

Tablet as a Tool for Creating Pupils ePortfolios in Science Subjects

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Abstract—The paper deals one of the possible use of mobile technologies (namely tablets) in science teaching and teaching of computer science and informatics. The processing of pupils' portfolios is discussed in the paper. It is the creation of new material - i.e. the highest level of integration of ICT into teaching by SAMR model. The scope of the paper consists of the review of available information, theoretical knowledge, semi finished draft of portfolios model. The second part discusses the case study, which ran in secondary school. During the learning the students made up ICT portfolio both in science subjects (particularly chemistry, biology and physics as well as within learning of ICT).

Keywords—Didactic of informatics, education, ePortfolio, tablet.

I. INTRODUCTION

Today time allows access large amount of information, which can be understand as great advantage for the education. At the same time it can be confusing mainly for primary and secondary schools pupils. They have no longer the need to study the textbook or carefully keep notes because everything is possible almost immediately found on the internet. However, they often lack comprehensive overview or notes from their own experiences that may in time be forgotten. Therefore it is the appropriate means of creation of portfolio. The paper portfolio, however, is for the pupils the synonymous textbook. Nowadays mobile devices with large storage capacity and the possibility of memory card or cloud storage offer a portfolio in digital form.

Using of electronic portfolio also represents a good way to connect more study subjects and thus meet the requirements for interdisciplinarity as well as implementation of modern technologies to learning required by National Curriculum [1]. It is advisable to support the creation and processing of learning portfolios in lessons of informatics. The creation and processing of portfolios includes the topics as follows: processing and editing documents, video, audio, furthermore graphic design or creating a blog or website.

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Classical portfolio was known for a long time. Traditionally it consists of the seminar work, self-evaluation, notes or written essay and teacher assessment. Recently, the portfolios can also use photographs, audio or video. Today technology is so advanced for creation of electronic portfolio. The digital portfolio (i.e. E-portfolio) supports not only learning with modern technologies, but the pupils can get their own visual material that evokes their subjective experience. Creation is due to extension of ICT technologies very simple. Materials can be neatly categorized in folders or on the websites.

Other advantage of creation of portfolio is that students will learn to process the results of their work, which they will need in future in their professional life.

A. Integration of ICT to education

Different Curricula (e.g. [1] in the Czech Republic) support the integration of ICT in learning of different subjects. We will focus for the integration of mobile devices in the paper. The integration can be monitored at four levels - substitution, augmentation, modification and redefinition. Explanation of these terms can be found in SAMR model (see Fig. 1). The aim should be integration at the highest level (i.e. redefinition), which in practice means that the technology is used for creation of new materials (i.e. the technology has an irreplaceable function) [2].

To reach the goal the tablets or smart phones can be used. The pupils can used tablets or smart phones can for creation of photo galleries (for example herbarium with text), videos (records of laboratory work) or audio recordings (recordings of language training for feedback and analysis of possible errors in pronunciation). They can also use simple and available applications for the graphic design of the themes (mind maps, word clouds or infographics). Pupils have personal relationship to these materials. It can occur after longer period of time when looking at their portfolio, they will equip many other information that relates to the topic (this because they create it themselves, they faced with various challenges, connect it with some situations).

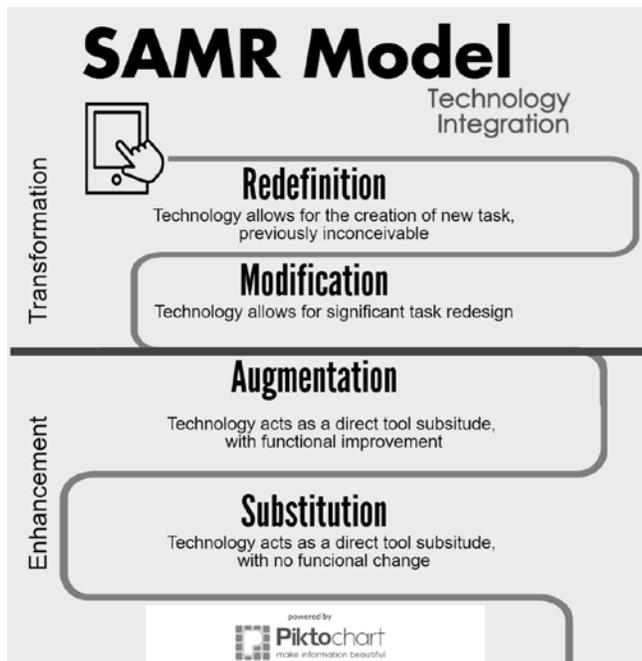


Figure 1. SAMR Model of Technology Integration (adapted from [2]).

Ideal is the use of mobile technology in the 1:1 ratio – i.e. each student has their own devices [3]. This can be done in two ways. Either we borrow equipment or use so-called BYOD (= Bring Your Own Device). We must beware of the availability of used applications in the operating system in the second option. However, there are situations when just one device in the group – this is an example of shooting, when in the group of pupils their roles are divided (one of them is a cameraman, others are involved in the course of the experiment).

If mobile technology is being used in education in a suitable way, it is important always to think well, what problems can occur and try to prevent them. It is also necessary to specify the requirements (and possibly recommendations) that must be met for the creation of learning materials. As already mentioned, the advantage is cooperation among teachers. Taking good learning material is not so easy and requires enough time. Therefore, it is ideal to work on these materials in subjects of informatics and computer technology.

II. PORTFOLIO AS A LEARNING TOOL

“A portfolio can be a thickly stuffed file of assorted drafts, final pieces, and odd items or a thin, carefully chosen collection of one’s best work. A portfolio can include student’s work in one subject area over a few months or be the culmination of years of study.” [4]

Portfolios have been widely used in industries such as graphic arts and design. Education is one of three groups of portfolios.

There are six steps to implement portfolios in education [5]:

1. Giving clearly information at the beginning

2. Limiting the number of components
3. Defining the evaluation criteria
4. Teaching and facilitating the processes of self-reflection and self-evaluation
5. Indicating the appropriate time for the portfolio
6. Providing advice

More detailed requirements and recommendations can be found naturally in other literature [6].

Portfolio is a way, how brought closer to pupils, how let him create something, how monitor his progress (not only from the perspective of the teacher or the test results, but also from the perspective of the student himself). It is the opportunity to create some relationship to certain topics. Its components can be some documentation (for parents or for students), activities, photographs, videos, letters of recommendation, work and evaluations.

There are many ways how we can categorize portfolio by individual types. Here we can see several types:

- Work portfolio (sometimes also developing or student portfolio) – content is selected by student; it contains a lot of documents, which is not in relation only to the school
- Presentation portfolio (sometimes also institutional portfolio) – content is selected by student (it is often based on the requirements of the institution or teacher); it contains examples of his work
- Documentation portfolio (sometimes also evaluating or teaching portfolio) – content is selected by student and the teacher; it contains a large number of works that show the development and achievement of desired goals [7]

Nowadays, it is becoming increasingly popular so-called e-portfolio [7]. This is a non-print material that can be stored on the mass media (CD, DVD, external drive) or on the website. For creating of e-portfolios we can also use special management systems (e.g. Epsilon, Mahara [8] or Taskstream).

Use of portfolios at primary or secondary school is described by M. Demirel and H. Duman [9], who focused on its use in English language teaching. The authors show (in their research and in comparison with other studies) that portfolio had positive effects on reading, writing and listening skills of students and had no effects on the speaking skills.

Portfolios (both paper and electronic) are very often used in university education – not only in the Czech Republic [10], but also in the world.

ECAR study [11] was published in 2013 and it was performed in 13 different countries. It deals with the use of ICT among university students. There is marginally mention of e-portfolios. It shows that 46 % of students do not make portfolio, 39 % make it in just one course, 9 % more often and only 6 % of students make it in approximately half of subjects.

“Longitudinal ECAR data show us that there has been a dramatic increase in e-portfolio use since we first asked about it in 2010, but the 2012 to 2013 finding was that e-portfolio use was flat over the past year... Students’ interest in e-

portfolios may increase in the future as a function of the need to document their skills, abilities, and experiences.” [11]

A positive influence of portfolio in the high education is also shown in this research [6], and very interesting is an article about using e-portfolios on social media in high education [12]. Another study deals with research of examining electronic portfolio [13].

III. CREATION OF CONTENT OF PORTFOLIO

Below are several examples how to use mobile technology (concretely tablets) as a tool for making portfolio content.

A. Use of Photography

One of the basic functions of tablets, through which we can create new content with pupils, is photography. For the portfolio it is necessary to clearly define what the photographs can include. Very common are the product photos of students or a series of photographs that serve as documentation for certain activities (e.g. in laboratory work). The pupils can also create materials that can be processed subsequently. As a suitable example is the photography of plants or animals from which pupils can create your own atlas. There are suitable applications for graphically adjustment and processing (see Fig. 2).

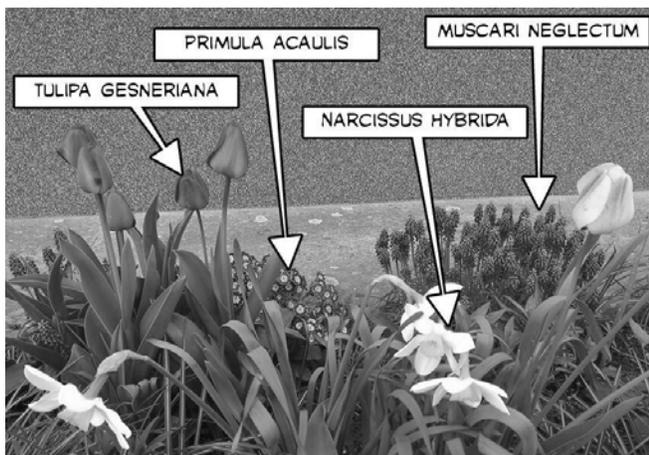


Figure 2. Photo Herbal with Labels (adjust in PicSay).

B. Use of Audio Recording

Audio recording is especially popular between foreign language teachers (because of feedback for students - check of pronunciation). Audio recording can be used in even in science subjects - for example, recording the sounds of animals, recording of lectures.

Audio recording can be created by means of camera. Much better is to install an application that record sound better. The actual soundtrack (no image) is better for their smaller size.

C. Use of Video

Recording of videos has to be under legal formalities. It is necessary to have the agreement of pupils. Most schools solve this problem by general agreement. If there is pupil in the class

without agreement, it is necessary to ensure that the pupil is not visible in the video.

Very interesting are activities the video is recorded by pupils themselves. The interesting video tutorials are created in this way [14]. These videos remind pupils of the subject of matter. These activities are suitable for example for outdoor activities, or for the laboratory work. The attention has to be paid to certain principles and requirement given to pupils in written form (see Fig. 3).

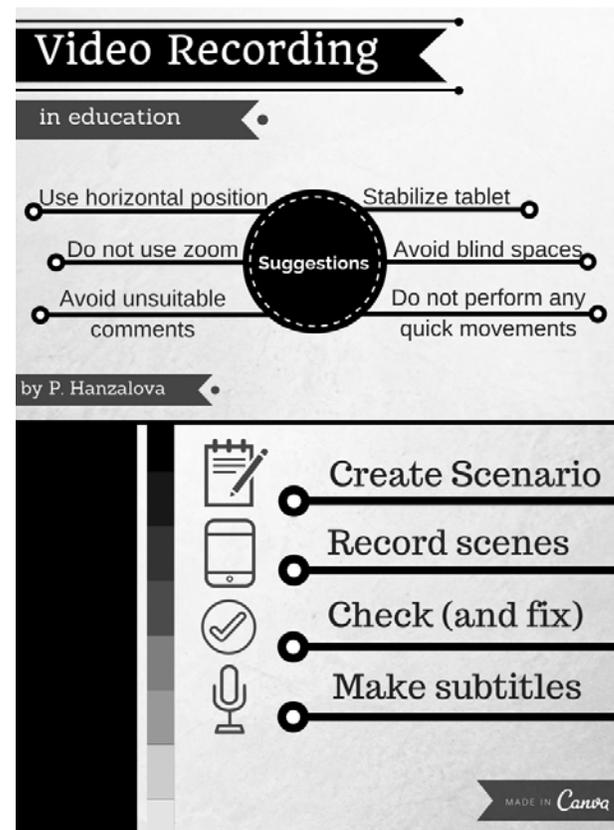


Figure 3. Instructions for Video Recording (made in Canva).

Video is also useful in pupils' presentations. The presentation is very useful for preparation of the defence of theses, conference presentation, or also for the interviews.

Video works also as perfect feedback. Pupils thus convince themselves on their speech, on their move during presenting, inform them what they are presenting and what they are speaking. They can find their filler words.

D. Use of Application

For creation of content of portfolio we can use to work with applications that can be found in internet. For each activity the multiple applications can be used (depending on the operating system of available equipment). Operation and control of the application is often simple and intuitive. Pupils therefore have no problem to learn the operation and control of the application. The pupils have enough time for creating of the content by means of the application.

E. Mind Maps

Mind maps are used for organization of information into categories as well as for show the relationships between them (see Fig. 4). The different applications allow creation of very lucid mind maps. The storage is solved differently in different applications. However it is always possible created graphical representation record to photos (using printscreen) and save it as an image. There are several options for editing the maps (background, borders, shapes, icons or notes).

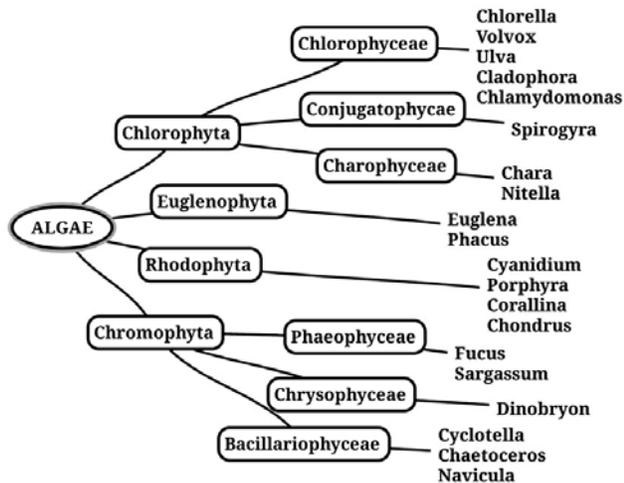


Figure 4. Algae and Their Classification (print screen from Mind Map).

There are lot of applications and online editors for the creation of mind maps (Mind maps, SimpleMind, Mind Mup - application is connected to the Google account, maps can be stored on Google Drive). There is no need to download and install the application. It works directly in the browser. Some applications allow insertion of picture or a web link.

Word Clouds

Word Clouds is graphical tool for processing of keywords. The resulting images can be used as a brainstorming for given topic for practice (mixed up names from which we select those from a particular topic - see Fig. 5). Word cloud is generated automatically. In different applications there are different settings - some allow formation of cloud that has a certain shape.

Word cloud can be in both offline or online form Language, CloudArt, Worditout, Tagxedo, etc.).

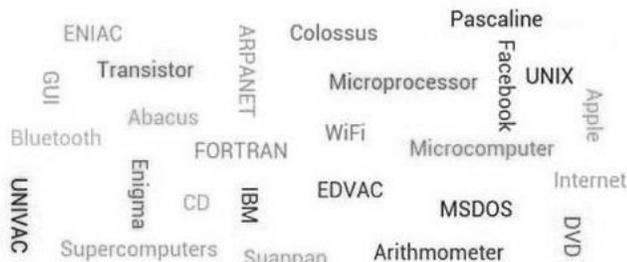


Figure 5. Word Cloud – Computer History (print screen from iLanguage).

F. Infographics

It is a graphic data processing again but there is a greater focus on the visual aspect. We can use pictures and graphs that display the given topic clearly. There are many applications that are actually databases of available infographics. But there is a problem to find an application for its creation. The easier way is through online editors – e.g. piktochart.com (see Fig. 1), canva.com (see Fig. 3).

G. Labels

Making photos as content of portfolio has already been mentioned above. Sometimes it is appropriate something connect to the picture (it may be a label, tag, link) or something delete or cover (face, inappropriate objects). There are offline or online applications for this purpose. Some of the applications also allow editing of the images. The applications allow insertion icons, labels or notes as well as underlining the important things. Examples of the applications are PicSay (see Fig. 2), Sketch, SketchBook Express.

IV. CREATION OF E-PORTFOLIO IN PRACTISE

In the following part of the paper the creation of e-portfolios in secondary school is described. The topic was first discussed with pupils. The interesting views of pupils were received from discussion. The pupils views help create content of learning material. The learning, creation and evaluation of portfolio topics took place in the fourth class of the secondary school (age students is around 15 years).

A. Experiences from Czech Schools

Suggestions and information was received both of the aforementioned resources and the Czech schools website [15] dealing portfolio. Some of the Czech schools, their experience (both from teachers and children point of view) are presented.

Web pages were created within the project Quality I project. Participants of the project were selected schools throughout the Czech Republic. It is interesting that among them there was only one secondary school, all the rest were primary schools. They focus primarily on evaluating the types of portfolios.

B. Discussion with Pupils of Final Class

First, the discussion on portfolio's topic with pupils of graduation classes was realized. We asked them whether they know portfolio, if they are using portfolios and whether they would appreciate portfolios (in form of a folder on computer). One of the topics of discussion was also the practical application of portfolio.

The result is as follows: nearly 90% of pupils have already the portfolio met. The pupil's portfolios are not always ideally sized, arranged and graphically modified. Approximately half of the students would welcome working with portfolio within hours of computer science and informatics (it was mostly girls,

boys, this way of storing and presenting documents are often considered useless).

When discussing what material should be put into the portfolio include, pupils frequently mentioned reading literature (electronic newspaper reader), awards and certificates, successful professional work, reflections or picture.

During the discussion of the content of portfolio the pupils discussed whether the portfolios can be personalized i.e. whether it can include personal materials. All pupils agreed that it is necessary to distinguish between the pupil's portfolio (intended for actual pupil) and presentation portfolio.

Some pupil's replies that emerged during the discussion follow:

“Portfolio would be very handy to me, since I want to study the university program focused on psychology, where one of requirements is enough literature. I pointed portfolio this way and I would have such documents prepared for adoption in the course, and certainly higher quality than now when I try it on myself.”

“The portfolio I already have. I am trying to shoot pictures professionally. I have samples of my work stored on my websites.”

“Simplified portfolio I already have in my computer. I have categorized the results of my work in the folders.”

C. E-portfolio in ICT Lesson

The portfolio was created by pupils of the fourth class of secondary school within the science subjects and lessons of computer science and engineering. The interdisciplinary relations of ICT with other were fulfilled. It was assumed, however, collaboration between teachers. It was one of the most difficult organizational matters.

The desired content of the portfolio was determined first. The group of teachers of different subjects agreed on processing of topics. The exact requirements laid down at the beginning were very important because the pupils knew the criterion of evaluation.

Pupils record videos within the lessons of biology and chemistry. The videos were subsequently edited in the lessons of ICT. The videos were edited, removed the audio track and subtitles were added. This video was the first part of portfolio.

The task of biology portfolio was forming photo-herbarium. The condition was to collect photos of about 30 species of plants and subsequent processing of brief information on them. The materials were re-edited in ICT lessons.

Laboratory work of physics lessons were processed in MS Excel spreadsheet editor and became part of the portfolio, including photographs from work.

Everything was supply by various small projects or group work, graphic design theme, self-assessment or teacher assessment. Students can freely add their own drawings, documents etc.

The portfolios were evaluated in terms of content, of graphic design and creativity.

Feedback from students was very positive. They apprise interdisciplinary approach (ICT lessons were evaluated very positively because they have learned things that they can use in everyday life – video editing, photos). For teachers, it was quite challenging, especially timely consuming. Most activities require more time both for preparation as well as for performing.

V. CONCLUSION

Creating of portfolio is important part of a successful career start every ambitious individual. The portfolios should be made from study time. The portfolio should testify about the pupils, record their accomplishments, goals and considerations. It is up to the individual what to portfolio will include.

The use of portfolios in primary schools is increasingly supported. This is also supported by proposal of entrance exams for secondary school – the secondary school should have the opportunity to take into account pupil's the portfolio where pupil's efforts, interests, creativity and actual results or work are presented. *“It is necessary to start with the development and promotion of portfolios as a tool for description and demonstration of such pupil's competence the tests are unable to capture.”* [16]

Nowadays, student portfolios are already common at universities. It is therefore reason for starting with learning of principles of portfolio at education of primary schools, namely at with e-portfolios during ICT lessons.

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REFERENCES

1. MŠMT. *“Strategie vzdělávací politiky České republiky do roku 2020”* [online]. Praha, MŠMT, 2014. Available: <http://www.msmt.cz/vzdelavani/skolstvi-v-cr/strategie-a-koncepcni-dokumenty-cerven-2009>
2. K. Goodwin., *“Use of Tablet Technology in the Classroom: A Partnership between Sydney Region and the NSW Curriculum and Learning Innovation Centre”*, [online]. State of New South Wales, Department of Education and Communities. 2012 Available at <http://clie.det.nsw.edu.au/clie/documents/iPad_Evaluation_Sydney_Region_exec_sum.pdf>
3. S. Hubalovsky, S., P. Hanzalova. *“Comparative Analysis of Applications Supporting Teaching Programming by Historical Encryption Algorithms.”* In: Recent Advances in Educational Technologies, (EMET 2015), Zakynthos Island, Greece, 2015, pp. 66–73. ISSN 2227-4618, ISBN 978-1-61804-322-1.

4. R. C. Wade, D. B. Yarbrough. "Portfolios: A tool for reflective thinking in teacher education?" In: Teaching and Teacher Education. **12**, 1996, pp. 63–79
5. P. Amaya, J. E. Agudo, H. Sánchez, M. Rico, R. Hernández-Linares. "Educational e-portfolios: uses and tools." In: Social and Behavioral Sciences **93**, 2013, pp. 1169–1173
6. M. F. Baris, N. Tosun. "Influence of E-Portfolio Supported Education Process to Academic Success of the Students." In: Social and Behavioral Sciences **103**, 2013, pp. 492–499
7. G. Lorenzo, J. Ittelson. "An Overview of E-Portfolios." Educause Learning Initiative: advancing learning through IT innovation. 2005 Available from: <https://net.educause.edu/ir/library/pdf/ELI3001.pdf>
8. S. A. A. Seman, W. E. W. Rasid, H. M. Nasir. "E-teaching Portfolio Implementation using Mahara Open Source Management System." In: Social and Behavioral Sciences **65**, 2012, pp. 1169–1173
9. M. Demirel, H. Duman. "The Use Of Portfolio In English Language Teaching And Its Effects On Achievement And Attitude." In: Social and Behavioral Sciences **191**, 2015 pp. 2634–2640
10. T. Svatoš. "Studentské portfolio jako zdroj poznání postojů začínajících studentů učitelství." In: Pedagogika. **56**, 2006, pp. 45–57
11. E. Dahlstrom, J. D. Walker, Ch. Dziuban. "ECAR Study of Undergraduate Students and Information Technology. (Research Report)." Louisville, CO: EDUCAUSE Center for Analysis and Research. 2013. Available from: <https://net.educause.edu/ir/library/pdf/ERS1302/ERS1302.pdf>
12. K. Chantananurpak. "Using e-Portfolio on Social Media." In: Social and Behavioral Sciences **186**, 2015. pp. 1275–1281
13. I. Balaban, E. Mu, B. Divjak. "Development of an electronic Portfolio system success model: An information systems approach." In: Computers and Education **60**, 2013, pp. 396–411
14. K. Chroustová, V. Machková, P. Hanzalová. "Towards the Implementation of Mobile Technology into the Experimental Chemistry Education." In: DIVAI 2016 – 11th International Scientific Conference on Distance Learning in Applied Informatics (to be published)
15. CERMAT. "Projekt Kvalita I" [online]. ©2008. Available from : <http://www.esf-kvalita1.cz/portfolio/oprojektu.php>
16. EDUin. "Tisková zpráva: Státní přijímačky mají alternativu, zkusme žákovská portfolia." [online] 15. 4. 2016. Available from: <http://www.eduin.cz/tiskove-zpravy/tiskova-zprava-statni-prijimacky-maji-alternativu-zkusme-zakovska-portfolia/>

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