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### **Abstract**

**Abstract:** This lead article for the special issue of the *Canadian Journal of Learning and Technology* explores directions for research and development on electronic portfolios, which are digital containers capable of storing visual and auditory content; software for which may also be designed to support a variety of pedagogical processes and assessment purposes. The paper is organized around several key questions: What are the types and characteristics of electronic portfolios? What are the outcomes and processes that electronic portfolios support for their creators? What are the contexts in which EPs are most effective and worthwhile? Who are electronic portfolio users/viewers and how do we provide appropriate professional development to encourage correct adoption and widespread and sustained use? What do we know and need to know about technical and administrative issues? What is evidence of electronic portfolio success? How do we move forward with funding and infrastructure?

**Résumé:** L'article principal du numéro spécial de La Revue Canadienne de l'Apprentissage et de la Technologie examine les directions à suivre pour la recherche et le développement sur les portfolios électroniques qui sont des récipients numériques en mesure d'emmagasiner du contenu visuel et audio; des logiciels qui pourraient aussi être conçus pour prendre en charge une variété de processus pédagogiques et à des fins d'évaluation. L'article porte sur plusieurs questions importantes : Quels sont les types et les caractéristiques des portfolios électroniques? Quels sont les résultats et les processus que les portfolios électroniques appuient pour leurs créateurs? Dans quels contextes les portfolios électroniques sont-ils les plus efficaces et intéressants? Quelles sont les personnes qui utilisent et qui consultent les

portfolios électroniques et comment pouvons-nous offrir un perfectionnement professionnel approprié afin d'encourager l'adoption correcte ainsi que l'utilisation généralisée et durable? Que savons-nous et que devons-nous savoir à propos des questions techniques et administratives? Comment se manifeste la réussite des portfolios électroniques? Comment allons-nous de l'avant avec le financement et l'infrastructure?

### **Introduction**

An electronic portfolio (EP) is a digital container capable of storing visual and auditory content including text, images, video and sound. EPs may also be software tools not only because they organize content but also because they are designed to support a variety of pedagogical processes and assessment purposes. EPs are gaining in popularity not only because they provide multimedia display and assessment possibilities for school and work contexts, which are useful for authentic assessment and the evaluation of prior learning, but also because they may scaffold attempts at knowledge construction. The potential of EPs are nothing short of revolutionary as a dramatic expression of the possibilities of e-learning from cradle to grave as epitomized in the slogan "E-portfolio for Life".

Historically speaking, EPs are the Information Age's version of the artist's portfolio in the sense that they not only summarize an artist's creative achievements but also illustrate those achievements. An artist, architect, or engineer who displays her portfolio of work allows the viewer to form a direct impression of that work without having to rely on the judgments of others. EPs tell a story both literally and figuratively by keeping a temporal and structural record of events.

The purpose of this paper is to explore the research and development issues surrounding EPs in a comprehensive fashion given the complexity of the subject matter. It serves to introduce this special issue of the *Canadian Journal of Learning and Technology*. It should also help to organize what we know and what we need to know about EPs from technical, administrative, pedagogical, governmental, and other perspectives. The content reflects the current state of the literature, the observations of the authors formed at several LIFIA and EIFEL conferences on EPs, and the input and feedback received from conference attendees. The paper is organized around several key questions: What are the types and characteristics of EPs? What are the outcomes and processes that EPs support for their creators? What are the contexts in which EPs are most effective and worthwhile? Who are EP users/viewers and how do we provide appropriate professional development to encourage correct adoption and widespread and sustained use? What do we know and need to know about technical and administrative issues? What is evidence of EP success? How do we move forward with funding and infrastructure?

### ***What are the types and characteristics of EPs?***

The authors are especially interested in the use of EPs to support learning and this is undoubtedly reflected in the concepts and ideas emphasized in this paper. EPs have three

broad purposes: process, showcase, and assessment. First, EPs may be designed as *process portfolios* supporting how users learn through embedded structures and strategies. Process portfolios are personal learning management tools. They are meant to encourage individual improvement, personal growth and development, and a commitment to life-long learning.

### ***Process portfolios***

A process portfolio can be defined as a purposeful collection of student work that tells the story of a student's effort, progress and/or achievement in one or more areas (Arter & Spandel, 1992; MacIsaac & Jackson, 1994). The Quebec Education Programme (QEP) (Ministère de l'Éducation du Québec, 2000) is based on the principles of socio-constructivism including a belief in the value of portfolios; the QEP requires teachers and students to develop proficiency with them. Consequently, the use of portfolios has been mandated within the elementary Language Arts curriculum and is encouraged in other core subject areas. The QEP lists the following as possible advantages of portfolios, they: involve students in their learning (as a tool for reflection); allow students to increase their ability to self-evaluate; teach students to make choices; encourage students to better understand themselves and focus on their strengths; allow students to reflect on their procedures, strategies, and accomplishments so that they can improve and correct them and ultimately succeed; promote feedback during the learning process, particularly during individual conferences; encourage students to reflect on their strengths, needs, errors, interests, challenges, and objectives; encourage interactive processes among students, teachers, and parents; shows student progress because it tracks performance over time; and they are used to assess competencies developed by students.

The QESN-RÉCIT (2004) identifies five stages to the portfolio process, for print-based or digital portfolios: (1) collection, (2) selection, (3) reflection, (4) evaluation and (5) celebration (see: [http://www.qesnrecit.qc.ca/portfolio/port\\_eng.html](http://www.qesnrecit.qc.ca/portfolio/port_eng.html)). These stages are similar to those laid out by Danielson and Abrutyn (1997) for developing portfolios. In the collection stage, teachers and students work together to save artefacts that represent successes and opportunities for growth. In the selection stage, teachers and students review and evaluate the saved artefacts and jointly decide which best demonstrate the achievement of learning goals. At the reflection stage, students articulate their thinking about each piece in the portfolio. Students evaluate their own growth over time as well as discover any gaps in their development. This stage is undoubtedly the most crucial and it is what enables portfolios to become lifelong learning tools. In the evaluation stage students compare their reflections to their pre-set goals and other achievement standards and indicators and set learning goals for the future. Finally, in the celebration stage students share their portfolios with their peers. "This is the stage where appropriate public commitments can be made to encourage collaboration and commitment to professional developments and lifelong learning" (Barrett, 2001). An example of a process portfolio software tool is described elsewhere in this issue by Wade and Abrami (2005).

### ***Showcase and assessment portfolios***

EPs may be designed as *showcase portfolios* illustrating learner competencies and achievements. Showcase EPs may also demonstrate workplace skills and accomplishments. "Demonstration" is the key concept in showcase portfolios as they illustrate what has been learned and do not merely describe what has been learned.

Finally, EPs may be designed as *assessment portfolios* where the focus is especially on external evaluation or judgment. Assessment EPs may be used for both the formative and summative evaluation of learning. However, the use of portfolios in high stakes assessment of learning is problematic, while the use of portfolios in formative assessment of instruction or learning may be powerful. EPs may contain traditional forms of evidence but more often assessment portfolios contain complex evidence in a variety of forms and are, therefore, often associated with attempts at authentic assessment given that EPs allow for virtual demonstrations of competencies. Assessment portfolios may also include scoring rubrics, templates and benchmarks as evaluation criteria. Their applications include lifelong learning and personal reflection, workplace training and the assessment of prior learning. EPs may be used flexibly to judge prior learning, foreign credentials, experiential learning, non-credit experiences, using forms of competency-based and authentic assessment. And EPs may be used for accreditation purposes to provide credit for training, credit, and certification purposes. These latter assessments, based on the demonstration of competencies, are especially appealing to judge immigrants, minorities, and mature learners where life experiences, rather than credentials, are especially relevant to judge.

Using technology in the classroom should change the way that instruction occurs if we are to move away from teacher-directed instructional methods to student-directed methods. These socio-constructivist methods, which encourage inquiry, problem solving, and collaborative methods of learning emphasize the acquisition of a new set of skills and knowledge. Our traditional methods of classroom/teacher assessment do not wholly or readily account for these new skills, nor are they equipped to measure the deeper cognitive processes, like problem solving and critical thinking, that should evolve as a result of technology use. Nor do traditional assessment methods readily allow students to demonstrate their new knowledge in multiple forms such as through the use of multimedia. This calls for the use of classroom/teacher assessment tools that are better suited to providing a more accurate representation of student ability which do not stigmatize learners but better engages them in the learning process. Such integrative and honestly representative forms of assessment are termed *authentic*. This idea of authentic assessment is deeply rooted in the theoretical direction of hermeneutics, which advocates a more contextualized and collaborative approach to assessment. "Like psychometrics, hermeneutics is a general approach to the interpretation of human products, expressions or actions" (Moss, Schutz, and Collins, 1998, p. 143). It provides a context for combining information across multiple pieces of evidence rather than relying on a sole source of evaluation.

Miller and Legg (1993) define portfolio assessment as a specific form of authentic or performance assessment that attempts to measure higher order thinking skills including

the ability to communicate clearly, to make judgments, and to demonstrate specific competencies. Resnick (1992) describes portfolios as not being direct assessment measures, since they preserve the complexity of the cognitive skills being assessed rather than decomposing it into smaller components.

The assessment of EPs raises old and new challenges and opportunities. Some of the challenges include: determining the authenticity of digital evidence; the technical requirements and barriers to EP use; and difficulties in judging, using scoring rubrics and templates, the quantity and quality of virtual evidence. The challenges generally relate to what quantitative researchers refer to as reliability and validity and qualitative researchers refer to as convergence and truthfulness. For either paradigm, one must also consider the development of standards for accuracy and comprehensiveness of portfolio evidence.

Finally, we need research which explores the advantages and disadvantages of electronic portfolio assessment compared to: paper-based portfolios, traditional tests and essays, high stakes assessment, and interviews and resumes. We fear that the widespread belief that EPs for assessment provide more accurate evidence is true with qualifications and restrictions that need careful documentation. We are also concerned that assessment portfolios provide effective evidence at some sacrifice of efficiency and may not be wisely used under certain logistical and time constraints. And we worry that when assessment portfolios are in wide use they will generate the same negativity as other forms of assessment. Therefore, let us not confuse the form of assessment with the purpose of assessment.

EPs are often considered the record of an individual's learning and achievement as student, teacher, worker, manager, and coach, regardless of context, age and situation. But there is no need to limit EPs to individuals. EPs are also useful for groups including learning and work teams, including schools and offices as learning communities. Larger organizations and communities may also benefit from EPs including institutions, companies, factories, government agencies, and NGOs. Applications of EPs to groups and organizations have not been well explored.

Within the context of school and learning, there are several possible affordances of EPs. They are purported to encourage the development of literacy skills by encouraging composition and editing skills. They may also encourage certain numeracy skills, particularly problem solving, although EP tools are rarely designed to contain facility for equation writing and mathematical expressions. EPs also may encourage the development of other literacies including ICT and media skills, musical and artistic expression by allowing users to paint, draw, or otherwise create using new media.

EPs may also encourage collaboration, communication, and the development of interpersonal skills. Communication may be between and among students, teachers and parents as well as among workers and managers. And EPs may help students learn better how to organize and represent their work.

EPs may provide containers encouraging flexible, inclusive, and distributed evidence of learning including variable times and places for learning. Their enriched, interactive multimedia nature means that EPs contain virtual learning artefacts including text, audio, and video and may use such innovative learning strategies as concept maps and visual models. EPs allow for conferencing and collaboration in multiple forms such as computer conferencing, web casts, audio/video conferences, blogs, and wikis.

In addition to their flexibility of content, EPs also allow, as appropriate, a degree of standardization across geographic regions encouraging a sense of fairness, inclusivity of learners/users with special needs (plus immigrants, minorities and natives), and portability from time to time and place to place.

EPs may resemble digital scrapbooks documenting baby's first steps or granddad's oral history. In the largest sense some think of EPs as *virtual identities* or digital archives and, therefore, the containers that record all that is significant in one's life. EPs have important uses for formal learning from preschool and kindergarten through high school, undergraduate school and graduate school. EPs also have important uses for informal learning especially adult and lifelong learning applications. But a virtual identity and "portfolio for life" go beyond educational applications and may also include: health and medical records; financial and tax records; legal documents; work-related, career, and professional activities; the family scrapbook(s) and personal diaries or storybooks; social binders of friends and colleagues; records of hobbies and extracurricular activities.

When conceived this broadly, EPs take on new meanings and new complexities. Important among these is the structure and organization of EPs as virtual identities which may require dynamic restructuring periodically, in some cases daily, in others annually, and in yet other cases, episodically. Creating a lifelong virtual identity means creating a virtual personal library. If we are to have EPs for life we will have to give attention to the cataloguing and tagging of information as complex and variable requiring both storage and retrieval. EPs will, therefore, require information management systems designed by information specialists. EPs for life will require that we: organize content and work; track progress and allow calendaring; have data files and large storage capabilities; and include assessment evidence and evaluation results.

The possibilities of EPs for life are vast but the storage and retrieval issues are equally challenging. We need to know more about how to create personal templates for virtual personal libraries and archives.

### ***What are the outcomes and processes that EPs support for their creators?***

The creators of EPs may be students or workers and they may also be teachers and managers. But whatever their role, they may create portfolios to document or to learn. We consider the uses of portfolios for learning to be their most important use. Consequently, we consider research on the outcomes and processes supported by EP to be the most important research.

Digital portfolios have unique advantages over paper-based ones. First, learners can easily integrate multimedia materials, allowing them to use a variety of tools to demonstrate and develop understanding. This may be especially advantageous for at-risk children whose competencies may be better reflected through these authentic tasks. At the same time, by engaging these learners, their deficiencies in core competencies may be overcome. Second, digital portfolios are superior for cataloguing and organizing learning materials better illustrating the process of learner development. Finally, digital portfolios have communication advantages. The portfolio is easy to share with peers, teachers, parents and others, and lets them provide feedback through a single electronic container.

What are the immediate and long-term outcomes EP use supports? Advocates of EPs, like most educators, hope that the use of electronic portfolios encourages long-lasting impacts on learning and impacts which go beyond the acquisition of basic skills and the surface processing of information to the development of higher level thinking abilities, like synthesis, analysis, and evaluation, and the deep processing of information. Advocates also believe that EPs support learning across the life span, in informal and formal settings, and may even help develop cross-curricular competencies. And because EPs use technology, they may also help develop learners' technology skills and encourage positive attitudes towards the uses of technology for learning.

In addition to the development of curricular and cross-curricular competencies and content expertise, process portfolios, in particular, are expected to benefit the creator's ability to self-regulate and monitor their own learning, thereby developing their meta-cognitive awareness and abilities and aptitudes for lifelong learning and learning how to learn.

Proponents of socio-cognitive models emphasize that to develop effective self-regulated learning strategies, "students need to be involved in complex meaningful tasks, choosing the products and processes that will be evaluated, modifying tasks and assessment criteria to attain an optimal challenge, obtaining support from peers, and evaluating their own work" (Perry, 1998, p. 716). Educators believe that portfolios allow students to think critically, and become active, independent and self-regulated learners (Mills-Courts & Amiran, 1991; Perry, 1998). Wade and Yarbrough (1996) elaborate on the pedagogical value of using portfolios as a learning tool. Portfolios are developmental in their nature, since a portfolio represents a certain period of students' growth and learning. Portfolios should not be solely used for short-term goal attainment since they are the culmination of long-term learning outcomes. Portfolios are dual-valued in that they offer both the teachers and the students the opportunity of dyadic interaction. A portfolio allows the student the opportunity to reflect and record learning process while offering teachers an authentic integrative approach of evaluating student growth and achievements as well as acting as a feedback mechanism for their teaching practices. Given that the use of portfolios allows students to choose and organize the kind of content they want to include, this engages the students in the evaluation and assessment process. Contrary to traditional testing methods, which do not readily reflect student growth, portfolios may

demonstrate learning gains and thus promote authentic learning. Portfolios are also interactive in that they enable students to share their work with their teachers and peers, thus seeking guidance or suggestions. In this way, the development and establishment of the portfolio may be seen as a form of collaboration.

Finally, as elaborated by Wade and Abrami (2005), portfolios can provide evidence of student self-regulation. Students may review their own work and then modify learning goals as a result of such reflection. The process of reflection is what makes portfolios a tool for life-long learning and professional development rather than a mere collection of work (Foote & Vermette, 2001). The student needs to be able to make a direct connection between each submission in the portfolio and an intended learning goal. The student needs to be able to explain why a specific submission was placed within the portfolio. Barrett (2004) further confirms the importance of this idea when she says, "the artifacts need to be accompanied by the learner's rationale, or their argument as to why these artifacts constitute evidence of achieving specific goals, outcomes, or standards." (p. 3). Bereiter and Scardamalia (1989) mention that portfolios encourage the pursuit of personal cognitive learning goals, what they call "intentional learning". Portfolios prompt students to look back, to digest and debrief, and to review what happened so that they can set new goals and determine next steps (Camp, 1992). In an attempt to demonstrate the effects of reflection, Sweidel (1996) asked students self-reflective questions about their study strategies and found that at the end of the semester they were able to identify relationships between the process and the outcome of their studying. When students use portfolios, they assume more responsibility for their learning, better understand their strengths and limitations, and learn to set goals (Hillyer & Lye, 1996). Portfolios help students become involved in the evaluation of their own learning (Fenwick & Parsons, 1999).

Process portfolios are expected to have positive effects on attitudinal, motivational, and affective outcomes. Because process portfolios are socio-constructivist in orientation, they encourage learners to explore topics from a personal perspective capitalizing on and potentially increasing intrinsic interest. Intrinsic interest and the involvement in authentic learning tasks may also lead to increased time-on-task, learner engagement, and sense of personal commitment and ownership. Since the learner controls the construction of a portfolio and learning is student-centered, there are concomitant benefits to self-efficacy beliefs. Other potential benefits of process portfolio usage include attribution to effort and beliefs in effort-outcome co-variation. Other possible benefits associated with EPs include: mastery vs. performance and work-avoidant learning orientation; and enhanced academic and social self-esteem. Finally, because students peer conference and may even work collaboratively on group portfolios, process EPs may help develop students' interpersonal and social skills.

Unfortunately, evidence to date on the impacts of EPs on learning and achievement and other outcomes is sparse. Ten years ago, Herman and Winters (1994) concluded that there was a "dearth of empirical evidence" on the impact of EPs. This sentiment was echoed by



Lyons (1998): “there is not yet a body of systematic data documenting their [portfolio] uses or their long-term consequences” (p. 247). Zeichner and Wray (2001) concluded similarly: “Despite the current popularity of teaching portfolios, there have been very few systematic studies of the nature and consequences of their use for either assessment or development purposes” (p. 615). And finally, Carney (2005) concluded, “Electronic portfolios show promise for enhancing learning, but if we fail to critically evaluate our uses of the device, we may find that they will go the way of Papert’s Logo turtles and become yet another educational fad—an innovation poorly understood and often implemented in ways contrary to its theoretical underpinnings” (p. 4).

Methodological complications and controversies challenge researchers in this area. First, there is the question about whether a quantitative or qualitative research paradigm is appropriate for answering questions about EP impact. Second, there is the question about the instructional sensitivity of traditional learning measures to EP effects, particularly, among those who argue for EPs as alternative and/or authentic tools for assessment. Finally, there is the question about the strength and pervasiveness of the EP treatment. EPs are not curricular content but tools for learning content. They are a pedagogical approach or strategy for learning that needs to be used correctly, widely, and for a reasonable period of time for effects to appear. Research on EP effectiveness, therefore, may need to include measures of implementation fidelity to insure their use by teachers and students is faithful to their purpose.

What are the cognitive, motivational and affective *processes* EPs use supports? Process EPs, in particular, encourage through their structures and activities the following processes: goal setting and planning; peer, teacher and parent conferencing; personal reflection and authentic assessment; knowledge building and refinement; contextualized and meaningful learning; and multimedia learning or learning with technology.

There are several theoretical orientations that may be useful to understanding the underlying processes by which EPs operate successfully. EPs are sympathetic to socio-constructivist notions of learning where learners use portfolios as a tool to construct and refine their understanding and also share with peers, teachers, and parents to learn socially. Notions of self-regulation are also apparent in process EPs, where goal setting, planning, reflection, and conferencing occur. Because learners use EPs to set goals, plan, and then get feedback, EPs may operate positively on self-efficacy beliefs and attributions for learning. Finally, because EPs incorporate text, audio and video, multimedia learning may occur where information is processed and encoded in more than a single modality.

We need further research that identifies the underlying EP processes, makes sure they are encouraged or scaffolded in EP tools, and used appropriately by teachers and students. We also need to explore the relationship between process and outcome and how these processes impact on the learner and learning outcomes.

### ***What are the contexts in which EPs are most effective and worthwhile?***

While the designers, developers, and advocates may hope for pervasive and general

effects, it is probably more realistic to assume there will be circumstances and individuals for whom EPs work best. For which learners are EPs advantageous and why? Are there gender effects; are EPs more acceptable to females than males? Do learners of all ability levels use them well? Do EPs encourage inclusivity and learning for students with special needs and otherwise minimize the marginalization of students? Are there age effects (school children, vs., university, vs. adult and workplace applications)? For which instructors are EPs most effective and for which instructional strategies (e.g., lecturing vs. problem-based learning)? For which content, curricula, and type/level of expertise (e.g., language arts vs. math and science)?

***Who are EP users/viewers and how do we provide appropriate professional development to encourage correct adoption and widespread and sustained use?***

Users of EPs are those with a formal responsibility to take the contents of EPs and judge them formatively or summatively. Teachers and faculty, principals, and other educational administrators, plus parents and peers may view portfolios to assist the learning of students or to judge learning quality and quantity. This judgment may occur in the context of a traditional course or in a distance learning environment at all levels of education including teacher certification and other forms of professional assessment. Users of educational EPs may also wish to assess prior learning to provide equivalent credit for course completed in other jurisdictions and for certain work and relevant life experiences where competency can be demonstrated. Users of EPs may also be employers, managers, and others wishing to examine evidence concerning the competencies of a person to undertake a job or the competencies of a person once hired.

Beyond users of EPs are viewers of EPs, such as family members, friends, and acquaintances. They are those without any formal responsibility for judging or otherwise using the contents of EPs. Their informal role may nevertheless have a powerful impact on the creators of EPs, especially considered in terms of the pervasive possibilities of EPs "for life".

As EPs grow in power, flexibility, and pervasiveness it may not be reasonable to think of them as simple and easy to use tools. Process EPs have complex underlying theoretical mechanisms that require more than technical knowledge to use appropriately. Both the creators of EPs and the users of EPs need time and possibly assistance in learning to use EPs wisely.

We need to learn how to best teach students and creators to use EPs and how do we scaffold this learning using or within EPs. How do we design and apply EPs so both creators and users use them willingly and strategically? How important is customization and individualization of the tool and its features?

We also need to learn how to best teach teachers and users of EPs. How do teaching practices change with the use of EPs? What form of technical training is necessary? How much technical skills training is needed in software use and in development of multimedia content (e.g., Digital photography, scanning, Quicktime videos, etc.) What about

technology integration skills? And what form of pedagogical development is needed? How should we teach and scaffold general principles of socio-constructivism and self-regulation? For example, teachers and users need to know:

- How, when, and why to use EP?
- Strategies, processes and outcomes of EP use and how to achieve them?
- Effective peer or student led conferencing: How to lead discussion (students)? How to guide and engage in discussion (parents)?
- How do employers use EPs: How to extract meaningful information and link it to job requirements?
- In addition, there are questions about effective means of delivering training and professional development:
  - Via workshops, mentoring, etc.?
  - Embedded just-in-time multimedia activities or electronic performance support?
  - As scaffolded tools, guidelines, planning tools, scoring rubrics, demonstrations, explanations, activities and templates, embedded in EP?
  - By insuring that EP is embedded in curriculum, not added-on?
  - Using Swap and Share days and creating communities of practice?
  - By helping form online communities and taking advantage of blogs/wikis?

Finally, we cannot naively assume that because there is a grassroots movement in favour of EPs, that alone is sufficient to insure their widespread and sustained use. We need also to insure top-down support. How do we encourage teacher, principal, administrator, technician, and policy-maker buy-in? In some cases, this top down support may mean showing how EPs support learning and curricular objectives, are cost and time efficient, do not create technical challenges beyond what IT staff may be able to support, and so on. For example, arguments for EPs might include: Use of EPs to meet Teaching Standards and (ISTE National Educational) Technology Standards; they encourage curricular and pedagogical fidelity; and they encourage student-centered learning.

### ***What do we know and need to know about technical and administrative issues?***

EPs take advantage of technology but are also bound by the limits of what technology can provide within the systems within which EPs operate. There are, therefore, questions of a more technical nature that need to be addressed to insure EP success. These include: Should EPs be designed using Open Source code (e.g., MYSQL vs. SQL) and how does one deal with issues of ownership/modifications? What about interoperability of different EP tools and technical standards for their design? How do we deal with issues of archiving—including storage issues and size? What about portability over time and locations? How do we deal with the interface with databases for organizational use (e.g., school boards)? What about public vs. private access and security? How do we deal with illegal and inappropriate content? What about insuring inclusivity and accessibility following Universal Design Standards? What about bilingual and multilingual content? How do we insure proper technical and pedagogical support especially when the tools are brought to scale? How do we encourage maximal usability and value? What are the similarities and differences with other tools such as: Course and learning management systems (e.g., WebCT, Blackboard); Multimedia text processors (e.g., WORD); and Learning objects and Learning Object Repositories? What do we know about administrative issues? How do we get technical and administrative buy-in, establish value-added, and insure return on investment? How do we

deal with policy issues and government or agency support and use?

### ***What is evidence of EP success?***

With most initiatives, whether they are business-oriented, educational, philanthropic or otherwise, there are often criteria by which the success of the initiative is judged. In the case of the EP movement, what are the criteria by which the initiative will be judged in the short term and in the long term? One criterion might be scalability, the extent to which EPs are in wide use throughout Canada, the United States, and the rest of the world. Another criterion might be satisfaction, including sustainability and long-term maintenance and commitment to EPs. A third criterion might be cost versus benefit, worthiness, or efficiency and return on investment. A fourth criterion might be learning gains and effectiveness including personal enrichment. A final criterion might include the number of accurate prior learning assessments and successful job placements or advancements due to EPs.

### ***How do we move forward with funding and infrastructure?***

There are research and development issues in this article to keep a team occupied for the next decade. Clearly, not all the issues are of equal importance and some may not even require careful inquiry to address. Nevertheless, a carefully orchestrated network of researchers and developers might help move the initiative forward better than even concentrated individual efforts might achieve. In Canada, working in collaboration with groups like the Learning Innovations Forum (LIFIA), we might create the Canadian Network for Research on E-portfolio (CANREP). If so, how do we create and maintain a research network creation and membership base? What are appropriate structures, roles, responsibilities, mandates, priorities, reporting, vision, etc. of such a network? How and who will funding come from? Who will take the lead on writing funding proposals? How do we establish research priority areas?

### ***Conclusion***

This paper explored the research and development issues surrounding EPs and introduced this special issue of the *Canadian Journal of Learning and Technology*. It helped to organize what we know and what we need to know about EPs from technical, administrative, pedagogical, governmental, and other perspectives. It explained: a) the types and characteristics of EPs; b) the outcomes and processes that EPs support; c) the contexts in which EPs are most effective and worthwhile; d) EP users/viewers and how we provide appropriate professional development; e) technical and administrative issues; f) evidence of EP success; and g) funding and infrastructure possibilities. Further research and development promise to enhance what we know about EPs and provide educators with a powerful and flexible tool for active teaching and learning.

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### **Endnotes**

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