance increased over the year more than the control group who did not complete a portfolio. The control group saw no improvement in self-efficacy over the school year. Chang (2009) saw self-reported motivation scores increase after implementation of an e-portfolio. Chang and Tseng (2013) witnessed an increase in motivation. Meyer, Abrami, Wade, Aslan, and Deault (2010) and Abrami, Venikatesh, Meyer, and Wade (2013) found indications of improved writing test scores for fourth graders in Canada using their comprehensive ePEARL system.

Research Question 3. How can e-portfolios be designed, implemented, and assessed in order to enhance self-regulation and student achievement?

Table 5 pertains to recommendations regarding design and implementation of e-portfolios. With motivational strategies, communities of practice were emphasized encouraging implementation at a broad level. With learning strategies, knowledge building is facilitated with e-portfolios of class notes (Van Aalst & Chan, 2007). Also, organizing e-portfolios via concept mapping diagrams is stressed (Kim & Olaciregui, 2008).

Table 5. *Characteristics of Studies Addressing Question 3*

| Author/ Year | S/L | Origin | Res Des | N | Type | MSLQ Aspect | Meas. Source | Results | Stud Rxn. |
|--|-----|------------------|--------------|-------|---------------------|--------------------------------|----------------------------|---|-----------|
| Meyer, Abrami, Wade, & Scherzer (2011) | M/P | Canada | Mixed Method | 16 | Comprehensive | Motivation/Implementation | 3 instruments / interviews | Need full integration and multiple teacher buy in | +/- |
| Barrett (2007) | M/S | United States | Qual | 3000 | Comprehensive | Motivation/Learning Strategies | Survey/Site visit | Community of practice is important | +/- |
| Chang, Wu, & Ku (2005) | M/S | Hong Kong | Mixed Method | 37 | Comprehensive | Motivation/Metacognition | Survey | E-portfolios facilitated learning | + |
| Kim and Oloaciregui (2008) | L/P | United States | Mixed Method | 25/25 | Developmental | Intrinsic value/cognition | Pre/post | Concept mapping organization better than hierarchical | + |
| Van Aalst & Chan (2007) | L/S | Canada/Hong Kong | Quasi | 14/7 | Showcase/Assessment | Peer/teacher feedback | Pre/post | Increase in exam/conceptualization | + |

Notes: S/L=Strategy/Academic Level , M=Motivation Strategy, L=Learning Strategy, P=Primary level S=Secondary level, Res Des = Research Design, Qual=Qualitative, Quasi=Quasi experiment, Quant=Quantitative, N= Sample Size, Meas. Source=Measurement Source Stud Rxn. = Student reaction to portfolios

Recommendations that address motivation or learning strategies on the primary and secondary educational level are listed in Table 6 and they also address the pitfalls for different e-portfolio types listed for research question one.

Table 6. *Guidelines for Portfolios*

| | Pitfalls | Recommendations relevant to motivation and self-regulation |
|----------------------|---|--|
| General | Solo instructors (lack of buy in), technical issues, lack of motivation, no clear results, lack of full implementation, expense | Explain benefits to instructors and students, train all stakeholders, use the most fool proof method but have a backup if something goes wrong, limit and clearly outline goals and expectations, motivate students by showing direct benefits, provide constant guidance, use free or widely available products |
| Developmental | Does not show final evidence of learning, assess overall performance, difficult to navigate | Make sure that the whole process is monitored including the final product, have criteria with clearly outlined expectations to capture and assess and use concept mapping approach to design and organize portfolio |
| Reflection | Can be burdensome and perfunctory if quality of reflection is not emphasized | Provide samples of reflection, monitor closely, oversee entries, and provide feedback promptly |
| Assessment | Does not reflect student progress, does not provide full picture of student | Make sure the showcase captures user and instructor goals, couple with developmental portfolio, review even if it is not for a grade or immediate result |
| Showcase | This assessment may not have the same rigor as standardized tests | Use scaffolding, templates, and rubrics, should be authentic process (real life scenario) should assess understanding, performance, critical thinking |

Conclusion and Discussion

The purpose of this review is to explore the potential of e-portfolios to influence motivation, self-regulation, and academic performance. Peer-reviewed publications that focused on electronic, digital, web, or online portfolios were examined and coded. Findings suggest: 1) Both the process and product portfolios were associated with motivation and self-regulation. 2) Numerous studies demonstrate the benefits of e-portfolios for increasing learning strategies, motivation strategies, academic achievement, and technical aptitude. 3) E-portfolios must be student-centered, offer some user control, and require full commitment and planning. In most studies, the experimental group that compiled e-portfolios matched or surpassed the performance of control group. This review suggests that e-portfolios can have an impact on self-regulation and academic performance at the K-12 level.

E-portfolios are usually supplemental devices for re-enforcing and personalizing the subject matter; they are not necessarily the focus of the course. However, this literature review indicates that students enhance their metacognition and their ability to explore learning as a result of the e-portfolios. E-portfolios offer a number of flexible and creative ways for students to interact with content. The e-portfolios facilitated scaffolding between learner and instructor. The instructor could maintain regular and structured communication with individuals and groups. Learner autonomy is stressed in some studies, but with other portfolio studies, instructors play more of a key role. Nevertheless, the quality of instruction is an essential part of evaluating application of new knowledge.

Peer learning was extensively explored in numerous studies. Assessments among peers, teachers, and students were unreliable (Chang, Tseng, Lou, 2012). However, students reported that the use of peer evaluations helped improve their writing (Nicolaidou, 2012; 2013). Face-to face interaction was more cumbersome and less impartial than electronic systems of peer reflection, assessment, and interaction. In some cases, the e-portfolio offered a practical tool for students to employ with greater flexibility. Authentic learning in which the student actually completes a performance based task was evidenced with product portfolios as well as process portfolios.

It is unclear whether e-portfolios account for the improvement in performance or if other factors play a role. Nicolaidou (2013) found that paper portfolios were as effective as e-portfolios for facilitating improvements in writing exam scores. Other studies found that e-portfolios offered the advantage of accessibility and affordability. However, Van Aalst and Chan (2007) and Abrami, Venikatesh, Meyer, and Wade (2013) found that courses with e-portfolios offer unique affordances. However, the activities completed in courses with the e-portfolio may have been different than those without an e-portfolio, so it may be difficult to make a fair comparison.

Recommendations for further research include the following:

- More research testing the effectiveness of e-portfolios on self-regulation and achievement.
- Innovative uses of portfolios in assessment and authentic learning
- Larger sample sizes testing against standardized measures
- More exploration of mobile learning and distance learning with electronic portfolios

Recommendations for practice include the following:

- Portfolios must be ingrained in the classroom for a long period of time or used for assessment after buildup
- Portfolios require buy-in from students, teachers, and IT, and administrators
- Portfolios should be student-centered assessments for learning which demonstrate each student's learning process, performance, problem solving, and self-regulation capacities.

References

- Abrami, P. C., Venkatesh, V., Meyer, E. J., & Wade, C. A. (2013). Using electronic portfolios to foster literacy and self-regulated learning skills in elementary students. *Journal of Educational Psychology*, 105 (4), 1188-1208. doi: 10.1037/a0032448
- Acker, S. R., & Halasek, K. (2008). Preparing high school students for college-level writing: using ePortfolio to support a successful transition. *JGE: The Journal of General Education*, 57(1), 1-14.
- Alawdat, M. Using E-portfolios and ESL learners (2013). *US-China Education Review*, 3, 339-351.
- Bandura, A. (1986). *Social foundations of thought and action. A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall.
- Barak, M. (2012). From 'doing' To 'doing with learning': reflection on an effort to promote self-regulated learning on technological projects in high school. *European Journal of Engineering Education*, 37, 105-116.
- Barrett, H.C. (2007). Researching electronic portfolios and learner engagement: the REFLECT Initiative. *Journal of Adolescent and Adult Literacy* 50, 436-449. Doi:10.1583/JAAL50.6.2

- Butler, P. A. (2006) A review of the literature on portfolios and electronic portfolios, Massey University College of Education Palmerston North, New Zealand.
- Cambridge, B.L. (2004). Electronic Portfolios? Retrieved from <http://www.educause.edu/ir/library/powerpoint/LIVE042.pps>
- Cambridge, D. (2010). *E-portfolios for Lifelong Learning and Assessment*. San Francisco: Jossey-Bass.
- Chang, C.-C. (2009). Self-evaluated effects of web-based portfolio assessment system for various student motivation levels. *Journal of Educational Computing Research*, 41(4), 391-405.
- Chang, C.-C. & Tseng, K.H. (2009) Use and performances of web-based portfolio assessment. *British Journal of Educational Technology*, 40, 358-370.
- Chang, C. C., Tseng, K. H., Liang, C. Y., & Liao, Y. M. (2013). Constructing and evaluating online goal-setting mechanisms in web-based portfolio assessment system for facilitating self-regulated learning. *Computers & Education*, 69, 237-249.
- Chang, C.-C., Tseng, K.-H., & Lou, S.-J. (2012). A comparative analysis of the consistency and difference among teacher-assessment, student self-assessment and peer-assessment in a web-based portfolio assessment environment for high school students. *Computers & Education*, 58, 303-320.
- Chang, Y.-J., Wu, C.-T., & Ku, H.Y.. (2005). The introduction of electronic portfolios to teach and assess English as a foreign language in Taiwan. *TechTrends*, 49(1), 30-35.
- Chou, P.-N., & Chang, C.-C. (2011). Effects of reflection category and reflection quality on learning outcomes during web-based portfolio assessment process: a case study of high School students in computer application course. *Turkish Online Journal of Educational Technology - TOJET*, 10(3), 101-114.
- Davies, D., Collier, C., & Howe, A. (2012). Assessing scientific and technological enquiry skills at age 11 using the e-scape system. *International Journal of Technology & Design Education*, 22(2), 247-263.
- De Bruin, H. L., van der Schaaf, M. F., Oosterbaan, A. E., & Prins, F. J. (2012). Secondary-school students' motivation for portfolio reflection. *Irish Educational Studies*, 31(4), 415-431.
- Dorn, C. M., & Sabol, F. R. (2006). The effectiveness and use of digital portfolios for the assessment of art performances in selected secondary schools. *Studies in Art Education: A Journal of Issues and Research in Art Education*, 47(4), 344-362.
- Guzeller, C. O. (2012). The effect of web-based portfolio use on academic achievement and retention. *Asia Pacific Education Review*, 13(3), 457-464.
- Heredia, Y.; Icaza, J. I. (2012)Technology-based participatory learning for indigenous children in Chiapas schools, Mexico. *Journal of Information Technology Education: Innovations in Practice*, 11, 251-270.
- Kim, P., & Olaciregui, C. (2008). The effects of a concept map-based information display in an electronic portfolio system on information processing and retention in a fifth-grade science class covering the Earth's atmosphere. *British Journal of Educational Technology*, 39(4), 700-714.
- Meyer, E., Abrami, P. C., Wade, C. A., Aslan, O., & Deault, L. (2010). Improving literacy and metacognition with electronic portfolios: Teaching and learning with ePEARL. *Computers & Education*, 55(1), 84-91.
- Meyer, E. J., Abrami, P. C., Wade, A., & Scherzer, R. (2011). Electronic portfolios in the classroom: factors impacting teachers' integration of new technologies and new pedagogies. *Technology, Pedagogy & Education*, 20(2), 191.
- Nicolaidou, I. (2012). Can process portfolios affect students' writing self-efficacy? *International Journal of Educational Research*, 56, 10-22.
- Nicolaidou, I. (2013). E-portfolios supporting primary students' writing performance and peer feedback. *Computers & Education*, 68, 404-415. doi: 10.1016/j.compedu.2013.06.004
- Or Kan, S. (2011). Cooperative learning environment with the web 2.0 tool e-portfolios. *Turkish Online Journal of Distance Education*, 12(3), 201-214.
- Paulson, F. L., Paulson, P. R., & Meyer, C. (1991). What makes a portfolio a portfolio? *Educational Leadership*, 48(5), 60-63
- Pintrich, P. R. and Degroot, E.V. (2000). Motivational and self-regulated learning components of classroom, *Journal of Education Psychology*, 82, 33-40.
- Tezci, E., & Dikici, A. (2006). The Effects of digital portfolio assessment process on students' writing and drawing performances. *Turkish Online Journal of Educational Technology – TOJET*, 5(2), 46-5.
- van Aalst, J., & Chan, C. K. K. (2007). Student-directed assessment of knowledge building using electronic portfolios. *Journal of the Learning Sciences*, 16(2), 175-220.
- Wall, K., Higgins, S., Miller, J., & Packard, N. (2006). Developing digital portfolios: investigating how digital portfolios can facilitate pupil talk about learning. *Technology, Pedagogy & Education*, 15(3), 261.

- Weir, T., & Connor, S. (2009). The use of digital video in physical education. *Technology, Pedagogy and Education*, 18(2), 155-171.
- Williams, P. J. (2012). Investigating the feasibility of using digital representations of work for performance assessment in engineering. *International Journal of Technology and Design Education*, 22(2), 187-203.
- Zimmerman, B. J. (2008). Investigating self-regulation and motivation: historical background, methodological developments, and future prospects. *American Educational Research Journal*, 45 (1), 166-183.