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ON THE CREATION OF SUSTAINABLE DESIGN PATTERNS OF ICT INTEGRATION IN THE CLASSROOM

Research in progress

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Abstract

The paper focuses on the methodology of making observations that account for the actual use of ICT infrastructure and tools in the classroom. The observational study is part of a project that focuses on scenario feasibility as an enabler of ICT usage. In particular, the observations provide input on pattern mining with the aim to help teachers and other stakeholders in the decision-making process of selecting suitable ICT facilities.

Keywords: design patterns, learning scenario feasibility, classroom observations, technology decision making in education

1. Introduction

This paper addresses the issue of facilitating the decision-making process of teachers and other schools' stakeholders regarding the selection and judicious use of ICT tools for everyday classroom practices. The goals is to help teachers a) design their lessons from the viewpoint of allocation of the necessary ICT facilities while matching the available resources with the intended learning designs, and b) evaluate the feasibility of carrying out particular types of learning activities given the available school ICT facilities. The supporting decision-making functionalities will constitute one of the main contributions of the eSIT4SIP (Empowering the School IT infrastructures for the implementation of Sustainable Instructional Patterns) European project. In addition, the eSIT4SIP project will equip teachers with a large number of design patterns and scenarios on how to foster innovative teaching approaches in a technology-infused learning environment effectively. The design patterns will encapsulate a compact set of guidelines concerning classroom usage for several types of applications, address a wide range of situations, and bridge the gap between the technological (what is feasible?) and the pedagogical aspects (what is intended?) of learning scenarios. The project partners in the participating countries have engaged schools in order to help inform the design of the digital tools to be created as well as provide valuable information regarding teaching practices that will lead to the elicitation of patterns. In fact, the elicitation of patterns is dependent on the following data collection methods: a) interviews aimed at understanding what current ICT practices are followed by each participating school, b) school visits with classroom observations focusing on the technology integration aspect and c) the existing literature (Figure 1).

The eSIT4SIP project also aims at facilitating the cooperation among schools from different European countries with a view of establishing exchanges of best practices regarding the use of ICT for learning and related decision making processes. The duration of the project is three years (2016 – 2019) and each participating country (Cyprus, Sweden and Germany) will engage several schools; in particular,

five active schools per country with a small group of participating teachers and students per school. Initially, the ICT infrastructure as well as the e-maturity of the participating schools and the practices regarding the ICT infrastructure at these schools are analysed (Müller & Libbrecht, 2015).

This paper focuses on the methodological approach we set and the rationale behind it. The approach assumes the need to use distinct methods to obtain complementary information and triangulate findings that, in turn, will facilitate the uncovering of patterns. Observational studies in the classrooms can help us identify issues that teachers might not be aware of or are just not able to immediately report when interviewed regarding the way the ICT infrastructure and tools are actually being used. In fact, experts on a certain domain are often unaware of particular aspects/details of their own activities. Their experience enabled them to chunk and automate particular procedures involved in the tasks that form the overall activity. However, these same details, overlooked by experts, are frequently of importance to novices, especially when dealing with activities' breakdowns. We believe such meaningful web of information together with the tools supporting decision making will encourage teachers to explore new practices and contribute to the system enriching it and widening the scope.

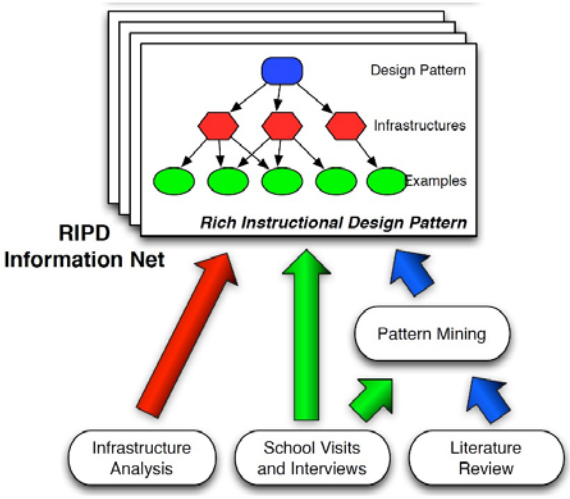

Figure 1 The RIPD process of the eSIT4SIP project

1 Describing educational activities and practices

Pozzi & Earp (2006) mention that a scenario is "a sequence of phases within which students have tasks to do and specific roles to play" (p. 281). It defines the activities performed by students and tutors, their sequencing, as well as, the learning objects and tools that are provided to the different actors. A scenario that integrates ICT involves the application of effective teaching strategies with the aim of achieving learning objectives through the use of an appropriate computerized environment. Defining design patterns is challenging, since it is tempting to think of them as a catalogue of templates or metaphors. Besides that, there are several challenges mentioned in the literature that revolve around their creation, their usage and their evaluation, including: lack in educational theory or epistemology (Childs et al, 2016), not being used by educators and too abstract as they describe problems in a very broad way (Bescherer & Spannagel, 2009), as well as, achieving a striking balance between abstraction and complexity (Voigt & Swatman, 2006), and fit-for-purpose granularity.

A number of projects are focused on the mining of best practices in learning design and teaching in terms of didactical design patterns. This is an approach to documenting solutions to a design problem in a particular field of expertise in a semi-formal way, first introduced by the architect Christopher Alexander in 1977. Examples of such projects are the Pedagogical Patterns Project, the Kaleidoscope

Network of Excellence, the TELL (Towards Effective network supported collaborative learning activities) project, and the PCeL pattern repository (Derntl & Motschnig-Pitrik, 2004). Results from several initiatives on the collection of such patterns can be found in the recently published compendium (Childs et al, 2016). The problem is that they typically lack a link to a description of the suggested ICT infrastructure. This makes it difficult for teachers to foresee which demands and changes to the infrastructure are required to implement them. Hence, our approach will produce guidance notes, scenarios and patterns for the effective use of the existing ICT infrastructure and equipment available in the educational institutions. The basic premise between the creation of technology-infused design patterns is that the three main aspects of any learning environment - content, pedagogy and technology – are dynamically interrelated and must co-exist in a meaningful pedagogically way. Consequently, it is suggested (reference) that any change in Content Knowledge (CK), Pedagogical Knowledge (PK), or Technological Knowledge (TK), must be followed by a change in the other two aspects to achieve the intended educational goals (Mouasher & Lodge, 2016).

2 Methodology

2.1 The "Rich Instructional Design Pattern" (RIDP) methodology

The "Rich Instructional Design Pattern" (RIDP) methodology of facilitating the decision-making process has two main components, pattern mining and ICT school infrastructure analysis, and three main outcomes. The RIDP methodology will provide the following elements:

- A comprehensive mapping of each of the schools' ICT infrastructures and teaching context based on an infrastructure modelling language to be developed in the project.
- A thorough survey of the ICT usage in these schools in terms of observed-practice scenarios.
- An abstract picture of the observed practices in terms of didactical patterns, based on the essentials of similar approaches, and facilitating the mapping to other subject fields and problem domains.
- A mapping of these patterns to ICT infrastructures found at schools, thus creating a toolset relating the infrastructure to the educational practices.

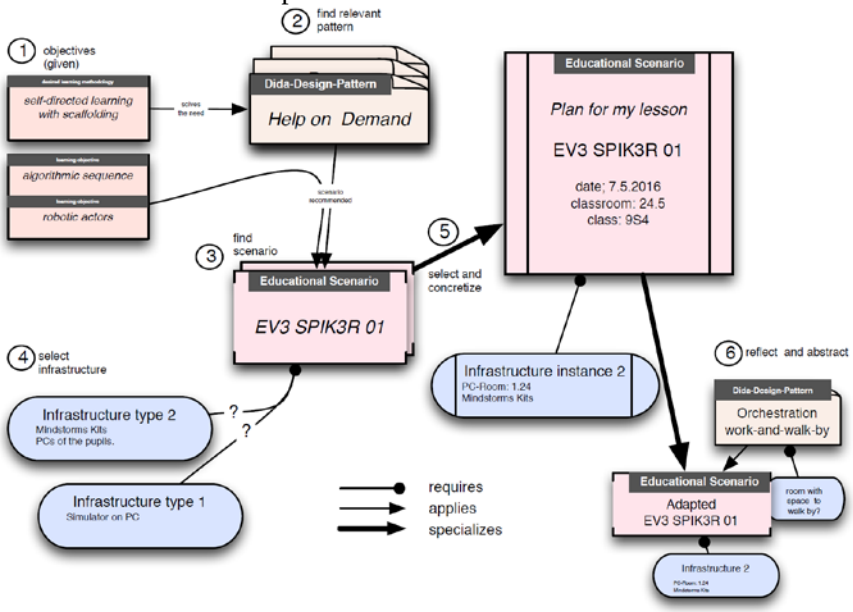

Figure 2 An example of the RIPD process [figure taken by (Müller & Libbrecht, 2015)]

This map will allow schools and teachers to identify interesting practices from other partner schools with similar infrastructures, thus showing up notable and technically feasible scenarios, also indicating the necessary infrastructure extensions. Through the exchanges among schools, mediated by the partners, a cross-fertilization is expected, initiated by the identified practices and toolsets. The mappings and the representations will be refined based on the effectiveness of the exchanges and developments realized. We aim to extend this mapping tool and inventory so that it encompasses desired educational practices, trends and current technologies. This extension will be based on perspectives gathered from the participating schools in specific workshops. The developed map of educational patterns and infrastructures will be made available online as an interactive information resource, allowing other schools and teachers to relate themselves to typical infrastructures and practices, and search for feasible incremental developments. This map will also support the exchange of information among member states about current practice in ICT and will foster reflection on the educational system and its challenges. Figure 2 illustrates an example of the RIPD process in the context of the eSIT4SIP project.

2.2 The observational study methodology

The idea is to develop the observational study taking into consideration the possibility to complement the information collected via other methods. There are different approaches to collect data from observations. To simplify, we consider two rough alternatives (Baekamn & Gottman, 1997):

- Structured approaches - that involve the use/creation of an observational grid (that states what the researchers will look for) and a coding scheme (that precisely states how will the researchers code what is being observed). Usually, this approach is used when the research is intending to pursue a more quantitative stance.
- Unstructured approaches - in this case the researchers are usually looking at descriptions of what they see based on their own understanding of the situation. This, for example, leads to what has been termed as "thick descriptions". The analysis is more interpretative and less suited for quantitative approaches.

This section describes the procedure followed, which is a mixture of both aforementioned approaches, and then proposes the set of fixed categories we use and how these will be refined.

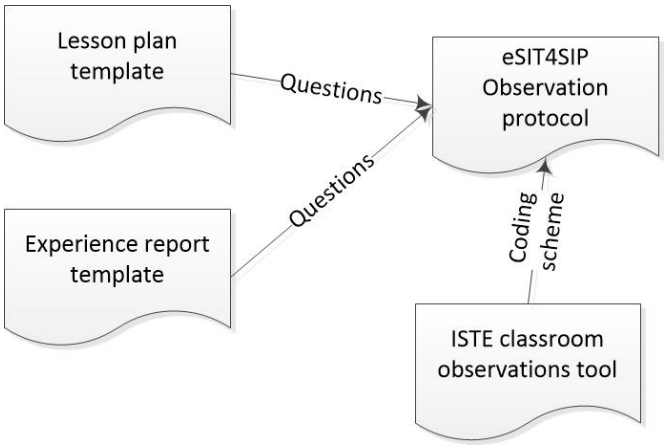

Figure 2 The creation of the eSIT4SIP observation protocol

The first step was to investigate how the previous work already conducted on the topic could contribute to our work. The questions of observation protocol are in line with parameters that were distilled from two sources: a lesson plan template and an experience report template. Both templates were previously used in European research projects. In particular, the lesson plan template was used in the con-

text of the Open Discovery Space project (Hadzilacos et al, 2013) as part of the educational design framework aiming to support teachers in designing lesson plans for resource-based e-learning. The experience report template was used in the context of the KeytoNature (K2N) project and was used to summarise the experiences of the K2N partners and teachers while developing and applying pedagogical scenarios and lesson plans in schools and universities[1].
The coding scheme (e.g. the categories) of the observation protocol are inspired by ISTE Classroom Observation Tool (ICOT) which was launched by the International Society for Technology in Education (ISTE) and validated by Bielefeldt (2012) as an instrument that could provide guidance technology decisions from classroom observation. In particular, the ICOT provided a basis for the coding scheme of several attributes of the learning environment that were closely related to the questions of the observation protocol (coming from the ODS lesson plan template or the K2N project). For the remaining questions of the observation protocol that are not in line with the ICOT, the coding scheme will be created from scratch during pilot classroom observations. In general, during its pilot testing, the observation protocol will be refined and the updated version will be finally used for the observations.

3 The eSIT4SIP observation protocol

The questions of the resulting observation protocol are not a mere aggregation of those included in the ODS lesson plan template and the K2N experience report template. The first part of the protocol includes the general categories used for all the observational studies. The second part of the protocol includes some of the questions included in one (or both) of the aforementioned instruments; those that are relevant to the educational context focusing on the integration of technology. Some conceptual mappings among of the elements included in a) the ODS learning template, b) the K2N experience report template and c) the eSIT4SIP observation protocol are shown in Annex1.

Yet, the purpose of our project is not just to uncover and propose ICT-infused patterns and scenarios but to cater for robust and sustainable alternatives that take into account the school reality and contextual characteristics, like breakdowns. Thus, some extra questions were added to the observation protocol to reflect that. These questions include the physical arrangement, the influence of the technology on the content-student, student-student and teacher-student interaction, and so on. Of particular interest are cases in which what we observe is not in accordance to the lesson plan and of even more interest are cases in which this happens and the teacher is not aware of it. We would like to arrive, through the observations, to a simple analysis of frequencies and sequences of behaviors that could give answers to the following questions:

- How many times this behavior happened?
- What were the steps observed?
- What were the steps involved in overcoming the breakdown?

Consequently, these questions were also included in the observation protocol. The observation protocol is included in Annex 1.

4 Discussion

The first step of our observational study is to design a suitable observational protocol that will enable us to collect more detailed information for each lesson we observe. Each observation protocol has to

[1] Available online from: http://www.keytonature.eu/handbook/Experience_report

be unique because it addresses different questions (Baekamn & Gottman, 1997). We created a dedicated protocol while taking into account previous similar work and projects.

During the plot testing of the observation protocol, it will be fine-tuned also based on the lesson plan provided by the observed teacher. Next, after the observations, we will return to our teacher and reveal the collected data. This will enable us to discuss with the teacher our preliminary findings and maybe try to elucidate all the things observed that somehow were outside the lesson plan. We might also try to get additional comments regarding potential breakdowns or deviations from the lesson plan in order to elicit the teacher's perspective on the events recorded. The final step is to try to generate an experience report and reflect to what extent we have a potential pattern. As a final concluding remark it should be noted that the methodologies proposed in this paper can be exploited by stakeholders, such as tutors, educational technologists and policymakers, not only in the context of school education but also in higher education settings.

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Annex 1 The questions of the eSIT4SIP observation protocol

1. Background information

1.1 Observer(s):

1.2 Observation date: (DD/MM/YYYY)--/--/----

1.3 Length of the Observation(Minutes):

1.4 Observation start time:

1.5 Observation end time:

1.6 School name:

1.7 Teacher name:

1.8 Subject matter/topic:

1.9 Number of students:

1.10 Student age:

1.11Physical arrangement (Draw or describe the physical arrangement of the classroom)

1.12 Teacher’s stated goals for the lesson (If possible, speak with the teacher before the observation begins and complete this section with the following information). What is the teacher planning to do?

1.13 Are there particular outcomes the teacher is hoping for?

1.14 How does the lesson/activity fit in with the unit that the class has been doing before?

1.15 Technology (Describe the technology resources present in the classroom and include the number of each.)

2. Observation Notes –learning situation

2.1Structure of the Lesson

2.1.1 Describe the structure of the lesson that you observe.

2.1.2 What is happening in the classroom? What are the teacher and the students doing?

2.2.Interactions Between the Teachers and Students

2.2.1How do the teachers and students interact?

2.2.2 Try to capture examples of the type of questions teachers ask student and how students respond, as well as the questions students ask teachers and the teacher's responses.

2.3 Interactions Among Students

2.3.1Do students have an opportunity to interact with one another? If so, how do they interact?

2.3.2 Do they work on a task together?

2.3.3 Do they provide feedback to one another?

2.3.4 What role, if any, does the technology play in these student interactions?

2.4 Use of the Technology/Device

2.4.1 What activity are teachers and/or students doing with the technology?

2.4.2 What is the teacher doing with the technology? What are the students doing with the technology?

2.4.3 How does the technology influence how students are interacting with a) the content, b) the teacher and c) each other?

2.4.4 What kinds of products are the students producing with the technology?

2.4.5 Are teachers or students experiencing difficulties in their use of the technology/device? Are they able to troubleshoot?

2.5 Use of Other Resources: What other resources or technology does the teacher and/or the students use?

2.6 Other Observations: What else is characteristic of what the teacher and/or the students do?

References

Bakeman, R., & Gottman, J. M. (1997). Observing interaction: An introduction to sequential analysis. Cambridge university press.

Bescherer, C., & Spannagel, C. (2009). Design patterns for the use of technology in introductory mathematics tutorials. In Education and technology for a better world (pp. 427-435). Springer Berlin Heidelberg.

Bielefeldt, T. (2012). Guidance for technology decisions from classroom observation. Journal of Research on Technology in Education, 44(3), 205-223.

Childs, M., Mor, Y., Winters, N., Cerulli, M., Björk, S., Alexopoulou, E., ... & Wijers, M. (2006). Learning patterns for the design and deployment of mathematical games: Literature review.

Hadzilacos, T. el al, . "D4. 1 The Open Discovery Space Educational Design." OPEN DISCOVERY SPACE (2013). Available from http://opendiscoveryspace.eu/sites/ods/files/d4.1_the_open_discovery_space_educational_design.pdf

Mor, Y., Mellar, H., Warburton, S., & Winters, N. (Eds.). (2014). Practical design patterns for teaching and learning with technology. Springer.

Mouasher, A., & Lodge, J. M. (2016). The Search for Pedagogical Dynamism – Design Patterns and the Unselfconscious Process. Educational Technology & Society, 19 (2), 274–285.

Müller, W., & Libbrecht, P. (2015, September). Can I do that? Scenario Feasibility as an Enabler of ICT Usage. In The Proceedings of International Conference on Informatics in Schools: Situation, Evolution and Perspectives—ISSEP 2015. (p. 55).

Pozzi, F., & Earp, J. (2006). Approaching pedagogical planning in learning design. Current Developments in Technology-Assisted Education, 1, 281-286.

Voigt, C., & Swatman, P. M. (2006). Describing a design pattern: Why is it not enough to identify patterns in educational design? (Doctoral dissertation, Sydney University Press).