DIGIPOE: AN OPEN STANDARD AND REFERENCE IMPLEMENTATION FOR DIGITAL PORTFOLIOS

Eleni Georgiou, Athena Stassopoulou and Marios Dikaiakos

ABSTRACT
In this paper we present the design and implementation of a software system aiming at helping educators in the process of appraisal for self-improvement and self-evaluation. The system is a "Digital Portfolio Environment" (DigiPoE) that allows the user to construct a comprehensive view of his/her work and enable the insertion and maintenance of multimedia content and artifacts into the portfolio (audio, video, graphics, text etc). The digital portfolio offers an innovative method of assessment/self-evaluation to educators since it enables them to maintain and provide a much richer presentation of their work. Based on an analysis of requirements, we designed DigiPoE to include nine categories of information that are important to the users of the system. A user/educator can change, add or delete information and artifacts in these nine categories and publish the digital portfolio (in its entirety or parts of it) on various media, such as compact disks, floppy disks or over the Internet. The user has the option to choose parts of the portfolio (if any) that are to remain private, i.e. not published, when the final user portfolio is presented. DigiPoE organizes the content of the digital portfolio as a hierarchical structure of nodes, which is encoded as an XML grammar. This hierarchical structure is essentially an index to the content of the digital portfolio and its collection of artifacts. The choice of XML provides numerous advantages. There is already a variety of free, Java-based software that can be used to parse XML grammars. Given the platform-independent design of Java, the choice of XML enables the easy retargeting of the DiPoE user-interface module to different computing platforms; this interaction takes place through the widely known interface paradigm of the WWW browser. The two technologies, XML and JAVA, used together provide a solution that is both extensible and platform free.

KEYWORDS
Digital Portfolio, self-evaluation, assessment of educators, XML grammar, JAVA.

INTRODUCTION

Teacher Portfolios are organized collections of information describing the major strengths and teaching achievements of educators. A teacher portfolio contains, organizes, and presents documents and artifacts related to the teacher's educational activities. For example, a portfolio may contain collections of student-work over time, thus capturing and presenting student progress more accurately than the typical testing and grading procedures used in schools. Hence, a teacher portfolio can be used as evidence for the scope and quality of an educator's teaching proficiency. The information structure of portfolios should enhance the observation of professional advancements achieved by teachers throughout their carriers. Moreover, portfolios should empower teachers to reflect upon the teaching and learning process [5]. The adoption of teacher portfolios and portfolio assessment by educational systems can support performance-

based education. Consequently, it will encourage school communities to engage in a recursive process of self-reflection, self-critique, self-correction, and self-renewal [2].

In recent years, with the advent of Internet as a global infrastructure for communication and information exchange, the production, dissemination and archiving of information in digital form has being widely adopted by the research and scientific communities, media companies and publishing houses, libraries and educational organizations [4]. This trend dictates the employment of Information and Communication Technologies (ICT) for the organization, storage, and publishing of teacher portfolios in digital format. Storing portfolio information in digital format can improve considerably the benefits of portfolio-adoption by educators and educational systems alike, for a variety of reasons:

- "Digital" portfolios can store "traditional" portfolio material following digitization; storing content in digital format reduces the cost of storage and maintenance, and enables the easier and cheaper processing and distribution of information.
- Besides "traditional" content, i.e., text and drawings, digital portfolios can include multi-media presentations, such as, video or audio recordings from classrooms, sound or video interviews with students or parents, digital photos of bulletin boards, student projects, etc.
- With the wider adoption of computer technologies by schools and pupils, an increasing part of teacher and student work is created in digital form and can be easily put into digital storage.

The adoption of computer technologies and the use of digitized media for storing portfolio-related information, however, raise new challenges:

- Many digital formats are proprietary and can be accessed only through specific, costly systems.
- Digital formats and storage media technologies evolve fast, superseding older formats and media that go out of the market; this trend renders numerous digital archives obsolete and the information stored within them unreachable.
- Transforming old digital archives into modern formats and storing them into modern digital media is an error-prone and expensive process.
- Dealing with the digitization process or coping with the difficulties of modern computer technology can often be a challenging experience, especially for people that are not computer literate or lack the time and the resources to put information into digital format and organize it.
- Going through volumes of information in digital format not properly organized, can be very difficult, and results to known problems, such as *information overloading* and *network disorientation* [7].

Furthermore, the adoption of Digital Portfolios must avoid two risks:

1. Adopting the view that a Digital Portfolio is a mere collection of material contained in traditional teacher portfolios, ported into digital media. Such an approach would limit the scope and functionality of Digital Portfolios by failing to grasp the full capacity provided by ICT. On the other hand, the full adoption of Information and Communication Technologies for organizing, maintaining, reviewing and distributing teacher portfolios can support a major change in the appraisal and evaluation of educational activities, in the context of educational systems in the Information Society.
2. On the other hand, the hype created by innovative ICT should not become the driving force for designing and adopting teacher-portfolio tools and environments. Digital

> portfolios not linked to actual benchmarks that educators are supposed to be demonstrating, not focusing on teacher progress and achievement, typically deviate from the original goal and focus of teachers' portfolios and become mere multimedia presentations of little use. It should be noted that high technology disconnected from a focus on curriculum standards will only exacerbate the lack of meaningful integration of technology into teaching and learning.

In this paper, we report work conducted in the context of the APSIFAE research project, which sought to study the development and deployment of digital portfolios in the educational system of Cyprus. In particular, we seek to address the issues mentioned above by proposing a view of Digital Portfolios as flexible, extensible, and user-friendly software environments that enable educators to collect, organize, store, publish and disseminate portfolio-related content under an *open, extensible standard* describing the structure and semantics of collected information. It is our conjecture that such environments should be "minimalist," in the sense that they should not incorporate software components for media-format interpretation and presentation. Instead, they should have an *open architecture*, enabling the interpretation and presentation of stored media-formats via popular, external software, such as the Acrobat Reader by Adobe (for pdf format), the MediaPlayer by Microsfot (for audio and video), etc. Access to the structure and interactive functionality of the Digital Portfolio and to its contents should be provided via ubiquitous, platform-independent interfaces with wide acceptance, such as the various browsers of the World-Wide Web (Internet Explorer by Microsoft, Mozilla, Opera, etc.).

With these remarks in mind, we define *Digital Portfolio as a hypermedia presentation of information (documents and various artifacts) related to the educational activities of teachers, organized according to an open standard describing the organization and semantics of its contents.* A Digital Portfolio is created with the help of a Digital Portfolio Environment, an open software system providing a reference-implementation of basic portfolio functionalities for inserting, updating and annotating digital content, storing it in digital format and publishing it in standalone (CDROM) or networked media (Internet), according to the portfolio standard.

The contribution of this paper is an open standard, expressed in XML that describes the structure and semantics of a digital portfolio. Also, a reference-implementation of a Digital Portfolio Environment (DigiPoE) complying with this standard and enabling a user to:

- Construct a comprehensive view of his/her work.
- Insert and maintain multimedia content and artifacts into the portfolio (audio, video, graphics, text etc).
- Publish the portfolio or parts thereof in digital media, such as CD-ROMS or hard disks.

Access to the environment and the portfolio is provided through a widely used interface, that of Web browsers. DigiPoE offers an innovative method of assessment/self-evaluation to educators as it provides them with a simple tool for organizing a much richer presentation of their work, based on an open standard. It should be noted that the employment of XML and the open philosophy of DigiPoE make very easy the porting of the whole platform on Internet.

The rest of the paper is organized as follows: Section 2 presents the proposed structure and meta-data of Digital Portfolios according to the DigiPoE standard. Section 3 describes shortly the implementation of the DigiPoE and its user interface. Section 4 summarizes our conclusions.

STANDARDIZING THE DIGITAL PORTFOLIO

We consider as an essential part of the Digital Portfolio, a *standard* that describe the portfolio's structure, contents and organization. The standard is *a common and open agreement* about what information can be placed within a portfolio. The adoption of a common, open standard and the production of teacher portfolios according to this standard will enable the collective processing of published teachers' digital portfolios, the exchange of portfolios between different computer systems, etc. Hence, the educational system will be provided with a powerful tool for the evaluation of educators, the assessment and further development of educational policies.

In the context of the APSIFAE project, members of the research group produced questionnaires seeking to capture the views and requirements of educators about digital portfolios. A number of teachers were invited to complete a questionnaire and indicate what items they would include in their portfolios. Furthermore, they were asked to report their reflections about what they see as evidence of professional growth. The APSIFAE team analyzed the questionnaires. The technical team discussed results of this analysis in order to guide the design of the DigiPoE standard and software environment.

Contents of teacher portfolios

A core set of items are included in most teacher portfolios [1,3,8,11], and fall into the following categories:

- Evidence from oneself: This category presents all selected information on teaching responsibilities and activities along with solid evidence of their effectiveness, as well as any further information about the personality of the teacher, inside and outside the school. This information can be categorized as follows:
  - *Documents derived directly from teaching*:
    - A reflective statement by the teacher, describing his/her personal teaching philosophy, strategies, objectives, and methodologies.
    - Copies of lesson or unit plans.
    - Handouts given to students.
    - Assignments.
    - Photographs, videotapes, or audiotapes of classroom activities.
    - Instructional innovations and assessment of their effectiveness.
    - Worksheets, lesson plans and examples of long-term planning.
    - Document of the educational skills of teachers.
  - *Documents that can be used by the teacher for self-reflection and self-assessment at a later stage:*
    - Teacher journals.
    - Detailed descriptions of analyses of lessons.
    - Reflection on the outcomes of teaching activities.
    - A videotape of the teacher teaching a typical class.
    - Video and audio recordings of lessons.
    - Self-evaluation of teaching-related activities.
    - Reflections on the contents of the portfolio that describe what each entry represents and why it is included, what the teacher learned from the experience about teaching and learning, and why that is important (personal meaning of learning).
    - A structured description of the above items put into a common context and seeking to present a coherent view of a teacher's own work.
  - *Documents about the teacher's educational approach and skills:*
    - Evidence regarding the subject matter of a teacher.

  - Participation in training programs, seminars, etc.
  - Participation in out-of-school activities.
  - Copies of certificates acquired by a teacher from her participation to training activities, pre- and in-service.
- Evidence from others: A common finding that emerged from the requirements analysis phase is the emphasis on documents describing the evaluations of others. Teachers assemble a body of evidence to demonstrate what other people have to say about their teaching competence across different areas, such as:
  - Tests and samples of student work (with or without teacher feedback).
  - Feedback from others such as parents, students and colleagues.
  - References from peers.
  - Evidence of collaborative work with peers.
  - Official reports from inspectors and letters of recommendations.
  - Comments by a teaching observer, peer or administrator recommendations, student evaluations.

Digital portfolios as an XML standard

Taking into consideration the portfolio contents described above, and based on evidence provided from the analysis of questionnaires and an in-depth analysis of the requirements, we were able to identify different "chapters" that must be included in a digital portfolio. Each of these chapters contains information (text, links to artifacts) that is organized in different ways:

- Personal: This category includes personal information of educators, such as communication information, personal photo, some comments or thoughts in general.
- Curriculum Vitae: The teacher can complete his/her CV, according to the European format. The teacher can also add reports from inspectors and letters of recommendations and copies of certificates acquired by a teacher from his/her participation to training activities, pre- and in-service.
- Journal: This a professional journal about what the teacher learned from teaching and learning.
- Teaching Philosophy: This category includes a reflective statement by the teacher, describing his/her personal teaching philosophy, strategies, objectives, and methodologies.
- Lessons: This section includes copies of lesson or unit plans, handouts given to students, assignments, worksheets, multimedia material recordings from teaching a typical class.
- Feedback: This category includes feedback and comments by a teaching observer, peer or administrator, recommendations and student evaluations.
- Student work: In student work section, the teacher can add tests and samples of student work.
- Activities: Information and multimedia material from participation in out-of-school or in school activities is included here.
- School Problems: The teacher can add all the problems she/he encountered during the years of teaching, and how all those problems were solved.

To describe these chapters we adopt XML, the eXtensible Markup Language (W3C-XML) [9, 10]. XML is a standard adopted by World-Wide Web Consortium to complement the HyperText Markup Language (HTML) for data exchange over the Internet. In contrast to HTML, which focuses on the presentation of digital content via Web browsers, XML focuses on the description of content-structure. XML does not rely on a restricted set of "markup tags"

but allows the definition of new grammars and tags. Each XML document can contain an optional description of its grammar or a pointer to such a description, encoded as a DTD (Document Type Definition) file. An alternative way of specifying XML grammars is via the XML Schema (W3C-XML-Schema). Using XML we can describe structured data in a human and machine-readable manner. XML provides a number of advantages: (i) It is an open standard for describing structured data; XML-encoded data can easily be ported across different computing platforms and are easily publishable on the World-Wide Web; (ii) An XML grammar, such as the one proposed by DigiPoE, can easily be extended to cope with new requirements without, however, cancelling the validity of digital portfolios developed according to earlier versions of the grammar; (iii) There is already a variety of free, Java-based software that can be used to parse XML grammars. The real power of XML comes from the fact that with XML one can define his own set of tags describing different types of rules and relationships: e.g., business rules, data types, data relationships. Furthermore, it is very easy to incorporate within an XML definition other, existing XML definitions. Because of its advantages, XML is widely used to standardize digital content and content-exchange on Internet. The nine chapters of the portfolio were described in the system by the data type definition presented in the following two tables:

```
<?xml version="1.0" encoding="UTF-8"?>

<!ELEMENT digipoe (personal, lessoninfo, activitiesinfo, studentworkinfo, cv, feedbackinfo, journalinfo,
teachingphilosophy, schoolproblems)>

<!ELEMENT personal (nameinfo, phone, fax, email, personaltext, address, personallinks, ophoto)>

<!ELEMENT nameinfo EMPTY>
<!ATTLIST nameinfo
    fname CDATA #REQUIRED
    lname CDATA #REQUIRED
    title CDATA #REQUIRED>
<!ELEMENT phone EMPTY>
<!ATTLIST phone
 phonenumber CDATA #REQUIRED
 mode CDATA #REQUIRED>
<!ELEMENT fax EMPTY>
<!ATTLIST fax
   faxnumber CDATA #REQUIRED
   mode CDATA #REQUIRED>
<!ELEMENT email EMPTY>
<!ATTLIST email
  eaddress CDATA #REQUIRED
  mode CDATA #REQUIRED>
<!ELEMENT personaltext EMPTY>
<!ATTLIST personaltext
 context CDATA #REQUIRED
 mode CDATA #REQUIRED>
<!ELEMENT address EMPTY>
<!ATTLIST address
   mode CDATA #REQUIRED
   street CDATA #REQUIRED
   code CDATA #REQUIRED
   city CDATA #REQUIRED
   country CDATA #REQUIRED
   institution CDATA #REQUIRED
   department CDATA #REQUIRED>
<!ELEMENT personallinks EMPTY>
<!ATTLIST personallinks
   path CDATA #REQUIRED
   path1 CDATA #REQUIRED
   descr1 CDATA #REQUIRED
   path2 CDATA #REQUIRED
   descr2 CDATA #REQUIRED>
<!ELEMENT ophoto EMPTY>
<!ATTLIST ophoto
    description CDATA #REQUIRED
    path CDATA #REQUIRED>
```

Table 1: The XML Grammar of DigiPoE. Description of elements capturing personal information

```
<!ELEMENT cv (personalinfo, workexperience, educationinfo, skillinfo, referenceinfo)>
<!ELEMENT personalinfo EMPTY>
<!ATTLIST personalinfo
    title CDATA #REQUIRED
    fname CDATA #REQUIRED
    lname CDATA #REQUIRED
    address CDATA #REQUIRED
    city CDATA #REQUIRED
    zipcode CDATA #REQUIRED
    country CDATA #REQUIRED
    phone1 CDATA #REQUIRED
    phone2 CDATA #REQUIRED
    phone3 CDATA #REQUIRED
    fax CDATA #REQUIRED
    email CDATA #REQUIRED
    nationality CDATA #REQUIRED
    bdate CDATA #REQUIRED
    flang CDATA #REQUIRED
    olang CDATA #REQUIRED>
<!ELEMENT workexperience (work)>
<!ELEMENT work EMPTY>
<!ATTLIST work
    fdate CDATA #REQUIRED
    sdate CDATA #REQUIRED
    companyname CDATA #REQUIRED
    companyloc CDATA #REQUIRED
    companytype CDATA #REQUIRED
    jobtitle CDATA #REQUIRED
    responsibilities CDATA #REQUIRED>
<!ELEMENT educationinfo (education)>
<!ELEMENT education EMPTY>
<!ATTLIST education
    fdate CDATA #REQUIRED
    sdate CDATA #REQUIRED
    ename CDATA #REQUIRED
    etype CDATA #REQUIRED
    subjects CDATA #REQUIRED
    title CDATA #REQUIRED
    orgname CDATA #REQUIRED
    elocation CDATA #REQUIRED>
<!ELEMENT skillinfo EMPTY>
<!ATTLIST skillinfo
    skills CDATA #REQUIRED>
<!ELEMENT referenceinfo EMPTY>
<!ATTLIST referenceinfo
    references CDATA #REQUIRED>
```

Table 2: The XML Grammar used by DigiPoE to describe the CV of a teacher (follows European Union's standardized description of CV's in XML).

```
<!ELEMENT lessoninfo (lesson)>
<!ELEMENT lesson (lessonlink)>
<!ATTLIST lesson
    sdate CDATA #REQUIRED
    fdate CDATA #REQUIRED
    mode CDATA #REQUIRED
    title CDATA #REQUIRED
    context CDATA #REQUIRED>
<!ELEMENT lessonlink EMPTY>
<!ATTLIST lessonlink
    path CDATA #REQUIRED
    type CDATA #REQUIRED
    date CDATA #REQUIRED
    title CDATA #REQUIRED
    description CDATA #REQUIRED
    mode CDATA #REQUIRED>
<!ELEMENT teachingphilosophy EMPTY>
<!ATTLIST teachingphilosophy
    philosophytext CDATA #REQUIRED>
<!ELEMENT activitiesinfo (activity)>
<!ELEMENT activity (activitylinks)>
<!ATTLIST activity
    date CDATA #REQUIRED
    from CDATA #REQUIRED
    score CDATA #REQUIRED
    title CDATA #REQUIRED
    context CDATA #REQUIRED
    mode CDATA #REQUIRED>
<!ELEMENT activitylinks EMPTY>
<!ATTLIST activitylinks
    path CDATA #REQUIRED
    ispic CDATA #REQUIRED
    title CDATA #REQUIRED>
<!ELEMENT journalinfo (journal)>
<!ELEMENT journal EMPTY>
<!ATTLIST journal
    date CDATA #REQUIRED
    title CDATA #REQUIRED
    context CDATA #REQUIRED
    mode CDATA #REQUIRED>
```

Table 3: The XML Grammar of DigiPoE. Description of elements capturing information about lessons, activities, reflections of the teacher on his teaching philosophy and daily work.

```
<!ELEMENT studentworkinfo (student)>
<!ELEMENT student (studlink)>
<!ATTLIST student
    context CDATA #REQUIRED
    date CDATA #REQUIRED
    score CDATA #REQUIRED
    from CDATA #REQUIRED
    title CDATA #REQUIRED
    mode CDATA #REQUIRED>
<!ELEMENT problemlink EMPTY>
<!ATTLIST problemlink
    path CDATA #REQUIRED
    ispic CDATA #REQUIRED
    title CDATA #REQUIRED>
<!ELEMENT feedbackinfo (feedback)>
<!ELEMENT feedback EMPTY>
```

<!ELEMENT studlink EMPTY>	<!ATTLIST feedback
<!ATTLIST studlink	date CDATA #REQUIRED
path CDATA #REQUIRED	score CDATA #REQUIRED
ispic CDATA #REQUIRED	from CDATA #REQUIRED
title CDATA #REQUIRED>	title CDATA #REQUIRED
<!ELEMENT schoolproblems (problem)>	context CDATA #REQUIRED
	mode CDATA #REQUIRED>

Table 4: The XML Grammar of DigiPoE. Description of elements capturing excerpts of student work, reflections on school problems and evidence of feedback received by the teacher.

Figure 1 presents an excerpt from the contents of a Digital Portfolio organized according to the DigiPoE grammar.

SYSTEM IMPLEMENTATION

XML and JAVA

The "Digital Portfolio Environment" (DigiPoE) application is XML-based. Therefore, it can read and process XML documents, apply its logic on retrieved information, update an XML database with new information and/or documents, and generate dynamic HTML output. The basic functionality of DIGIPOE consists of the following three phases, which are typical in software systems designed to process XML data:

- *XML input processing*: Parsing and validating the source document; Recognizing/searching for relevant information based on its location or tagging in the source document; extracting the relevant information once it has been located; optionally, mapping/binding the retrieved information to business objects.
- *Business logic handling***:** The actual processing of the input information, possibly resulting to the creation of output information.
- *XML output processing***:** Constructing a model of the output document to be generated; walk through the model and generate the output file.

There are two basic approaches in XML data-processing; DOM (Document Object Model) and SAX *(*Simple API for XML). Both approaches are supported by freeware parsers written in JAVA. DigiPoE is based on a DOM JAVA parser.

According to DOM, the XML input processing is done in at least two cycles: first, the DOM parser reads in an XML file and creates a tree-like data structure that models the XML source document (DOM tree). Then, the DIGIPOE code “walks through” the DOM tree, searching for relevant information to extract data, perform updates, etc.

This last cycle can be repeated as many times as necessary since the DOM tree persists in memory. The "Digital Portfolio Environment" (DigiPoE) application applies its logic directly to the DOM tree. Calls to the DOM libraries of the XML parser employed by DigiPoE are made from within a set of *JAVA Servlets*, i.e. JAVA classes which conform to the Java servlet API [6]. Servlets can be executed on demand by a standard Web server equipped with a Servlet-Engine module. The idea behind the Servlet is to produce web content which is generated on request, rather than statically from an HTML file.

```
<?xml version="1.0" encoding="iso-8859-7"?>
<apsifae>
<lessoninfo>
        <lesson sdate="" fdate="" mode="" title="" context="">
                <lessonlink path="" type="" date="" title="" description="" mode=""/>
        </lesson>
</lessoninfo>
<activitiesinfo>
        <activity date="" from="" score="" title="" context="" mode="">
                <activitylinks path="" ispic="" title=""/>
        </activity>
</activitiesinfo>
<personal>
        <nameinfo fname="" lname="" title=""/>
        <phone phonenumber="" mode=""/>
        <fax faxnumber="" mode=""/>
        <email eaddress="" mode=""/>
        <personaltext context="" mode=""/>
        <address mode="" street="" code="" city="" country="" institution="" department=""/>
        <personallinks path="" path1="" descr1="" path2="" descr2=""/>
        <ophoto description="" path=""/>
</personal>
<studentworkinfo>
        <student context="" date="" score="" from="" title="" mode="">
                <studlink path="" ispic="" title=""/>
        </student>
</studentworkinfo>
<cv>
        <personalinfo title="" fname="" lname="" address="" city="" zipcode="" country="" phone1="" phone2=
        <workexperience>
                <work fdate="" sdate="" companyname="" companyloc="" companytype="" jobtitle="" responsibil

        </workexperience>
        <educationinfo>
                <education fdate="" sdate="" ename="" etype="" subjects="" title="" orgname="" elocation=""
        </educationinfo>
        <skillinfo skills=""/>
        <referenceinfo references=""/>
</cv>
<feedbackinfo> <feedback date="" score="" from="" title="" context="" mode=""/></feedbackinfo>
<journalinfo>
        <journal date="" title="" context="" mode=""/> </journalinfo>
<teachingphilosophy philosophytext=""/>
<schoolproblems>
        <problem context="" date="" title="" mode="">
                <problemlink path="" ispic="" title=""/>
        </problem>
</schoolproblems>
</apsifae>
```

Figure 1: Excerpt from an example Digital Portfolio following the DigiPoE grammar.

A quick tour of the user interface

Upon start-up, a user is presented with the index page, where she/he is prompt to enter the path of the folder in which all portfolio elements will be saved. The user may choose “Create New” to create a new portfolio, or “Change Old” to update un old version of a portfolio. After the selection, click “Go on” to continue.

The overall structure of the application is relatively simple, as shown in Figure 3. There are nine primary elements in the site; each one of them may be accessed directly from the main page. The structure is further broken down in the Figure 2.

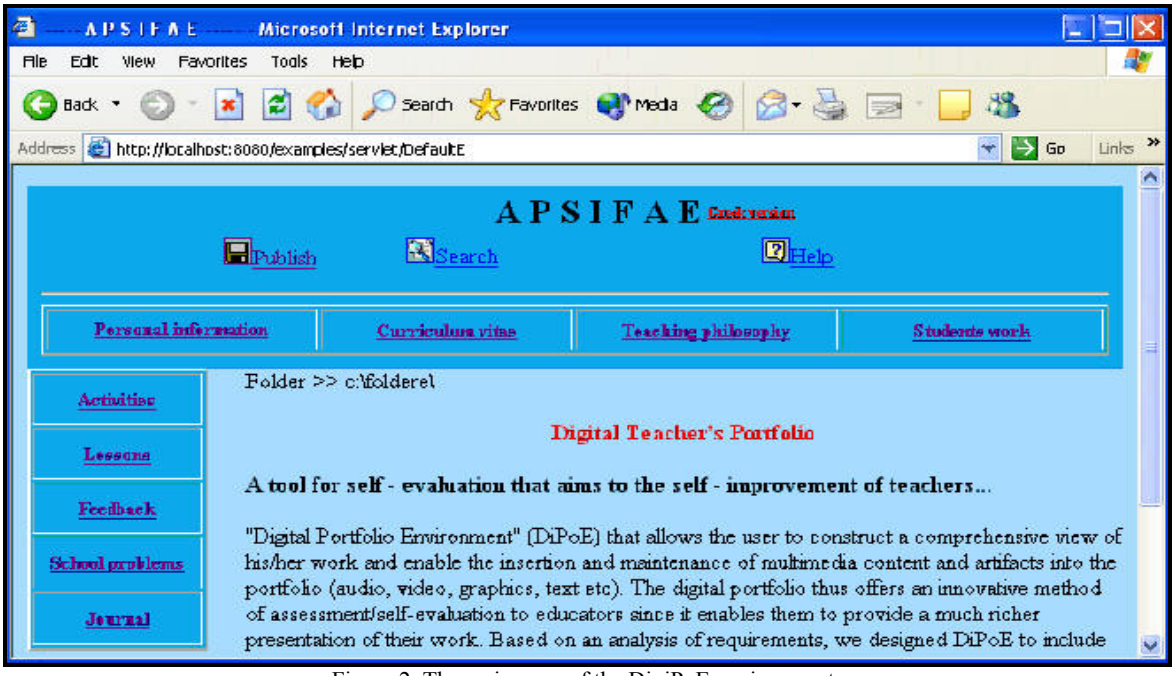

Figure 2. The main page of the DigiPoE environment.

Within the pages, primary navigation is provided on top and on the left of the screen, in a horizontal and vertical list of links. As mentioned earlier, based on an analysis of requirements, DigiPoE was designed to include nine categories of information: personal information, curriculum vitae information, teaching philosophy, journal (professional diary), feedback, activities, school problems, student work and lessons. The user can change, add or delete information and artifacts in these nine categories and publish the digital portfolio (in its entirety or parts of it) on various media such as compact disks, floppy disks or over the Internet depending on the user needs and the portfolio size. The user has the option to choose parts of the portfolio (if any) that are to remain private, i.e. not published, when the final user portfolio is presented.

Pages are displayed in a single browser window, with the exception of individual material links, which are shown in a pop-up. The pop-up contains no browser controls. Links are provided to Close and Print. Following any of the nine text links, the user can add change or delete information.

CONCLUSIONS

In this paper we presented the design and implementation of DigiPoE, the *Digital Portfolio Environment*. DigiPoE is based on an XML grammar describing the structure, contents and meta-data accompanying Digital Portfolios. The choice of XML and the employment of JAVA facilitate the portability and extensibility of the Portfolio. Furthermore, they enable the easy installation of DigiPoE on Internet. The wide adoption of the DigiPoE XML grammar as a standard for the organization, description and publication of digital portfolios opens many opportunities for enhancing the self-assessment and evaluation of educators. Furthermore, it enables the transformation of digital portfolios into a powerful tool for supporting the development and assessment of educational policy at a regional, national or international scale.

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Deleted:

Eleni Georgiou,
Dept. of Computer Science,
University of Cyprus, Nicosia, Cyprus

Athena Stassopoulou,
Dept. of Computer Science,
Intercollege, Nicosia, Cyprus

Marios Dikaiakos,
Dept. of Computer Science,
University of Cyprus, PO Box 20537,
1678 Nicosia, Cyprus
Email: ***mdd@ucy.ac.cy***