

EVA_pm: How XML can Scaffold Project-Based Learning¹

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Abstract:

This article presents EVA_pm, a scaffolding environment for students' projects. It's a constructivist environment that aims to scaffold Project-Based Learning (PBL) strategies (from the management of the students assignments up to the writing of their final report), to improve their effectiveness and serve as a reflection tool to help students develop meta-cognitive skills. EVA_pm leverages XML (eXtended Markup Language) and suggests a vocabulary (DTD) that describes students' projects (assessments, theses, etc.) as a prompting tool. The vocabulary is well accompanied with an online toolset ("commNcontrol" and "Virtual Book") to scaffold communication, visualization, peering, and progress tracking.

Keywords: Project-Based Learning (PBL), Scaffolding, XML, Reflection, Cognitive tools

Introduction

Project-Based Learning (PBL) is a teaching strategy that organizes learning around projects. By projects we mean complex tasks based on challenging questions or problems, that involve students in design, problem-solving, decision making or investigating activities that give them the opportunity to work autonomously and culminate in realistic results. Even though PBL is considered to be a profitable learning strategy, its implementation faces several challenges.

Students have difficulty to:

- ***Initiate inquiry;*** come up with coherent research questions, define main and sub-goals
- ***Define a research project;*** come up with a good research design and appropriate methodology
- ***Direct investigations;*** need guidance locating the required resources
- ***Manage time;*** fail to keep deadlines, underestimate time needed to do a task
- ***Collaborate and give feedback;*** difficulty in articulating their work with others and they don't give regular feedback of their work

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- ***Follow-up the project;*** rarely revise their products, thing that requires critical thinking skills and cognitive self-awareness [3].

Many researchers believe that PBL is a beneficial learning strategy and have worked out several methods to support it and improve it, but most of them were focusing on a specific problem and tried to remedy it. EVA_pm is a method and an environment that tries to enforce PBL and overcome several of its weak aspects. All the interventions to support PBL have been referred to as “scaffolding” [1] or “procedural facilitation” [2].

Why XML?

XML (eXtensible Markup Language) is a language for documents containing structured information, which means that is a mechanism to identify these structures. Apart from the technical advantages of XML (the most important by being the accepted format for exchanging data on the web), this study is based mostly on the conceptual advantages of it.

Among the most important is that XML adds semantics to the data (making them self explaining), one can create vocabularies according to it's needs and finally, XML separates data from their presentation and process.

This study uses structured text (XML) as a cognitive tool. To scaffold students to get a project done and reflect on their work, and to facilitate the tutor's role.

EVA_pm's components

The most important components that form EVA_pm (XML infoset) are :

EVA_pm ML; an XML grammar (currently implemented as a DTD that will soon be transformed into XML Schema) for project management that is used as cognitive tool to scaffold students during the projects

commNcontrol; a web portal that provides several tools to support the whole method and the grammars like awareness tools, versioning system, file transfer tools, discussion tools and tutor evaluation tools

Virtual Book; the web portal that joins the results of the projects (papers) and plays the role of the socio-constructivistic “product” element by giving the chance to the students to expose the common result of their work

EVA_paper ML; an XML grammar (also a DTD) for the paper that describes the results of the project and also serves as cognitive tool.

More precisely, students have to edit an xml file in several phases, that describes the project (specification and management) and which can be uploaded and shared online through a versioning system with the other members of a group. Viewing and interactions can be done through the “commNcontrol” where students and tutors can log on. The project culminates with students writing a paper that describes the product (again by editing an xml file) and a “Virtual Book” is being created with all the papers produced.

Implementation

The method that has been used for the implementation is close to participatory design and specifically to cooperative prototyping. This approach reduces the risk of not meeting the needs of users. So, EVA_pm has been designed following iterative cycles of user involvement.

From XML technologies the DTD and XSLT+FO have been used. Java servlets technology and Xerces Java parser (SAX and DOM API) from Apache Project was used for scripting and parsing the XML files.

Testing and Evaluation of EVA_pm

EVA_pm is the result of three years work on this project, and has always been tested with the students of STAF diploma at TECFA, University of Geneva for the course on “Teaching and learning in Virtual Space”. The most complete study has been done with staf-2001 students (12 students = 9 men and 3 women). There were 8 projects from which 4 from pairs and 4 from individuals. Project management has been organised around several phases. There are two things that have been evaluated, the learning environment and the students learning on research design.

For the *learning environment* whether it is useful or not and how ergonomic is. In conclusion, we could say that the grammars are mature and the toolset quite powerful. The interface though could be improved concerning the ergonomics and more features could be added to improve interaction.

For the *students learning*, and after using multiple sources of information (a case study, monitoring and evaluation of the projects, interview the tutor), we could say that students have acquired some basic knowledge of research design and that EVA_pm should be used more times to get to know more.

In general, lack of powerful XML editors poses some problems for the moment and grammars need more documentation and special training.

Results

Concerning students, the results of this research show *strong evidence* that EVA_pm could help students to initiate and develop scientific inquiry. There is *some evidence* that it scaffolds students to direct the investigations needed when running a project. There is *strong evidence* that EVA_pm helps students to better manage the time and respect the given deadlines. There is *strong evidence* that EVA_pm ML helps students avoid having or overcome writer’s block. There is *evidence* that students using EVA_pm acquire at least *some basic knowledge* on project design and research skills. There is *strong evidence* that EVA_pm environment improves team management and to some extent also collaboration (especially it’s versioning system). To *some extent*, EVA_pm makes students reflect on their work.

As for the tutors, there is *strong evidence* that EVA_pm scaffolds their role and facilitates monitoring and evaluation. There is *some evidence* that through EVA_pm the tutors could verify whether knowledge has been acquired, but not to a satisfactory level.

Generally speaking, there is **strong evidence** that using EVA_pm motivates the peers and **undoubtedly** distributes to big audiences the projects. Of course, all the above are happening only and with the precious contribution of the tutor(s).

An important disadvantage of the method, for the time being, seems to be the edition of XML which hopefully will change very soon. It has to be noted also that special training for the grammars has to be made in order to use them. In addition, there are several things that could be improved concerning the grammar (make possible to adapt the grammar to the level of the students and the needs of the project), improve the usability of EVA's interface and why not add new features for the interaction between tutors and students.

Conclusions

The initial goal of this research was to develop a Scaffolding Learning Environment that would improve PBL efficiency and help to overcome the most common pitfalls. To reach this goal Markup Languages (XML grammars) were conceived to describe the student's projects and their final results and an online environment was implemented with several tools to facilitate some tasks.

Based on the above findings, EVA_pm has a lot of potential in it. Significant issues and challenges remain, but we believe that it demonstrates a successful approach and we are glad that we gave it a chance.

References

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URL

Access to EVA's commNcontrol (through guest account):

<http://tecfa.unige.ch/tecfa/teaching/staf18/files-g/commNcontrol.html>